Exploring pedagogical dissonance in including a traditional acupuncture treatment approach into a western biomedical evidence-based Physiotherapy curriculum

Thesis presented for the degree of MSc in Physiotherapy, Department of Health and Rehabilitation Sciences, Physiotherapy Division, University of Cape Town

Cape Town, 26 December 2021

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Supervisors: A/Prof. Soraya Maart

Dr. Lieselotte Corten

DECLARATION

Date: 22nd December 2021

I, Ana Alexandra da Cunha Pereira Anjos, UCT student number ANJANA001,confirm that this dissertation contains original content resulting from my incessant effort and extensive research work. I fully understand that plagiarism means using somebody else's ideas, inventions, writings without acknowledging their source, in one's scholarly work. I also understand that plagiarism is an academic fraud that undermines the integrity of scholarly work. As a master's student and researcher who wishes to contribute to the existing body of knowledge significantly, I have rationally made sure that the writings in this document are my original work. Wherever I have used somebody else's ideas, I have decorously acknowledged the original authors to ensure that this scholarly work sticks to the preeminent regulations on plagiarism. Therefore, this dissertation contains work originally done by me and never been priorly submitted to any institution of higher learning.

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“A doctor that only knows medicine not even medicine knows”.

Dr. Abel Salazar

(Portuguese doctor, professor, researcher, painter)

"Good it is to fight with determination, embrace life and live with passion, lose with class and win with boldness, For the triumph belongs to those who dare .... And life is too large to be negligible. "

Charles Chaplin

ACKNOWLEDGEMENT

The long journey of a master's work is impregnated by innumerous challenges that wouldn't be possible to overcome without the help of key people that have dedicated their hours, support, strength, and energy, directly or indirectly, for this journey to be possible.

To my parents that with their wisdoms and education have helped to mold the person that I am today to.

To my husband, Nuno Goncalves, for his unconditional support and love, and most of all is patience. I am grateful for having him by my side every day and to be able to share with him all my hopes and dreams and bring them into life, no matter how hard it is sometimes. Without him, our Francisco would not always let me think.

To my brother Nuno for always being there for me

Especially to my supervisor, Professor Soraya Maart, who has always believed in me, thank for your guidance and wisdom always with the highest scientific level, the continuous interest and critical vision, and to help me to overcome all the necessary steps for the conclusion of this work.

To my co-supervisor, Dr. Lieselotte Corten, for the opportunity, encouragement, and confidence.

To Dr. Pedro Borrego, my guardian Angel, for the teaching and support, thank you for all the valuable lessons

To all my friends and colleagues at Fatima College of health Sciences, Abu Dhabi, UAE, for all the guidance, patience, and support.

To everyone that in one way or the other helped me, supported me, and believed in my potential.

And of course, to my dear son, Francisco, whom I love unconditionally and who came to give a new color to my life, I hope from now on to make up for the hours of attention and fun I owe him. He was my most considerable stimulus on this journey.

COVER LETTER

Ana Alexandra Anjos

Master in Physiotherapy (Dissertation) Student

Supervisors: Dr. Soraya Maart

Dr. Lieselotte Corten

Exploring pedagogical dissonance in including a traditional acupuncture treatment approach into a Western biomedical evidence-based physiotherapy curriculum

Date: 22nd December 2021

I am pleased to submit my Final Master Thesis "Exploring pedagogical dissonance in including a traditional acupuncture treatment approach into a Western biomedical evidence-based physiotherapy curriculum". You will find the following documents enclosed:

- Abstract (page 10)
- Final Master Thesis
- Turnitin Originality Report signed by Supervisor (Dr. Soraya Maart) – (page 17 + attachment 10)

I would like to thank the opportunity that University of Cape Town was given to enrichen my curriculum and to work with wonderful professionals and persons. If any further material is required or other information is needed, please do not hesitate to contact me, Ana Alexandra Anjos (ana.anjos@fchs.ac.ae), or my supervisors (Dr. Soraya Maart – soraya.maart@uct.ac.za and Dr. Lieselotte Corten – lieselottecorten@hotmail.com).

_____

Ana Alexandra Anjos

ABSTRACT

Background:

We cannot speak about complementary and alternative medicine without speaking about the most popular form of it, acupuncture, and its connection with health maintenance or forms of intervention to recover it. Over the last few years, acupuncture has been increasingly used for the treatment of pain either as a combined or complementing therapy, and evidence also suggests an increased in physiotherapists interested in acupuncture.

The study aimed to 1) explore the scientific support for the combined use of acupuncture and physiotherapy in MSK conditions through a systematic review and 2) to explore the inclusion of acupuncture in undergraduate curricula as an elective course by doing a quantitative descriptive survey.

Methods:

Three major databases were used for the conduction of the systematic review of literature, taking place from March 2019 to May 2019, i.e., Cochrane Library, PubMed, and PEDro (Physiotherapy Evidence Database). For inclusion criteria were accepted only randomized controlled trials (RCT) published in English, released within the past decade, and using subject's adult population with MSK conditions.

A quantitative descriptive survey was conducted among physiotherapists registered with professional societies in the United Arab Emirates and South Africa. A questionnaire was distributed to registered members using an online format to explore demographic information, usage of acupuncture as a treatment modality, and level of agreement for including acupuncture in undergraduate curricula.

Results:

Systematic Review (CHAPTER 3)

The results from the electronic search yielded a total of 227 abstracts and study titles. Eight studies were considered after a detailed screening, in the included studies six of them were considered for a quantitative meta-analysis and all eight were used to perform a qualitative analysis. In total 960 patients were included, with 349 and 611 patients respectively divided into intervention and control groups.

No statistically significant results were found in studies assessing pain to back up the combination of physiotherapy and acupuncture, as well in studies assessing range of motion in knee osteoarthritis. When comparing the baseline of physiotherapy combined with acupuncture or physiotherapy alone statistically significant improvements were found within-group. The studies that examined Isometric Neck-Muscle Strength (INMS) expressed noteworthy bettering within groups with physiotherapy combined with acupuncture being more viable than acupuncture or physiotherapy alone. The Constant Shoulder Assessment (CSA) for shoulder function was altogether superior within the exercise plus acupuncture group compared with the exercise group.

Survey (CHAPTER 4)

One hundred eighty-one physiotherapists completed the survey, with 35.4% (n=64) from the UAE, while 64.5% (n=117) were from South Africa. Additionally, 78.5% (n=142) of the participants were female, while 21.5% (n=39) were males. The mean (SD) age of the participants was 41.2 (11.9) years, and there was no statistical difference between the two countries (t=0.04, p=0.97). Thirty-five percent had a postgraduate qualification. Sixty-two (34.2%) physiotherapists reported a specialization in acupuncture, with the majority at certificate level. More physiotherapists in the UAE (57%) agreed that acupuncture ought to be included within the undergrad educational curriculum compared to South Africa (44%).

Conclusion: There was no noteworthy prove found to back that the addition of acupuncture to physiotherapy treatments includes advantages to pain decrease. This review did, however, observe benefits of including acupuncture together with physiotherapy treatment in the diminishing of neck incapacity, muscle strength and shoulder function. Although physiotherapists are gaining qualification in acupuncture and using in practice, there is not sufficient traction on the inclusion of acupuncture in undergraduate curriculum.

Keywords: Acupuncture, Physiotherapy, Manual Therapy, Rehabilitation, Combination, Musculoskeletal conditions. *Prospero Registration number:* CRD42019122567.

List of publications used in this thesis

"Exploring pedagogical dissonance in including a traditional acupuncture treatment approach into Western biomedical evidence-based physiotherapy curriculum" – Chapter 3

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SYSTEMATIC REVIEW

Exploring the Effectiveness of Acupuncture as an Adjunct to Physiotherapy in the Treatment of Musculoskeletal Conditions: A Systematic Review

Ana Anjos[1,2,*], Soraya Mart[2], Nuno Goncalves[3], Pedro Borrego[4,5] and Lieselotte Corten[6]

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22nd December 2021

To whom it may concern

I, Soraya Maart, whereby declare that I agree that the article with the title "Exploring the effectiveness of Acupuncture as an adjunct to Physiotherapy treatments in musculoskeletal conditions: a protocol of a systematic review" published in BioMed Central Journal, may be included in the Master thesis of Ana Alexandra Anjos with the title ""Exploring pedagogical dissonance in including a Traditional Acupuncture treatment approach into Western biomedical evidence-based physiotherapy curriculum", further I declare that my contribution was the supervision of the findings of this work

Soraya Maart,

22nd December 2021

To whom it may concern

I, Pedro Santiago Borrego, whereby declare that I agree that the article with the title "Exploring the effectiveness of Acupuncture as an adjunct to Physiotherapy treatments in musculoskeletal conditions: a protocol of a systematic review" published in BioMed Central Journal, may be included in the Master thesis of Ana Alexandra Anjos with the title ""Exploring pedagogical dissonance in including a Traditional Acupuncture treatment approach into Western biomedical evidence-based physiotherapy curriculum", further I declare that my contribution was to verify the analytical methods.

Pedro Santiago Borrego,

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To whom it may concern

I, Nuno Goncalves, whereby declare that I agree that the article with the title "Exploring the effectiveness of Acupuncture as an adjunct to Physiotherapy treatments in musculoskeletal conditions: a protocol of a systematic review" published in BioMed Central Journal, may be included in the Master thesis of Ana Alexandra Anjos with the title ""Exploring pedagogical dissonance in including a Traditional Acupuncture treatment approach into Western biomedical evidence-based physiotherapy curriculum", further I declare that my contribution was mainly encouragement.

Nuno Goncalves,

22nd December 2021

To whom it may concern

I, Dr Lieselotte Corten, whereby declare that I agree that the article with the title "Exploring the effectiveness of Acupuncture as an adjunct to Physiotherapy treatments in musculoskeletal conditions: a protocol of a systematic review" published in BioMed Central Journal, may be included in the Master thesis of Ana Alexandra Anjos with the title ""Exploring pedagogical dissonance in including a Traditional Acupuncture treatment approach into Western biomedical evidence-based physiotherapy curriculum", further I declare that my contribution was the supervision of the findings of this work and overall structure and presentation.

Dr Lieselotte Corten,

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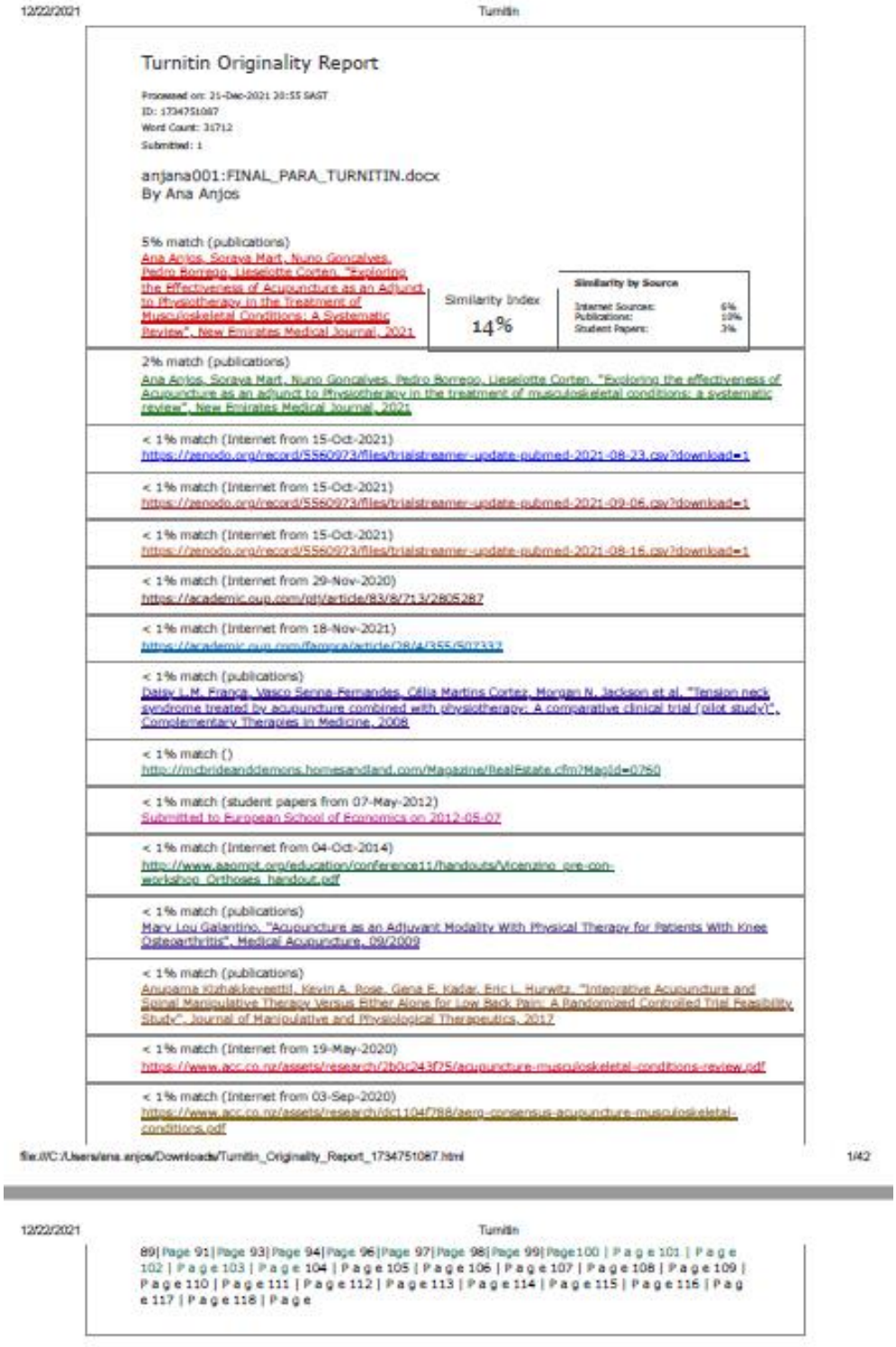

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LIST OF ABBREVIATIONS

6MWT – 6-Minute Walk Test

AEF-IV – Associacion Espanola de Fisioterapia Invasiva – Spanish Association of Invasive Physiotherapy)

AL-SCORE – Adolfsoon-Lysholm Shoulder Assessment

CAM – Complementary and Alternative Medicine/therapies

CAHCIM - Consortium of Academic Health Centers for Integrative Medicine

CGRP – Calcitonin Gene-Related Peptide

CICM - Confucius Institute for Chinese Medicine

COPD – Chronic Obstructive Pulmonary Disease

CSA – Constant Shoulder Assessment

DCFM - Deep Cervical Flexion Muscles

DMCT – Dunn's Multiple Comparison Test

EASE - Evaluating Acupuncture and Standard of CarE

EPS – Emirates Physiotherapy Society

EQ-5D-5L – EuroQol-five-dimension self-report Questionnaires

ESWT – Extracorporeal Shockwave Therapy

HEIs – Higher Education Institutions

INMS – Isometric Neck Muscle Strength

ICF - International Classification of Functioning, Disability and Health

MSK – Musculoskeletal

N/A – Not applicable

n.d – Not declared

NCCAM-NIH – National Center for Complementary and Alternative Medicine

NDI – Neck Disability Index

NGF - Neural Growth Factor

NHS – National Health System

NPRS – Numeric Pain Rating Scale

ODI – Oswestry Disability Index score

PASA – Physiotherapy Association of South Africa

PGQ – Pelvic Girdle Questionnaire

PT - Physiotherapy

Qi – Vital energy

RCT – Randomized Control Trials

ROM – Range of movement

SA – South Africa

SASP – South African Society of Physiotherapy

SDs – Standard Deviations

SIS – Subacromial Impingement Syndrome

SMT – Spinal Manipulative Therapy

TCM – Traditional Chinese Medicine

TENS – Transcutaneous Electrical Nerve Stimulation

TUG – Time-Up and Go test

UAE – United Arab Emirates

UK – United Kingdom

US - Ultrasound

VAS – Visual Analogic Scale

VAS_{mt} – VAS outcomes for muscular tension

VGF – Vascular Growth Factor

VIP – Vasoactive Intestinal Peptide

WCPT – World Confederation of Physiotherapy

WHO – World Health Organization

WOMAC – Western Ontario McMaster University Osteoarthritis Index

THESIS OUTLINE

The structure of the thesis will address the specific objectives outlined above.

Chapter 1- Introduction and Background to the study

Chapter 2- A literature review will provide a conceptual understanding of the two disciplines being explored. It will further provide background for the use of acupuncture in physiotherapy practice and explore the introduction of curriculum

Chapter 3- The methods and findings of a systematic review done to offer evidence on the effectiveness of acupuncture and physiotherapy in the treatment of musculoskeletal problems are included.

Chapter 4- Describes the methodology and results of a survey undertaken to explore the demographic profile of physiotherapists using acupuncture and the perceived view of its inclusion in undergraduate curriculum.

Chapter 5- Will provide a general discussion and conclusion

CHAPTER 1: INTRODUCTION AND BACKGROUND

Introduction

The World Health Organization (WHO) (1948) has defined health as more than the mere absence of disease, and has recognized the impact of physical, mental, and social systems involved in establishing well-being. In later years the development of the International Classification of Functioning, Disability and Health (ICF), has seen the definition of disability encompass the interaction of a person with a wellbeing situation and their surroundings (WHO, 2001). The definitions associated with defining health and seeking improved health, has necessitated the recognition that people would do whatever it takes to achieve a balance of well-being. Complimentary medicine and traditional approaches are now more widely accepted as treatment approaches of disease and health risk factors (WHO 2019; 2021).

Background to the Study

The WHO defined traditional medicine as a combination of abilities, practices, and knowledge tied down within the convictions and experiences of distinctive societies in the diagnosis, prevention, and treatment of distinctive therapeutic conditions, including mental illness (WHO, 2019). Other authors, such as Fokunang et al (2011) defined traditional medicine as the treatment practice that incorporates the beliefs and knowledge of using plants, animals, exercises, and spiritual practices combined or singularly used in the diagnosis, prevention, and treatment of diseases. Traditional medicine has been used by people worldwide long before the advent of westernized medicine (Abdullahi, 2011). The WHO (2013) has recognized the increase in the use of traditional and complementary medicines in different illnesses and health conditions. Traditional medicine encompasses beliefs and spiritual practices, western medicine uses evidence-based practices that include changes in lifestyle, different treatment protocols, and pharmacotherapy (WHO, 2013; 2021).

South Africa and United Arab Emirates (UAE), like other countries, have a pluralistic health system, where traditional medicine is an accepted alternative or complimentary practice (Siegfried, 2012; Ghazal, 2017; MOHAP, 2016; WHO, 2019). Interventions can range from, manual techniques or plant-based

medicines (Mokgobi, 2014). It is vital to point that traditional medicine is a dynamic and evolving concept due to the various regions, contexts, and cultures from which it is derived.

The search for "new therapies," referred to as "alternative" or "complementary" biomedicine, has grown among the South African and Emirati patient population (WHO, 2019). Globally patients have pushed this transition to the point where Complementary and Alternative Medicine (CAM) is now the Europe's second fastest expanding business (Garcia-Escamilla, 2017). Experts on new therapies point out that these therapies, including acupuncture, are derived from traditional complex organ systems, the so-called *Zang-Fu*, and have their rationality, embedded in knowledge from centuries of experiences (Greten, 2017; Porkert, 1996).

Acupuncture has become more popular among physiotherapists in recent years (Dascanio, 2018; 2015; Garcia-Escamilla, 2017). The increased studies of physiotherapists show this, with some benefits being reported of acupuncture in treating a range of medical conditions, particularly musculoskeletal conditions, which is a crucial area of intervention in physiotherapy (Dascanio, 2018; Lovesey, 2001; Kerr, 2001). Similarly, the inclusion of acupuncture to physiotherapy treatment has shown a significant and rapid reduction of pain with minimal side effects (Dascanio, 2018; Kerr, 2001).

South Africa has become one of the first countries to legitimate Chinese Medicine in 2001, recognizing its potential value to the medical system (Huaxia, 2019). In 2019 the Confucius Institute for Chinese Medicine (CICM) was established in South Africa in partnership with the University of Western Cape, with the aim to promote Chinese culture and to study the integration of traditional and modern Chinese Medicine science (Huaxia, 2019). In UAE it was not found any report of any college or University offering Traditional Chinese Medicine.

Many universities are offering courses in complementary and alternative medicine/therapies (CAM) globally. In the US, 57 medical schools primarily taught acupuncture (73%) as a topic (Brokaw, 2002). A Korean study recommended a more heterogenous and consistent educational approach to teaching effectively respond to patients who demand CAM by medical practitioners (Kim, 2012). There is, however, the continued debate around the inclusion of non-scientific evidence-based interventions in medical curricular.

PEDAGOGICAL DISSONANCE

Dissonance Theory refers to psychological tension that can occur as a result of inconsistencies within one`s cognition. In the context of physiotherapy cognition would refer to the knowledge construction within the discipline (Bradburry, 2018).

A few decades ago, teaching acupuncture in university health education in the Western world was practically unimaginable. Currently, in addition to the growing presence of these contents in different courses, there are records of experiences of an integrated nature in which these medicines and practices are inserted throughout the curricula, in order to reduce borders in health care (Maizes, 2002; Wetzel, 2002; CAHCIM, 2004; Taylor, 2011; Schiff, 2012; Haramati, 2013; Wiles, 2013).

The Implementation Guide for Curriculum in Integrative Medicine, published by the Consortium of Academic Health Centers for Integrative Medicine (CACHIM, 2004), defended the value of integrative medicine as a profession and its connection to patient care. It emphasizes the need to focus on the person as a whole by making "use of scientific evidence and uses, appropriately, all therapeutic approaches and treatments" (Otani, 2011, pg.49).

CAHCIM's (2004) proposal includes healthcare innovation through new clinical frameworks and educational programs capable of integrating "biomedicine, the complexity of the human being, the intrinsic nature of care and the rich diversity of therapeutic systems" (Kligler et al., 2004, pg.523), and emphasizes communication skills, the doctor-user relationship, and the comprehensive approach.

The integration of teaching of acupuncture in health education requires administrative and institutional support for their inclusion in already formatted curricula, with the involvement of teachers, students, and users in this process, use of local resources and respect for laws and cultural values and symbols (Barros, 2011). Thus, it is possible to minimize resistance of ideological, corporate, or epistemological content, which must be identified, debated, and understood (Broom, 2013; Teixeira, 2013; Tesser, 2008).

RATIONALE

The literature reviewed so far has shown sufficient evidence for the use of acupuncture by physiotherapists (Dascanio, 2015; Hay, 2004; Kerr, 2001). There are references to the teaching of

complementary and alternative Medicines, such as acupuncture, in undergraduate and postgraduate Medical and physiotherapy curriculums in the USA, Canada, Mexico, United Kingdom, Germany, Taiwan, Japan, Brazil and Korea (Broom, 2013; CAHCIM, 2004; Teixeira, 2013). The initiatives of the National Center for Complementary and Alternative Medicine (NCCAM-NIH) in the United States and the National Health System (NHS) in the United Kingdom, in order to meet population demand, in investing in the training of professionals with complementary and alternative medicine education projects in the training (Lee, 2007; Pearson, 2007; McDonough, 2013; Lipman, 2003; Hehir & Williams, 2012) are worth mentioning. However, there is still a gap in the perceived importance of including acupuncture in the physiotherapy curriculum. Building upon these questions and supported by increased interest from professionals in acupuncture (Dascanio, 2015; Dascanio, 2018; Garcia-Escamilla, 2017) and the scarcity of information about their attitudes, beliefs, and practices, this research aimed to explore these concepts among physiotherapists in the UAE and South Africa (Carnevale, 2017; Bodevan, 2004; Khamis, 2015).

PURPOSE OF THE STUDY

The purpose of the research is to assess the feasibility for recommending the inclusion of acupuncture in the undergraduate physiotherapy curriculum.

Aims of the study:

- To interrogate the existing evidence of physiotherapy in combination with acupuncture in musculoskeletal conditions.
- To explore the use of acupuncture among physiotherapists

RESEARCH QUESTIONS

Phase 1: (I) In patients with musculoskeletal disorders, how helpful is physiotherapy paired with acupuncture?

Phase 2: (I) How many certified physiotherapists in each region utilize acupuncture as a supplement to their physiotherapy treatment? (II) What is the level of Specialization of physiotherapists who use acupuncture in their practice? (III) In which conditions do these physiotherapists most commonly use acupuncture in their treatment? (IV) Explore the perception of physiotherapy professionals on the

inclusion of an elective course in undergraduate physiotherapy curriculum. (V) Explore the opinion of physiotherapists whether they would recommend including acupuncture as an elective course in undergraduate physiotherapy curriculum.

CHAPTER 2: LITERATURE REVIEW

This narrative literature review will describe both physiotherapy and acupuncture, explore the curriculum in both disciplines, and provide examples of how acupuncture has been included in biomedical disciplines. Literature was sourced from different databases, such as the indexed libraries of scientific articles, SCIELO, MEDLINE, PUBMED, LILACS, COCHRANE, and textbooks. Search terms included "physiotherapy", "acupuncture" and "curriculum", combining with operators "AND" and "OR". For this particular review, articles that can be accessed freely and published in English, Spanish and Portuguese were reviewed.

The intention for this literature review was to include publications as wide as possible, as acupuncture is not a new therapy, hence no limitation was placed during the search on the database. However, the relevant publication for this review was available only from 1980. So, all relevant articles from 1980 to 2021 were included in this review.

Physiotherapy

From an etymological standpoint, the concept of physiotherapy is derived from the Greek *Physis*, which means nature, and *therapeia,* which means treatment. It covers the entire scope of the term "therapy," that incorporates the use physical agents, exercises, hands-on therapy, or advice (WHO, 2005). However, the evolutionary development of this discipline, guided by society and science, has caused fundamental mismatches between the current meaning of the term physiotherapy and its etymological root (WHO, 2005). Just as the name suggests, physiotherapy involves treating ailments using physical approaches such as exercises, massage, or heat treatment rather than using conventional drugs and surgery (World Physiotherapy, 2021). According to Setchell et al (2017), physiotherapy treatment is tailored to help individuals and the general population restore, maintain, develop, and optimize their health. Generally, Setchell et al (2017) contended,

physiotherapy as a mode of treatment encompasses a holistic approach whereby the persons involved in the treatment process actively participate. Through the promotion of physical activities, prevention, hands-on-treatment, and rehabilitation, physiotherapy attempts to restore the emotional, physical, psychological, and social well-being of everyone involved (Wahl, 2018).

It's important to note that besides physiotherapy being a science that is built with a person-centered care approach, based in evidence and protocol interventions, this is not always in accordance with clinical guidelines, as despite the use of therapeutic exercises being backed by scientific proof, the use of electrotherapy, in general, is not recommended by current guidelines (McAlindon, 2014). Therefore, there is still room for techniques which are found clinically useful but not evidence or protocol based, such as more alternative interventions if found to be clinically relevant and/or fit in with person centered care, it is paramount that, in addition to consuming scientific research, physiotherapists look for techniques that help to treat their patients' problems and illnesses although not being based on evidence.

In this context, it is reflected that physiotherapy has been adapted to social needs, evolving from a purely therapeutic end to participating in health promotion, i.e., it not only deals with people with established health problems, but also ensures that they "stay healthy." In short, it is understood that physiotherapy is *"... the profession that helps, avoiding, modifying, correcting, or adapting the factors that limit the good functioning or behavior of people, using both physical means and instruments, to facilitate the highest degree of independence and self- sufficiency*" (WCPT, 1999).

SCOPE OF PRACTICE

The application of physiotherapy in the medical sector is vast. For instance, physiotherapy is used to alleviate and treat the conditions related to problems with the bones, soft tissues, joints, and the nervous system, including problems with movement due to the problem with the nervous system. Physiotherapy is also used to treat heart conditions and lungs to hasten recovery, especially after a heart attack or in the event of Chronic Obstructive Pulmonary Disease (COPD). Grammatopoulou et al. (2017) in a cross-sectional study, established that physiotherapists were important in helping Intensive Care Unit (ICU) patients with motion exercises. In a different study, Hall et al. (2021) investigated the scope of practice when physiotherapists are incorporated in the care for adults with cystic fibrosis. In a cross-sectional study that included 1058 participants, Hall et al. (2021) found physiotherapists effective in respiratory and exercise treatments assigned to patients. The scope of physiotherapy practice differs by

country, it incorporates the competency and effective application of physiotherapy skills (Kirsch, 2018). In the United States, the scope of physiotherapy practice is anchored in three pillars: personal; professional and legal. The legal practice of physiotherapy is governed by what is permitted by law such as the rules that guide the use of physiotherapy treatment (Kirsch, 2018). Professionally, physiotherapy practice is anchored on the available educational system and emerging frameworks guiding its application. Under personal scope, physiotherapy practice is dependent on the ability of a physiotherapist to perform their duties effectively and competently (Kirsch, 2018).

In the United Arab Emirates (UAE), the Scope of Practice for Physiotherapy as announced by the Emirates Physiotherapy Society, states that: "Physiotherapists with relevant continuing education may provide: Orthopaedic manipulative therapy, acupuncture/meridian therapy, Intervention for people with high risk and infectious diseases…" (EPS, 2018). Examples of other countries include, for example, Spain where the Associacion Espanola De Fisioterapia Invasiva (AEF-IV - Spanish Association of Invasive Physiotherapy), a subgroup of the Associacion Espanola de Fisioterapia (AEF - Spanish Association of Physiotherapy) states: "However, the incorporation of these techniques (dry needling, percutaneous electrolysis or acupuncture) into the daily clinical practice of the physiotherapist has created several fronts due to the heterogeneity of therapeutic and formative criteria that are too varied. To unify these criteria and increase global recognition by the scientific community, the scientific career of the AEF-INV started on February 13, 2017, becoming an independent subgroup of the Association Fisioterapeuta Espanola (AEF)." (AEFINV, n.d.), which allows us to assume that physiotherapists can work with acupuncture.

Given this situation, it is critical to investigate the effectiveness of acupuncture treatment on musculoskeletal conditions when used in conjunction with physiotherapy.

Acupuncture

In simple definitions, puncturing with needles is acupuncture. The term acupuncture, used in a broader sense, includes body surface needling, heat treatment (moxibustion) applied superficially, electroacupuncture with direct needle stimulation or transcutaneous electrical nerve stimulation (TENS), laser-acupuncture with a superficial application, microsystemic acupuncture with superficial needling (ear, face, hand, and scalp) and acupressure (massage and pressure in selected places) (Wu, 1996; Porkert, 1996).

Acupuncture is an integral part of a more comprehensive concept, Traditional Chinese Medicine (TCM), in which the treatment of diseases and functional disorders seeks to restore health by promoting

balance and functional harmony (Wu, 1996; Porkert, 1996). In TCM, the disease is seen as a functional disorder in the human body, and the treatment is directed at regulating and harmonizing the vital dysfunctions in the most acceptable and lasting way. In this way, acupuncture points have to harmonize, calming, facilitating, benefiting, and adjusting the organic functions (Gallego, 2007). In acupuncture, a model of acupuncture on the body's surface is joined by lines, named channels, conduits, or meridians. These systems of lines or channels are in turn connected with the internal organs (Greten, 2017; Porkert, 1996; Maciocia, 1996).

According to TCM, one of the health needs is having the ability to balance the environment and the human body. This balance is in a state of constant adjustment, and thus the normal physiological activities of the body are maintained. If external influences are more significant than the adaptive power of the organism, or if the body is unable to adjust to the conditions of change, equilibrium is lost, hence dysfunctions and diseases develop (Greten, 2017; Maciocia, 1996; Quiroz-Gonzalez, 2017). When external influences are responsible for the induction of diseases, these agents are exogenous pathogenic factors, generating the so-called external or exogenous diseases. In addition to the diseases caused by the exogenous pathogenic factors, there are several diseases determined by emotional and dysfunctional disorders of the internal organs with their clinical manifestations, generating the so-called internal or endogenous diseases (Greten, 2017; Porkert, 1996; Maciocia, 1996).

The literature reveals that acupuncture on its own may have the following effects on the body (Greten, 2017; Porkert, 1996, Maciocia, 1996):

A. **Analgesia**

Acupoint can be defined as a sensitive region on the body with the highest concentration of nerve endings; this region is in intimate relation with nerves, blood vessels, tendons, and jointcapsules (Quiroz-Gonzalez, 2017). Morpho functional studies have identified nerve plexuses, vascular elements, and muscle bundles as the most likely receptor sites of acupoints (Quiroz-Gonzalez, 2017).

Acupuncture points are areas where there are histologically more significant amounts of nerve receptors such as accessible nerve endings, muscle spindles, Golgi tendon organs, mastocytes, and capillaries, compared to surrounding makes the electrical potential of these areas different when compared to neighboring areas. Consequently, this facilitates the action potential in the local nerve fibers, which drive the stimuli to the central nervous system, mainly

through the fibers A-delta and C (Yin, 2018).

On the other hand, the analgesic and anesthetic effects of acupuncture are now conceived from scientific research as a process of excitation that releases endorphins (Mayor, 2013) in response to intense and vigorous stimuli on the needle inserted at the acupuncture points. This acts at the level of the A-delta fibers, situated at a more superficial level (Beissner, 2010).

Over the years, different studies have been conducted to describe the processes, actions and the neurochemical phenomena that occur during analgesia and anesthesia by acupuncture, which leads to an understanding of the importance of spinal reflexes as important mechanisms of action of this modality of treatment (Quiroz-Gonzalez, 2017). The research from Yin (2018) highlights the physiology of the nerve fibers and reflex arches as one of the actions due to action. According to Quiroz-Gonzalez (2017), the specific points selected for the treatment of a particular disease are found in the innervated somatic tissue of the same spinal segments that supply the visceral organism related to the cause of the disease.

B. <u>Protection against infections</u>

Although acupuncture seems to benefit modulation of the immune system, there are still several gaps in knowledge. For instance, the information available on acupuncture and its significance in treatment is scarce both electronically and in hard copy. The unavailability of empirical literature on acupuncture has limited its overall use in clinical treatments as medical practitioners and clinicians cannot fully ascertain or conclusively comment on its effectiveness. Overall, Li (2013) and Kou (2005) without certainty tried to explain how acupuncture could be used to restore the circulation of blood. According to the scholars, acupuncture excites the autonomic nervous system that activate or restore the normal circulation of blood.

Recent studies have shown that acupuncture has an impact on the populations of leukocytes and lymphocytes in human peripheral blood (Li, 2013; Kou, 2005). Acupuncture is also linked to a number of immunological changes. For instance, according to Kou (2005), Takashi (2009), and Pavao (2010), acupuncture altered the activity of lymphocytes, natural killer cells, macrophages, and neutrophils, all of which are important for the body's overall immunity. It has been demonstrated that the stimulation of specific points results in both immunological and functional changes at the cellular level that are significant, such as the alteration of the lymphocyte numbers (Pavao, 2010).

C. **Regulation of various physiological functions**

Ferreira (2010) and White (2008) defined psychological response as the use of acupuncture to activate the automated self-regulation mechanisms of the immune and endocrine systems. Stimulating and activating the immune and the endocrine systems is achieved by stimulating the systems at four levels: supraspinal or supra-segmental level, local level, segmental level and extra-segmental or spinal level (Ferreira, 2010; Duarte, 2011).

- **Segmental or medullary action**: key to understanding segmental action and effect of acupuncture can best be described by the theory of portal control suggested by Melzack and Wall. According to Melzack and Will, compared to the unmyelinated sensory nerves, the myelinated and high velocity fiber transmits its information to the central nervous system much faster when the activation occurs around an injured area rather than an area experiencing local pain. Critical to note is that the myelinated fibers tend to block the nerve impulses transmitted via the unmyelinated C fibers when the stimuli reaches the posterior horn of the spinal cord by releasing enkephalins and Gamma-Aminobutyric Acid (GABA), inhibitory neurotransmitters (Ferreira, 2010; Cheng, 2014). The various organ tissues of our body may have the same innervation. To obtain an effect, the needles are placed at the same innervations on the root nerve as in the affected site, of the posterior horn of the spinal cord similar to the level of the stimulated medullary segment (Ferreira, 2010; Zhou, 2010).

- **Extra-segmental or spinal action**: According to Ferreira (2010) and Cheng (2014), it is not clear how extra-segmental spinal action works since it can only be explained by the strength of stimulus rather than the location of the stimulus. The extra-segmental action is controlled by the periaqueductal matter of the brain by suppressing the activities of nerve cells located in the descending region of the posterior horn of the spinal cord.

- **Supra-spinal or central action:** The activation and stimulation of the Supra-spinal level occurs at the cerebral cortex of the brain, which is related to the spinal cord by the descending inhibitory bundles, as opposed to the other levels of acupuncture stimulation, which occur at the posterior horn of the spinal cord. The thalamus and the reticular system process the impulses created by acupuncture therapy before distributing them to the cerebellum, the somatosensory cortex, the prefrontal cortex, and the limbic system. The responses by each of the system will depend by the intensity of the stimuli. Overall, the action of supra-spinal action is observed by its control of the periaqueductal grey matter in the brainstem and suppressing the

activities of the nerve cells located the brainstem (Duarte Ferreira, 2010).). According to Mayor (2013) the supraspinal impacts or outcomes of acupuncture can be improved by electrostimulation.

- **Local Action**: Acupuncture stimulates sensitive peripheral neurological receptors, namely free nerve endings, composed predominantly of A delta fibres in the skin, and in the muscle of type II and III fibres, which forms a network responsible for the propagation of nerve stimulation to blood vessels and local immune cells (Li, 2013; Ferreira, 2010). According to Ferreira (2010), the axonal reflex will induce an increase in local blood supply due to the release of several vasoactive substances such as substance P, bradykinins, Calcitonin gene-related peptide (CGRP) (polypeptide related to the colcitonin gene), vasoactive intestinal peptide (VIP), Histamine, Serotonin, neural growth factor (NGF), vascular growth factor (VGF), etc. These substances are responsible for some of the effects observed at the time of puncture, namely heat and redness around the needle, paraesthesia, pruritus, or a sensation of heaviness or grinding – these act as promoters of healing either by vasodilation or by neurogenesis of blood vessels (Quiroz-Gonzalez, 2017; Ferreira, 2010). In addition to the local effects as described, there is also the release of biochemical analgesic substances such as β endorphin in large quantities, thus blocking nociception (Ferreira, 2010; Taffarel, 2009. These substances are released by the local inflammatory cells (granulocytes), demonstrating a type of activation of the immune system by acupuncture.

Physiotherapy and Acupuncture

Pain can present clinically in different ways and associated with multiple symptoms and as such examining the pain from different angles including from the central and the peripheral angles coupled with the manifested clinical symptoms would help alleviate the pain much easier (Gifford, 1997; Kumar, 2011). When clinicians and other medical professionals diagnose and evaluate the patient's type of pain, their comprehension and identification of these mechanisms aid clinical judgment and reasoning. (Nijs, 2009; Smart, 2006).

The choice of treatment plan and pain alleviation technique, the physiotherapist must have scientific and practical knowledge of the technique they are to perform given that each available technique is unique and contains a neurophysiological description of how it works (Smart, 2006). To

determine the most effective therapeutic and physiotherapy technique, Smart (2006) suggested that thorough background search on the application and use of technique to alleviate pain.

With intense stimulation in the medullary laminae of the posterior horn interneurons are stimulated to inhibit the feelings of pain. The action displayed by interneurons can be explained by the gate control of pain that the competition between the stimuli and noxious describe the mechanism of actions of interneurons. A more analysis of this stimulation yields that the arrival of the stimuli at the posterior horn of the spinal cord and taking into account the speed and intensity of the stimuli, it is arguable that the activations of interneurons stimulate the release of GABA and opioid substances (Nijis, 2009; Smart, 2006). Aside from acupuncture, the gate control theory also guides other pain-relieving methods such as manual therapy, myofascial release, transcutaneous electrical nerve stimulation and cold spray (Curatolo, 2006; Galeotti, 2002).

The regulation of the different physiological functions and processes can be used to explain the role of analgesia in protecting the body against infections. On the therapeutic effects of acupuncture, Kerr (2001) assumed that the actions were regulated by the actions of several organ systems described as being non-specific although with significant applications in addressing different functional disorders as explained by Kerr (2009) and Zhuo (1982). Thus, considering the broad acupuncture approach, it is possible to assume that physiotherapy treatment supplemented with acupuncture could be beneficial. In as early as 1982, good results in a range of conditions treated using acupuncture to complement physiotherapy treatment was reported (Duffin, 1982). Conditions treated included asthma, knee osteoarthritis, non-specific hip pain, post-patellectomy pain, scar pain, adhesive capsulitis, and eczema. Acupuncture was used to complement whenever conventional physiotherapy failed to provide effectiveness or if a plateau of improvement was achieved. Patients reported mainly a decrease in pain outcomes and improvements in function (Duffin, 1982).

Acupuncture has been widely used in physiotherapy for pain relief (Kerr, 2001). Acupuncture' analgesic effects have been area of research since the 1970s, revealing a positive relationship between stimulation of acupoints and improvement of function (Wen, 1995). According to Lovesey et al. (2001), physiotherapeutic modalities, such as Transcutaneous Electrical Neurostimulation (TENS), Ultrasounds (US), Cryotherapy, Extracorporeal Shockwave Therapy (ESWT) can decrease inflammation and increase local healing (Gosling, 2012), while acupuncture is administered to increase Qi (Vital Energy) in the meridian and the related organ or for local analgesia (Greten, 2017).

In the United Kingdom (UK), the use of acupuncture to supplement the professional skills of physiotherapists has been applied since the early 1980s and accepted as a standard modality to be used as part of the physiotherapeutic treatment (Lovesey, 2001).

When speaking about acupuncture and physiotherapy, it is essential to also distinguish between acupuncture and dry needling. Dry needling is a technique that may be used to treat a number of ailments, including muscular soreness, trigger points, spasms, and other muscle issues (Cagnie, 2013; Kalichman, 2010). Acupuncture is governed by TCM doctrines and works with meridian lines. As such, the needles must be inserted into specific acupuncture points that refer to different regions and organs of the body. On the other hand, during dry needling, the needles are inserted into points of muscular activation (Dommerholt, 2013; Zhou, 2015). Dry needling is a technique that may be used to treat a wide range of issues, including muscular soreness, trigger points, spasms, and other muscle issues (Dommerholt, 2013; Zhou, 2015). The effects of acupuncture compared to those of dry needling are that acupuncturists believe acupuncture points stimulate the nervous system. Gattie et al. (2017) claim that activating the central nervous system sends chemicals into the muscles, spinal cord, and brain, promoting the body's natural healing process. The outcome of these natural substances stimulated at acupuncture points enhances the emotional and physical wellbeing of those under treatment (Rose, 2018).

Physiotherapy Curriculum

The actual contents of an average physiotherapy Course, according to the guidelines of WCPT, are related to the whole process of individual, community, and family health-disease process. The epidemiological, social, and professional training reality provides the necessary care actions associated with physiotherapy (WCPT, 2003). The basis of these is in learning experiences in the biological, physical sciences, and clinical sciences.

The curricular organization of the physiotherapy course has an articulated and facilitating vision among the components and curricular activities with a technical, humanized, and resolute concern in the development of the professional (WCPT, 2003).

The physiotherapy departments actively participate in constructing knowledge, supporting the biotechnological, psychosocial, and specific physiotherapist training (WCPT, 2003). The physiotherapy

departments around the globe, following the WCPT Curriculum Guidelines, are constantly building and reshaping their content, when necessary, to meet the needs that may arise within their training and health contexts (WCPT, 2003).

The course on physiotherapy according to the WCPT Curriculum Guidelines, has to include the following aspects (WCPT, 2003):

- Biological and Physical Sciences
- Social/Behavioural/Technological Sciences
- Clinical Sciences
- Biodynamics of Human Motricity
- Health, Training, and Society

The curriculum should also include characteristics that are inherent to practice as a professional physiotherapist (WCPT, 2003):

- Patient/Client Care/Management through:
- Communication
- Consultation/Screening
- Critical analysis/clinical reasoning/clinical decision making
- Education
- Management/Administration/Supervision
- Research
- Accountability
- Altruism
- Compassion/Caring
- Cultural Competence
- Ethical Behaviour
- Integrity

- Personal/Professional development
- Professional duty
- Social responsibility and advocacy
- Teamwork

When exploring the physiotherapy scope of practice in South Africa (SA) and United Arab Emirates (UAE) countries it was noticeable that there is no reference to acupuncture in the physiotherapy scope of practice. However, the WCPT website refers to a subgroup, the "International Acupuncture Association of Physical Therapists," founded in 1991, which became a member of WCPT in 1999. Physiotherapists originally formed this subgroup from 5 countries - Australia, South Africa (represented by the South African Society of Physiotherapy Acupuncture in Physiotherapy Group), New Zealand, Sweden, and the United Kingdom. With these professionals practicing acupuncture since the 1980s, members from other countries - Hong Kong, Ireland, Greece, Macau, Canada, Denmark, Cyprus, and Argentina-have since joined the subgroup and individual members (WCPT, n.d.).

Acupuncture Curriculum

The WHO Guidelines on basic education and safety in acupuncture stated that "high-quality training should be attained to acquire a profile of clinical competence for the autonomous practice of acupuncture" (WHO, 1999). For instance, the education system should first and foremost promote a culture of self-reflection in addition to being tailored to meet specific students' needs. Additionally, the education system or curriculum should be designed in such a way that it promotes lifelong and continuous learning besides striving to integrate principles of acupuncture training and practice with the basic and clinical skills (WHO, 1999). It is intended that students acquire professional skills in primary care and in specific intervention areas of the different medical specialties, with a view to their future professional practice (WHO, 1999).

EXISTING RESEARCH ON ACUPUNCTURE INCLUSION IN PHYSIOTHERAPY CURRICULUM

Acupuncture, which is a subsection of the broader area of TCM, had been adopted in some educational institutions in the Western World (Carnevale, 2017; Bodevan, 2004; Brokaw, 2002; Kim, 2012; Machado, 2012) (Bodevan, 2004). However, the level of acceptance of such complementary or alternative medicine is still uncommon in Western colleges and universities. Despite the scarcity of literature on the inclusion of acupuncture in the physiotherapy curriculum, existing studies show that western colleges are becoming more interested in adopting the acupuncture curriculum. Carnevale et al. (2017) and Bodevan & Sant'Ana (2004) reported that despite Western colleges' adoption of acupuncture courses, most colleges and universities have opted to provide acupuncture courses separately to interested students rather than including them in the standard curriculum. In a study conducted in Brazil, the Higher Education Institutions (HEIs) of the State of Paraná that currently offer the undergraduate course in physiotherapy were surveyed, a questionnaire on the subject was sent to 24 Institutions , 50% return was received. It was note that none of the undergraduate courses have a specific discipline for this theme and, when this is addressed, it is inserted in 75% of other disciplines of the undergraduate curriculum, the other 25% do not allocate any workload to teaching this theme. As for the opinion of course coordinators regarding the insertion of acupuncture in the curriculum, they found that 58.3% of them considered this insertion necessary. When it was asked about the existence of physiotherapists specializing in acupuncture in the institution's faculty, we obtained the answer that in 91.6% of the courses that responded, they have at least one acupuncturist physiotherapist, it was also reported that most students believed that acupuncture was a critical adjunct therapy that should be included in the standard physiotherapy curriculum (Bodevan, 2004). Additionally, the study reported that acupuncture teaching in the Brazilian institution was only given to fourth- and fifth-year students and was not mandatory (Bodevan, 2004).

In another study conducted in Brazil, it was reported that acupuncture received a positive response in Brazil where legislation was passed by the Brazilian government in 1988, legalizing the use of acupuncture in standard physiotherapy practice (Carnevale, 2017). Since then, the passage of the legislation, acupuncture in medical practice has improved significantly (Bodevan, 2004; Machado, 2012). A proliferation in the use of acupuncture in physiotherapy practice has also compelled most physiotherapy colleges and institutions to include it in physiotherapy training (Carnevale, 2017). Brazil has approved a standard training program for acupuncture in physiotherapy, which takes approximately two years or 5760 training hours (Bodevan, 2004). One of the essential requirements for training learners on acupuncture is possessing profound knowledge and experience in both traditional medicine and Western

medicine. This is a model can be implemented in other countries, the UAE do not currently have any such mode of training. However, SA has a professional qualification in Chinese medicine as an exclusive course (Huaxia, 2019) but is not integrated into physiotherapy curriculum nor recognized by the physiotherapy council.

In the UK, acupuncturists also made some efforts to lobby for the legalization of acupuncture and subsequent development of standards of practice for acupuncture. However, the acupuncturists faced significant backlash from the science community as most skeptics believe traditional or alternative medicine is not scientifically plausible (Dascanio, 2015). In brief, the inclusion of acupuncture in the standard physiotherapy curriculum has not had much traction even in countries where it has been legalized, such as Brazil (Carnevale, 2017; Dascanio, 2018; Bodevan, 2004). In Brazil, for instance, acupuncture is offered as a separate elective course to physiotherapy students (Carnevale, 2017; Bodevan, 2004). There is also a paucity of research on acupuncture's inclusion in conventional physiotherapy curriculum.

Noteworthy, when examining the acupuncture curriculum, the World Health Organization (WHO) in 1999 suggested that individuals interested in acupuncture practice needed to receive high-quality training to enhance competence and autonomy in acupuncture practice. Additionally, in the same report, the WHO noted that acupuncture training and education should be student-centered in colleges and universities focused on imparting the most relevant and up-to-date skills on acupuncture research, learning, teaching, and overall student reflection, knowledge, and skills. Following the success of a combination of physiotherapy and acupuncture in relieving pain as illustrated in literature (Lovesey, 2001; Kerr, 2001; Lovesey et al., 2001; Kerr et al., 2001) concluded that physiotherapists thought that acupuncture should be incorporated early in professional training of physiotherapists.

In another study, Anderson et al. (2020) studied how an evidenced based Chinese medicine program could be developed and integrated into the overall existing learning programs. According to Anderson et al. (2020), developing and integrating evidence-based practice in Chinese medicine is a critical step in basing a vital biomedical education and practice among medical practitioners. The foundational principles of evidence-based practice and training are anchored on facilitating critical thinking in enhancing scientific evidence, understanding patients' preferences, and improving the clinical experience. The results by Anderson et al. (2020) reiterated student's positive perception of the inclusion of acupuncture or evidence-based practice in medical practice. A similar conclusion was reached by Chen (2019), who established that effective treatment of acute ischemic stroke and other medical conditions

required an in-depth and extensive use of the evidence-based practice. Even though Chen (2019) reported contradicting results on the acceptance and use of acupuncture in treating acute ischemic stroke, they demonstrated the effectiveness of acupuncture treatment in improving neurological deficits, cognitive impairment, and swallowing disorder. Similar to Anderson et al. (2020), Chen (2019) concluded that introducing acupuncture courses in the physiotherapy curriculum would see improved biomedical training and education and the use of critical thinking skills when attending to patients.

In the United States, the history of acupuncture is almost 50 years old (Chen, 2019). Examining Chinese medical history, Chen (2019) contended that acupuncture had been used for over three thousand years. In the United States, the rapid acceptance and use of acupuncture have seen the practice act passed by 47 states and the District of Columbia. In recent data, Chen (2019) reported more than 37000 licensed acupuncturists in the United States. Examining medical education in the United States, Chen (2019) reported that many medical students were highly interested in learning and applying acupuncture in their medical practice. Chen (2019) contended that legislation regulating the application of acupuncture had attracted high enrolments. For instance, a relative number of students have enrolled in Oriental medicine programs that include acupuncture and Chinese herbal education. Despite the significance of acupuncture education in American medical training, Chen (2019) established that the majority of acupuncture training schools were low in resources. Additionally, the acupuncture curricula in the United States lacked the basic practical biomedical, clinical training but instead focused on theoretically training acupuncture. Inadequate infrastructure for acupuncture training results in half-baked acupuncturists with limited practical acupuncture experience.

The continued acceptance and adoption of acupuncture in university and college curriculum indicates its significance in patient treatment. For instance, Anderson et al. (2020) found acupuncture to effectively alleviate pain from patient's findings that were supported by Chen (2019) . In addition to alleviating the effects of acute ischemic stroke, Chen (2019) found acupuncture to improve neurological deficit and cognitive impairment. The positive outcome of acupuncture has been supported by increased positive perception and interest among students wishing to specialize in acupuncture (Chen, 2019) (Qu, 2021).

CHAPTER 3: SYSTEMATIC REVIEW

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SYSTEMATIC REVIEW

Exploring the Effectiveness of Acupuncture as an Adjunct to Physiotherapy in the Treatment of Musculoskeletal Conditions: A Systematic Review

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Introduction

The review of the literature was deemed a crucial step in the development of scientific and academic work by Guyatt (2008) and Higgins (2019). At its core, review of literature helps the academic and scientific field in that it limits the reproduction or duplication of an existing research, allows scholars and researchers to identify gaps and limitations in existing research that form the base for more empirical research (Higgins, 2019). In addition to the above, conducting a literature review also helps in supporting the existence of a particular scientific problem, propose themes guiding the scientific analysis of the problem in addition to making the consolidated study material available in community and academic libraries for learning purposes and as a subsidy to science (Higgins, 2019; 2011). It is not by chance that articles that present literature reviews are usually among the most sought after by readers of scientific publications (Baek, 2018).

In order to develop such a curriculum, it is first necessary to understand what the existing literature, primarily randomized control trials (RCT), has to say about the efficacy of combining physiotherapy and acupuncture. This systematic review's primary goal is to serve as a foundation for a larger study. The goal of this study is to investigate whether acupuncture courses could be implemented

in undergraduate physiotherapy curricula. Because musculoskeletal conditions are among the most common ones to be treated with acupuncture, that condition was chosen. (Hopton, 2012; White, 2009).

Methodology

STUDY DESIGN

According to the Cochrane Foundation, a systematic review performs comprehensive and non-biased literature summaries, i.e., following an explicit method and selection criteria (Higgins, 2011). The researcher does not collect primary data in the current study rather analyses previously conducted research studies (Higgins, 2011).

According to Bastian et al. (2010), in the field of health sciences, roughly 75 randomized control trials and 11 systematic reviews are published per day. Thus, reliable, and accurate revision of available evidence is essential and crucial for decision-making by researchers and practitioners in the performance of their work (Higgins, 2011). Due to this constant need to update available scientific knowledge, systematic reviews are increasingly valued by the scientific community (Moher, 2009). The quality of systematic review, according to Moher et al. (2009), is not restricted to the end output, but must be ensured throughout the review process.

Because this study attempted to combine the data of existing properly conducted studies (controlled trials) addressing the efficacy of acupuncture treatment, a systematic review was employed. Additionally, a systematic review of literature will present an opportunity for the scholar to highlight or at glance tell the effectiveness of acupuncture in treatment based on previous findings. Moreover, the results of the systematic review may be used by the scholar to support the existence of the problem and also help in the drafting of recommendations for practice or future research.

AIMS AND OBJECTIVES

Given the above, the main objective of this systematic review is to synthesize the current body of knowledge in rehabilitation science in which physiotherapy is used in combination with acupuncture treatments.

Specific Objectives:

(I) Identify the level of specialization in acupuncture that is more common among physiotherapists.

(II) Analyze the opinion of physiotherapists regarding the inclusion of acupuncture in the Curriculum of physiotherapy.

(III) Determine the frequency with which physiotherapists employ acupuncture as a therapy method

(IV) Identify the most prevalent conditions that are treated with acupuncture as a stand-alone intervention or as a supplement to physiotherapy treatment

A systematic review of randomized controlled trials was conducted to assess the efficacy and efficiency of acupuncture treatment as an adjunct to physiotherapy in the treatment of musculoskeletal conditions using existing literature, with the sole goal of improving the quality of life of those involved. The review also reviews the cross-sectional studies that seek to identify the variance between the application of the two interventions and the respective impact on the health outcomes.

INCLUSION AND EXCLUSION CRITERIA

The review only included studies published in the English language to enable an accurate review. Only studies published during the last decade that looked at adult populations with musculoskeletal (MSK) disorders were included in the review. Studies published in non-English languages, focusing on a pediatric population, studies that included non-cross-sectional design or non-randomized study were not included in the systematic review. Furthermore, the scholar omitted any material that compared or contrasted different types of acupuncture. In addition, animal research was left out of the systematic review.

OUTCOME MEASURES

The primary outcome of this particular systematic research review is to examine the efficacy of acupuncture in the treating and managing MSK while being used as an adjunct therapy. Specifically, the study reviews how well acupuncture alleviates pain and facilitates the acquisition of range of movements (ROM). In addition to pain and ROM as primary outcome measures, secondary outcome measures that the researcher will also seek to address in the current systematic review include the quality of life,

functional outcomes, and strength of acupuncture. The secondary outcome measures were examined using a valid questionnaire developed by the researcher, by means of reliability and face validity tests.

DATA SOURCES

The data used to accomplish the current systematic review included previous randomized control study cross-sectional studies. The randomized controlled studies/literature were obtained from search databases and engines including in the PubMed, Cochrane Library, and PEDro were scoured for literature. In essence, to maximize on the search, keywords combined by Boolean operators AND and OR. The following keywords were used: Acupuncture, Physiotherapy, Physical Therapy, Manual Therapy, Rehabilitation, Neuromuscular disorders, Musculoskeletal (MSK) conditions (Attachment 1).

STUDY SELECTION

After completing the search for material in the identified databases, , independent reviewers (two) will be selected to give their expert opinion on whether the studies can be used to successfully respond to both the primary and secondary outcomes. Upon approval, the researcher will embark on other important areas of research. However, in the case where the experts rise question concerning the ability the research study to meet the outcomes, the researcher will be forced to re-examine and find a study that will help meet both primary and secondary study outcomes.

DATA EXTRACTION

The data contained in the reviewed systematic studies will be extracted by the two reviewers responsible for implementing the study selection (Attachment 2). An extraction table was developed to guide the data extraction to ensure that the relevant data has been included for the systematic review (Attachment 3). The following information was extracted: publication details, study design, sampling, participants, inclusion and exclusion criteria, intervention or treatment criteria, control and intervention group, the findings, and implication of the research.

ASSESSMENT OF RISK OF BIAS OF INCLUDED STUDIES

PEDro Quality Scale assess the authenticity and the validity of the findings of the studies included in the systematic research review, also known as risk of bias, through a number of questions (Shiwa, 2011). Several aspects of the studies are used in quality assessment criteria. The PEDro Quality Scale was created to aid PEDro database users in assessing the methodological quality of RCTs (internal validity, criteria 2–9), as well as the statistical description (if the research has a minimum of statistical information to allow the findings to be interpreted) (criteria 10 and 11) (Shiwa, 2011). The external validity of the study (criterion 1), generalization of results, or magnitude of treatment effect (i.e., whether the results are clinically relevant or not) are not included in the numerical analysis of the PEDro Quality Scale (Shiwa, 2011).

Besides the risks of bias, the quality scale also allowed the measurement of quality outcomes. Assessing the risks of bias, the researcher used two independent reviewers to assess and identify cases of bias that might impact and lower the quality of the identified outcomes. The identified reviewers will ensure there is a consensus between the reviewers and any disagreement is addressed by the introduction of a third party.

MEASURING RISK AND BIAS

The following eleven criteria were used in the evaluation of the quality of each study:

1. **Eligibility criteria were specified: no/yes**

When the report indicates the source of the participants and the list of criteria used to identify who was qualifies to participate in the study, this criterion (criterion 1) can be regarded met (Pedro.org, 1999). For the final score, this criterion is not considered (Schulz, 1995), since it does not evaluate internal validity or statistical validity of the study, but with external validity (Nedel, 2016).

2. Participants were arbitrarily grouped and assigned an order based on how treatments were administered): no/yes

If the report states that the subject distribution was random, it is assumed that there was random allocation in the research (Pedro.org, 1999), however, the method of randomness does not need to be explicitly described (Schulz, 1995). Procedures such as utilizing a random number generator (i.e., computers, random number tables.) or coin tossing should be considered random distribution. The condition is not met by quasi-random distribution approaches such as allocation by hospital record number or birth date, or alternation (Pedro.org, 1999). Randomization guarantees that treatment and control groups are similar within the restrictions imposed by chance (Pedro.org, 1999).

3. **Allocation was concealed: no/yes**

Blind/concealed distribution implies that who was responsible to establish the subject's eligibility to participate in the clinical study was unaware of the group to which the subject would belong when the decision was made (Pedro.org, 1999) (Schulz, 1995).

"Blind" or "hidden" refers to the fact that the person who determined the eligibility for inclusion of participants in the study did not know at that time in the allocation of the participant (Pedro.org, 1999) (Hollis, 1999). If the distribution is not hidden (or blinded), the decision to include the participant can be influenced by prior knowledge of the group to which the participant would be allocated. This can produce systematic deviations in the random distribution (Schulz, 1995; Hollis, 1999). There is empirical evidence that hidden distribution is a predictive factor in the therapeutic effect (Schulz, 1995; Hollis, 1999).

4**. The randomized groups were maintained identical at the baseline regarding key prognostic indicators: no/yes**

Studies involving therapeutic interventions require the report to state a minimum of one measure for treating medical complications, and its primary outcome measure characterizes the starting point (Schulz, 1995). The investigator must guarantee that it is impossible to predict clinically significant differences in the results for the various groups based on the predictive starting conditions. This criterion is reached even if only the initial study data are presented (Schulz, 1995).

This criterion is likely to predict potential bias that occurred at random in the random distribution (Schulz, 1995). Large disparities across groups might indicate faulty randomization processes (PEdro.org, 1999).

5**. <u>There was blinding of all subjects: no/yes</u>**

The term “blinding” refers to the fact that the person in issue (the patient, the therapist, or the assessor) had no idea which group the subject had been assigned to. Furthermore, patients are only termed “blind” if it is believed that they would be unable to discern between treatment groups (PEdro.org, 1999)

"Blinding" subjects ensures the there is no possibility for them to differentiate if they have or not received treatment (PEdro.org, 1999) (Schulz, 1995). The subjects were required to attest that the treatment’s success or lack of efficacy was not attributable to placebo or the Hawthorne effect (PEdro.org, 1999) (Schulz, 1995).

The most significant difficulty of these studies in reaching higher scores is associates closely with the blinding of evaluator, participants, and physiotherapists (Schulz, 1995). Although this difficulty may only be the result of the writing of the scientific text, in which information may have been suppressed or not presented to the reader, often, especially in a physiotherapy setting, the lack of this information can be attributed to the fact that subjects cannot be wholly blinded in this environment, due to the nature of the treatment in itself (Nedel, 2016).

6**. <u>The investigator blinded therapists who were recruited to administer the therapy: no/yes</u>**

"Blind" therapists presented them the opportunity to treat all participants equally as they would not tell who among them had received treatment. In blinding, the researcher seeks to lower or block the effects of the treatment procedure by ensuring the conditions are not right to record the effects or lack thereof on the condition being investigated (Schulz, 1995).

7. **Assessors who measured more than one outcome were blinded: no/yes**

"Blinding" the assessors are to ensure that they could not discriminate whether study participants received treatment (Schulz, 1995). When the assessors are "blind," the reader makes ensures that the treatment's apparent impact (or lack thereof) is not attributable to the influence of the assessors who assessed the treatments' outcomes (Schulz, 1995). If the patient was blind, the assessor is deemed blind in trials where critical outcomes are self-reported (e.g., visual analogue scale, pain diary) (PEdro.org, 1999).

8. **Key outcomes measures were obtained from more than 85% of the total participants previously allocated to various groups: no/yes**

Only if the report explicitly mentions both the number of subjects initially assigned to groups and the number of subjects from whom critical outcome measures were acquired, is this condition met. (PEdro.org, 1999). In clinical studies, that measure the outcomes at different points in time, a key outcome must be derived from a minimum of 85% of the subjects at one time (PEdro.org, 1999) (Schulz, 1995).

Outcome measures must be performed on all subjects that have been distributed to groups (Schulz, 1995). Subjects who did not respond to the assessments may be systematically different from those who responded, introducing bias into the study (Schulz, 1995). The magnitude of this bias increases as the number of participants who did not respond increases (Schulz, 1995).

9**. Participants whose outcome measures were determined received control conditions, and in case this situation was unachievable, more than one key outcome was examined for treatment: no/yes**

When individuals did not get treatment (or the control condition) as assigned and outcome measures were available, an intention to treat analysis was done as if subjects got the treatment (or control condition) they were assigned to. Eventhough there is no mention of analysis by intention to treat, this requirement is met if the report expressly says that all participants got the treatment or control conditions as assigned (PEdro.org, 2011).

It is almost inevitable that there will be no breaches of the research protocol in clinical trials (Schulz, 1995). Problems are considered protocol violations, such as subjects not receiving the treatments

they should or receiving treatments they should not receive (Schulz, 1995). Analyzing the data according to the interventions that the subjects received (instead of analyzing according to the treatments that the subjects should receive) can influence the results. It is also essential that it is done according to the planned conditions in the random distribution when the analysis is done (Schulz, 1995). This is commonly called "intention-to-treat analysis" (Schulz, 1995).

10. **Between-group statistical results were compared and reported for more than one key outcome: no/yes**

A statistical comparison between groups entails a statistical comparison between 2 groups (Nedel, 2016). This might include comparing two or more treatments or comparing the treatment to the control condition, depending on the study's design. (PEdro.org, 1999). A simple comparison of after-treatment outcomes or a comparison of changes in one group to changes in the other might be used in the analysis (when data is analyzed using a factor analysis of variance, the latter is frequently presented as group x time interaction). The comparison can take the form of hypothesis testing (it gives a "p" value showing how likely it is that the groups differed purely due to chance) or an estimate (the mean or median difference, for example, or a proportional difference, or the number needed to treat, or the relative risk or hazard ratio) and its confidence interval. (PEdro.org, 1999).

Statistical tests should be used in clinical trials to evaluate if the difference between groups happened "by chance". (Schulz, 1995).

11. **The study has point and variability measures for more than one key outcome no/yes**

The magnitude of the therapeutic effect is measured by a measure of accuracy (PEdro.org, 1999) (Schulz, 1995). The treatment's effect might be expressed as a difference in group outcomes or as the outcome in (all) groups (PEdro.org, 1999). Standard deviations (SDs), standard errors, confidence intervals, interquartile ranges (or other quantum ranges), and ranges are examples of variability measures (PEdro.org, 1999). Precision measurements and measures of variability can be presented graphically (Schulz, 1995). When the results are related to categorical variables, the criterion is considered to be fulfilled if the number of participants in groups and categories is identifiable (Schulz, 1995).

Clinical studies provide accurate estimates of the effect of a given treatment (Nedel, 2016). “The best estimate (point estimate) of the treatment is the difference between (or ratio of) the outcomes between the treatment and control groups. A measure of the degree of uncertainty associated with this estimate can only be calculated if the study presents measures of variability” (PEdro.org, 1999).

ASSESSMENT OF HETEROGENEITY

The statistical heterogeneity across the reviewed studies, attributable to the clinical and methodological heterogeneity, was assessed to determine the variance between the assessed sources. The I^2 test was applied to test the variance with 0% reflecting lack of heterogeneity, 25% reflecting low heterogeneity, 50 % variance reflecting moderate heterogeneity, whereas a value close to 75% reflects the risk of heterogeneity (Huedo-Medina, 2006). The I^2 value is the percentage of variance across studies that is due to heterogeneity rather than chance. When $p<0.05$ in Q statistics and $I^2>40\%$, heterogeneity is deemed significant (Huedo-Medina, 2006).

META-ANALYSIS

Meta-analysis is adopted in the review to pool the data of various research studies where possible (Hedges, 1986). A meta-analysis is a method of combining quantitative data from several studies to evaluate the degree to which the independent variable influences the dependent variable (Hedges, 1986). In comprehensive research, it employs statistical data from individual quantitative investigations as the units of measurement (Hedges, 1986). Impact size indices or mean differences are used to summarize the findings, which “may then be averaged to produce an overall assessment of effect magnitude” (Hedges, 1986). The meta-analysis’ strength stems from the fact that the effect size indicators are called-free. It is feasible to aggregate the findings of studies that assess the same construct by using a scale-free index of impact magnitude (Hedges, 1986).

The impacts of group type on the outcomes of each of the numerous experimental methods were evaluated in this study to assess the size of the overall effect, as evidenced by the findings of individual experiments. Q and I^2 tests were used to assess study heterogeneity. Q, sometimes known as Cochran’s Q, is a traditional measure of heterogeneity. The weighted sum of squares of individual measurements and the total weights of all measures in the research are used to generate the figure. The findings of the meta-analysis will be provided as a weighted mean difference with a 95% confidence interval and a

significance level of 0.05. Forest plots will be used to summarize the data from each research and meta-analysis.

Furthermore, because each study provided several types of estimates, a general inverse-variance method to the meta-analysis was required. As the name suggests, the inverse variance method entails initially determining the standard error of the effect estimate of a study and then using the reciprocal of the standard error as the weight for that particular study. As such, greater weights are assigned to more extensive studies whose standard errors are relatively small. Conversely, smaller weights are assigned to smaller studies whose standard errors are relatively huge. In addition, the evidence of heterogeneity was subjected to a random model based on a significant test for heterogeneity. Since we were insignificant heterogeneity, the random effect model was chosen (Higgins, 2019).

MEASURING OF TREATMENT EFFECT

In order to maximize the generality of the study outcomes, the mean is used to analyze continuous data with a confidence interval of 95% (Schulz, 1995). The risk ratio is also applied in assessing the dichotomous data. If the mean was not measured in the treatment effect, the corresponding statistics were reported with the 95% confidence interval (Schulz, 1995).

UNIT OF ANALYSIS ISSUE

The long-term studies that involve follow-up for over two months are repeatedly evaluated to help in classifying the results based on the time frame (Huedo-Medina, 2006; Hedges, 1986). The research that tests the intervention in more than one intervention group is categorized differently in the meta-analysis. Attachment 3 (3.1-3.5) details precisely how the groups in each study were categorized.

SUB-GROUP ANALYSIS

The studies will be further grouped into subgroups, to facilitate the analysis as it becomes more homogeneous. Such subgroups include the category of age, gender, the duration of the intervention, MSK conditions, follow-up, and key outcome measures.

Results

RESULTS OF THE SEARCH

The results from the electronic search yielded a total of 227 abstracts and study titles as illustrated in figure 1 below. Breaking down the electronic results, 29 of the obtained results were retrieved from PEDro, 189 from PUBMed and were retrieved from Cochrane. A closer examination of the retrieved studies revealed that 75 of them were duplicates and as a result were discarded leaving the researcher with 152 studies. In the second screening process that followed the study' inclusion criteria, it was found that 21 studies did not include or were not reporting on MSK conditions while 116 of other studies lacked information on physiotherapy and acupuncture treatment. Therefore, of the selected 227 studies, only fifteen made to the last stage of screening whereby seven were discarded for failing to meet the eligibility set by the researcher. Therefore, only eight studies were included in the current research with six included in a quantitative meta-analysis and all eight were used to perform a qualitative analysis (Fig 1).

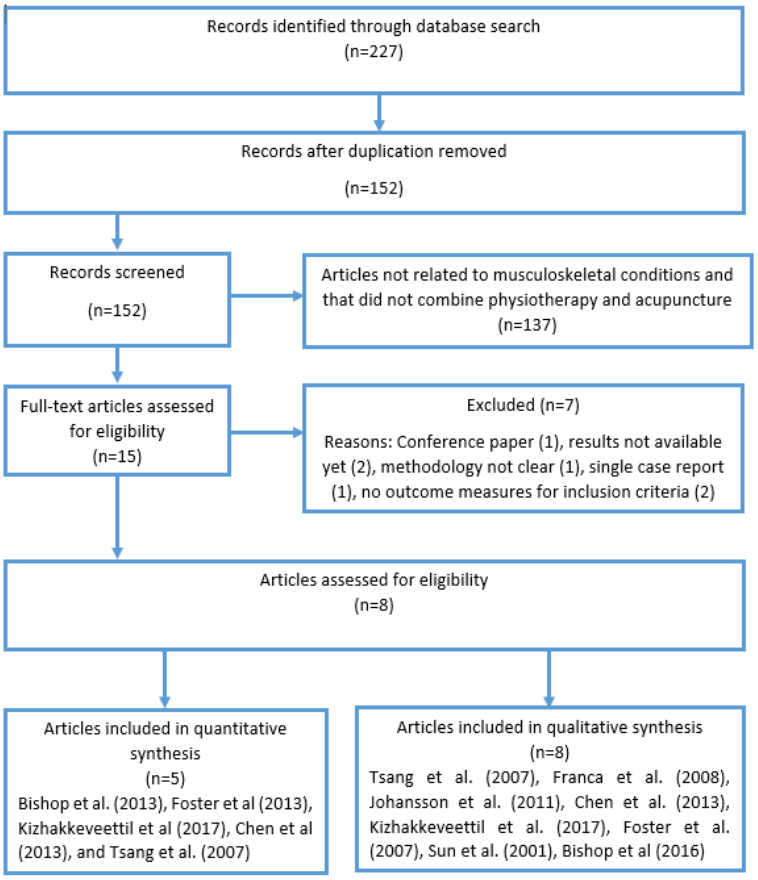

Figure 1 – Flowchart of the search

DESCRIPTION OF THE INCLUDED STUDIES

The current study utilized a quantitative cross-sectional research design with an extensive section of systematic literature review supported by the above flowchart. An analysis of the included studies revealed that the total participants included in the current quantitative study were 960 participants with 611 participants included in the control group while 349 patients were placed in the intervention group (Tsang, 2007; Franca, 2008; Johansson, 2011; Chen, 2013; Kizhakkeveettil, 2017; Foster, 2007; Sun, 2001; Bishop, 2016). In terms of gender, 418 of the participants were female (65%) while 223 were male (35%). Knee osteoarthritis (3 studies) (Tsang, 2007; Chen, 2013; Foster, 2007), tension neck syndrome (1 article) (Franca, 2008), subacromial impingement (1 article) (Johansson, 2011), low back pain (2 studies) (Kizhakkeveettil, 2017; Bishop, 2016), and frozen shoulder (1 article) (Sun, 2001) are the main clinical MSK disorders studied in the research (Table 1). Majority of reviewed acupuncture studies employed randomized control trials. For this particular review, six studies were randomized control trials as shown in table 1 below. There were no cross-over trials.

Table 1 – Study details

First Author (Year)/ Study location	Study Design/Length of study	Type of Injury	Sample size (n)
(Tsang, 2007)	Randomized Control Trial/Two weeks	Knee osteoarthritis	30
(Franca, 2008)	Prospective, comparative clinical trial/10 weeks with follow up after six months	Tension neck syndrome	46
(Johansoon, 2011)	Randomized Controlled Trial/12 months	Subacromial Impingement	91
(Chen, 2013)	Randomized double-blind controlled trial/12 weeks	Knee osteoarthritis	214
(Kizhakkeveettil, 2017)	Randomized Control Trial/60 days	Low Back Pain	101

(Foster, 2007)	Multicenter, Randomized Control Trial/3 weeks	Osteoarthritis of the knee	352
(Sun, 2001)	Randomized Control Trial/6 weeks	Frozen shoulder	35
(Bishop, 2016)	Randomized controlled trial/6 weeks	Pregnant women with back pain	91

INTERVENTIONS USED IN THE INCLUDED STUDIES

Medication and physiotherapy, acupuncture, placebo, and sham were all used in the trials that were included. Two studies compared physiotherapy with acupuncture to physiotherapy with sham acupuncture (Tsang, 2007, Franca, 2008). One research examined the effects of physiotherapy alone with physiotherapy combined with acupuncture. (Kizhakkeveettil, 2017). Another research aimed to see if there was a significant difference in outcomes between the intervention groups, who were given corticosteroids and home exercises, and the control group, who were given acupuncture and home exercises (Johansoon, 2011). The final four investigations compared three different groups: acupuncture alone was compared in two trials (Tsang, 2007) (Franca, 2008), physiotherapy alone, and acupuncture combined with physiotherapy (Chen, 2013; Foster, 2007); the other two studies compared physiotherapy alone (Chen, 2013; Sun, 2001), physiotherapy plus sham acupuncture and physiotherapy plus true acupuncture (Bishop, 2016) (Table 2). Studies described 16 different acupuncture points. acupuncture points were chosen based on the location of the disorder, the team's experience, or reports of evidence based on the usage of the chosen sites in the treatment of the disorders researched (Table 2).

In one trial, all groups received a conventional postoperative physiotherapy program, as well as 10 sessions of either acupuncture or sham acupuncture within 2 weeks (Tsang, 2007). In a ten-week trial Franca et al. (2008) divided participants into three groups for various treatments: Group-1 received both physiotherapy and acupuncture, Group-2 received just acupuncture, and Group-3 received only physiotherapy. Patients with subacromial impingement syndrome (SIS) were randomized to either subacromial corticosteroid injections or ten acupuncture sessions combined with home exercises in research by Johansson et al. (2011). Acupuncture was done at the same nine spots suggested by the

Traditional Chinese "Bi" syndrome approach to knee pain, using either regular needles or Streitberger non-skin puncturing needles, in a study conducted by Chen et al (2013). Participants with acute or chronic lower back pain were divided into three groups by Kizhakkeveettil et al. (2017): Group-1 received acupuncture; Group-2 spinal manipulative therapy (SMT); and Group-3 integrative acupuncture and SMT. Foster et al (2007) conducted a trial to see if adding acupuncture to a physiotherapy-administered course of advice and exercise for pain relief in people with osteoarthritis of the knee was beneficial. Advice and exercise (Group-1), advice and exercise plus real acupuncture (Group-2), and advice and exercise plus non-penetrating acupuncture (Group-3) were among the interventions. Sun et al. (2001) conducted a different trial in which 35 patients with frozen shoulder problems were randomly assigned to a six-week acupuncture group therapy. Finally, Bishop et al. (2016) conducted research in which participants were divided into three groups and given one of three treatments: Group-1 received conventional medicine; Group-2 conventional medicine plus genuine acupuncture, or Group-3 conventional medicine with non-penetrating acupuncture (Table 2).

Table 2 – General Intervention details

First Author (Year)/Location study	**Intervention Group**	**Control Group**
(Tsang, 2007)	**N=** 15 **(**3 **males,** 12 **females)** **Physiotherapy + Acupuncture** **Post-operative days** 1-2 (1) Deep breathing exercise (2) Ankle and toes exercise (3) Active assisted knee flexion and extension exercise (4) Limb maintenance exercises. **Postoperative days** 3–7 + (1) Ice therapy (2) Self-assisted knee flexion exercise (3 Passive stretching of the hamstring (4) Strengthening exercise of quadriceps (5) Full weight-bearing walking exercise with frame **Postoperative day** 7 **onwards**	**N=** 15 **(**3 **males,** 12 **females)** **Physiotherapy + Sham Acupuncture** **Post-operative days** 1-2 (1) Deep breathing exercise (2) Ankle and toes exercise (3) Active assisted knee flexion and extension exercise (4) Limb maintenance exercises. **Postoperative days** 3–7 + (1) Ice therapy (2) Self-assisted knee flexion exercise (3) Passive stretching of the hamstring (4) Strengthening exercise of quadriceps (5) Full weight-bearing walking exercise with frame **Postoperative day** 7 **onwards**

	+ (1) Eccentric control of quadriceps training (2) Stairs ascending and descending training (3) Proprioceptive training (4) Cardiovascular training + True Acupuncture points = ST32, ST33, GB31, GB35, GB34, ST36	+ (1) Eccentric control of quadriceps training (2) Stairs ascending and descending training (3) Proprioceptive training (4) Cardiovascular training + Sham Acupuncture (Acupuncture needles were put less than 5mm superficially and roughly 2 cm distant from the same acupoints as the acupuncture group)
(Johansoon, 2011)	**N=** 49 **(**27 **females,** 22 **males)** **Physiotherapy + Corticosteroids** Within one week of being included, the patients were sent to a GP for an injection of 1 mL Depomedrone + 8–10 mL 1% prilocaine. Patients were instructed to avoid heavy arm activities for the following two weeks after receiving the injection. Patients were then permitted to resume regular activities, although they were advised to avoid behaviors that may cause impingement	**N=** 42 **(**26 **females,** 16 **males)** **Physiotherapy + Acupuncture** Within one week of being enrolled, the patients began manual acupuncture as well as a home exercise regimen. For five weeks, the procedure was done twice weekly. The two-step home exercise regimen was based on clinical experience and previous effectiveness studies. To minimize causing discomfort to the afflicted tissues, the first segment used low-intensity repetitions to preserve mobility and increase circulation in the rotator cuff. The second half, on the other hand, avoided impingement by keeping the rotator cuff in a neutral posture. All of the tasks are detailed in previous research.
(Chen, 2013)	**N=** 104 **(**53 **females,** 51 **males)** **Physiotherapy + Acupuncture** ROM exercises, muscular strengthening, and cardiovascular conditioning (bike and treadmill apparatus) were all part of the physiotherapy treatment Acupuncture included primary acupoints such as GB34, SP9, ST36, ST35, and Xiyan and distal points such as UB60, GB39, SP6 and KI3	**N=** 109 **(**57 **females,** 52 **males)** **Physiotherapy + Sham Acupuncture** ROM exercises, muscular strengthening, and cardiovascular conditioning (bike and treadmill apparatus) were all part of the physiotherapy treatment Streitberger Non-penetration needle was used on the same points Except for the acupuncturist, who wasn't blinded owing to the nature of the intervention, all of the intervenient (patients, physical therapists, data collectors, and statistician) were blinded for this study. They went to training sessions to learn how

		to communicate with each patient in a structured way to avoid unblinding.
(Sun, 2001)	**N=** 13 **(**9 **females,** 4 **male)** **Physiotherapy + Acupuncture** Pendular exercises included flexion, abduction, horizontal abduction, elevation with elbow flexed, depression/elevation in lying position, elevation with stick, abduction with stick, elevation with stick behind head, crawling fingers for flexion and abduction, retraction, and external rotation with hand behind back/neck in standing position, and weight-bearing shoulder extension in sitting position. Participants were asked to perform selected shoulder exercises. For Acupuncture, the extra point of Zhongping was chosen.	**N=**22 **(**15 **females,** 7 **male)** **Physiotherapy** Exercise and home exercise programs were conducted in the same way as for the Physiotherapy group.

First Author (Year)/Location study	Physiotherapy	Acupuncture	Physiotherapy + True Acupuncture	Physiotherapy + Sham Acupuncture
(Bishop, 2016)	N= 32 (32 females) Women were allowed to seek back physiotherapy care, comprising a personalized assessment and 2 to 4 treatment sessions for six weeks. The sessions mainly consisted of advice, exercise tactics, massage, and manual therapy, among others. However, group sessions, Acupuncture, and hydrotherapy were not applicable when SC is concerned.	N/A	N= 32 (32 females) The same self-management pamphlet for physiotherapy plus true acupuncture. Besides, trained physiotherapists in EASE Back management administered Acupuncture. The Acupuncture therapy consists of six to eight sessions spread out over six weeks. Physiotherapy comprises a minimum of 6 and a maximum of 10 bilateral sites employing Western and trigger point acupuncture principles	N= 27 (27 females) Physiotherapy+ Non-penetrating Acupuncture Physiotherapy plus non-penetrating Acupuncture. The non-penetrating needles seem like actual needles, but the tips are dulled and the shaft slides freely in the handle, giving the sensation of penetration.
(Franca, 2008)	Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3	N=15 (12 females, 3 males)	N= 16 (12 females, 3 males)	N/A

	+ Physiotherapy: i) Stretching exercises of the deep cervical flexion muscles (DCFM). ii) recruitment exercises. of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) N= 15 Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises. of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs)	Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3	Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3 + Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs)	
(Kizhakkeveettil, 2017)	N= 36 (17 females, 19 male) Spinal Manipulation Techniques were used in specific contact points on vertebral processes + Passive articulatory mobilization of the lumbosacral spinal joints, paraspinal soft tissue stretching, digital pressure on painful sites, and post-isometric muscle relaxation techniques are all examples of passive articulatory mobilization. Physical treatment techniques such as heat, cold, ultrasound, and	N= 33 (10 females 23 male) Treatment involved Acupuncture needling, moxibustion, electrical Acupuncture, Tui Na, and cupping.	N= 31 (17 females, 14 male) Participants in the Acupuncture and Physiotherapy care group received both Acupuncture and Physiotherapy from separate practitioners using the previously described protocols.	N/A

	electrical muscle stimulation were employed as needed, as well as active care activities.			
(Foster, 2007)	N= 116 Patients received advice supplemented by a leaflet and individualized, progressed exercises	N/A	N= 117 Patients received advice supplemented by a leaflet and individualized, progressed exercises plus acupuncture on traditional Chinese acupuncture points	N= 119 Patients received advice supplemented by a leaflet and individualized, progressed exercises plus received acupuncture through a needle with a blunt tip and a shaft that collapses into the handle, giving the appearance of insertion (same protocol from true Acupuncture)

DFCM – Deep Cervical Flexion Muscles; ROM – Range of Motion; N/A – Not Applicable; EASE – Evaluating Acupuncture and Standard of CarE.

OUTCOME MEASURES USED IN THE INCLUDED STUDIES

An analysis of the included studies revealed that five out of the eight studies assessed pain as the most outcome measure. In measuring pain as an outcome each study employed its own technique with Franca (2008) measuring pain using Visual Analogic Scale (VAS), Kizhakkeveettil (2017) used the Numeric Pain Rating Scale (NPRS) while Tsang (2007) used Roland-Morris LBP Disability Questionnaire. In another study, Bishop (2016) used Adolfsson-Lysholm shoulder assessment (AL-SCORE). Chen (2013) and Foster (2007) used the Western Ontario and McMaster Universities Osteoarthritis index (WOMAC) pain subscale score as shown in table 3.

Besides pain as the most assessed outcome in the studies examined, other outcome measures that were examined by existing scholars included active and passive ROM as investigated by Tsang (2007) and measured using goniometer, quality of life measured by EuroQol-five-dimension self-report questionnaire (EQ-5D-5L). Other outcomes included ambulation measurement as investigated by Tsang (2007) and measured by timed-up and go test (TUG) shoulder assessment score measured by the AL-SCORE by Johansson (2011), VAS used in assessing the outcomes of muscular tension (VASmt) by Franca (2008) and Sun (2001) constant shoulder assessment.

Table 3 - Outcome measure and measurement tools

First Author (Year)	Outcome Measure	Measurement Tool
(Tsang, 2007)	- Pain - Active and Passive Knee ROM - Ambulation	- Numeric Pain rating scale - Goniometer - TUG
(Franca, 2008)	- Pain - Isometric Neck Muscle Strength - Muscular tension of the neck - Functional Disability	- VAS_{pain} - Pressure Biofeedback Device (Stabilizer, Chattanooga South Pacific, Australia) - VAS_{mt} - Neck Disability Index (NDI-BR)
(Johansoon, 2011)	- Pain - Shoulder function - Patient's Global Assessment of change	- AL-score - EQ-5D - Unaltered, minor improvement, huge improvement, or recovered on a five-point ordinal scale with fixed alternatives: unchanged, moderate improvement, large improvement, or recovered
(Chen, 2013)	- Change in WOMAC score - Brief Pain Inventory (BPI) - Patients can easily walk for 6 minutes on a level surface.	- WOMAC Index - 36-item Short Form Health Survey - 6 minutes-walk-test (6MWT)
(Kizhakkeveettil, 2017)	- Level of Disability - Pain	- Roland-Morris LBP Disability Questionnaire - Numeric Rating Scale (NRS)
(Foster, 2007)	- Pain - Function	- WOMAC – Pain sub-scale score - WOMAC – Function sub-scale score
(Sun, 2001)	- Functional mobility - Power - Pain	- Constant Shoulder Assessment
(Bishop, 2016)	- Pain intensity - Functioning	- NPRS - Pelvic Girdle Questionnaire (PGQ), - Oswestry Disability Index (ODI),

TUG – Time-up-go; EQ-5D – European Quality of Life Five Dimension; WOMAC – Western Ontario and McMaster Universities Arthritis Index; NPRS – Numerical Pain Rating Scale

QUALITY OF INCLUDED STUDIES

The quality of each study included in the research process was measured or assessed using the PEDro Quality Assessment Scale (Table 4). Using the scale, all the eight studies that were graded with three studies scoring 9/10, three other studies scoring 7/10 while two studies scored 8/10. Based on the PEDro scale rating, the eight selected studies had an average of score of 8.125 an indication of their quality and their key role in achieving the objectives of the study.

Overall, the explanations behind each trial's ratings were very similar. Only Chen et al. (2013) and Sun et al. (2001) were able to document blinding of therapists to group allocation, whereas Sun et al. (2001) failed to disclose concealment of allocation. The lack of blinding of the

therapists in other studies could be linked to the challenges of blinding the therapist who administers the physical treatment. According to Nedel (2016) while a researcher believing or trusting in a single technique for better results, his/her belief is likely to influence the outcome of the results with blinding of the data collection process minimizing the risks of doubt. If the physical treatment technique is identical between groups and the intervention group receives some additional non-physical interventions, it may be possible to blind the therapist. In regard to blinding of the participants, five studies were unable to report on this (Franca, 2008; Johansoon, 2011; Kizhakkeveettil, 2017; Foster, 2007; Sun, 2001). The blinding of outcome assessors had also the same results with four articles failing to report blinding of the assessors (Franca, 2008; Kizhakkeveettil, 2017; Foster, 2007; Bishop, 2016).

For all experiments, randomization was done using a variety of approaches. Tsang et al. (2007) employed block randomization to assign patients to the acupuncture or sham acupuncture groups at random using four-block randomization. Patients were randomly assigned to three groups in the study by Franca et al. (2008), and a series of random numbers of intervention codes was established using block randomization and sealed opaque envelopes by a person not engaged with the trial. Patients who volunteered to participate in the Johansson et al. (2011) trial were randomly assigned to receive a corticosteroid injection or acupuncture mixed with home exercises. A study coordinator who did not participate in the assessment process arbitrarily allocated participants to various groups using computer-generated numbers or list. The treatment options were placed in envelopes that were numbered according to the randomization list and kept hidden. Chen et al. (2013) performed randomization by initially allocating patients to groups without following any prescribed pattern. The purpose of randomization was to reduce allocation bias. For instance, Kizhakkeveettil et al. (2017) used a computer software to randomly assign individuals based on sex, presence of discomfort below the knee, degree of pain, and sex. Aside from the computer software, an adaptive randomization strategy that inquiries about the number of participants within every group in order to achieve

balance in both the control and intervention groups is also used. In a study by Foster et al. (2007), participants were randomized. Initially, Foster et al. (2007) selected a sample of participants to be used in the study. They then assigned the participants to groups without adherence to any prescribed pattern in order to reduce researcher bias. Sun et al. (2001) using the random table method to randomize patients into either of the formed group.

In the study by Bishop et al. (2016), a ratio of 1.1.1 was used to randomize women who were recruited for the study to the three arm treatment assessments using varying sizes of blocks that were unsystematically selected for a period of 24 weeks. A registered Clinical Trials Unit used remote telephone randomization to assign participants to groups.

Table 4 - Quality assessment of each study evaluated based on the PEDro Quality Assessment Scale

Article	Criteria											
	1. Eligibility	2. Randomization	3. Allocation concealment	4. Similar groups	5. Blinding (Subjects)	6. Blinding (Therapists)	7. Blinding (Assessors)	8. 85% outcome measures	9. All participants assigned to Control or treatment	10. Statistical Comparisons	11. Variability measures	TOTAL (/10)
(Tsang, 2007)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9
(Franca, 2008)	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	7
(Johansoon, 2011)	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	7
(Chen, 2013)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
(Kizhakkeveettil, 2017)	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	7
(Foster, 2007)	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	9
(Sun, 2001)	Yes	Yes	No	Yes	No	Yes[1]	Yes	Yes	Yes	Yes	Yes	8
(Bishop, 2016)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	8

1 Even though the study mentions that the therapists were blinded, they do not explain how the process was done. This is a limitation of the study

QUANTITATIVE ANALYSIS

Effects on Pain

Pain was the most used outcome measure, for which pooling of data was possible.

1) Comparison of the effects of physiotherapy alone to physiotherapy combined with acupuncture

The effect of physiotherapy compared to the combination of physiotherapy and acupuncture on pain was evaluated using the NPRS in two studies (Kizhakkeveettil, 2017; Bishop, 2016). Figure 2 summarizes the results, revealing a non-significant pooled effect of -0.61 (p= 0.67).

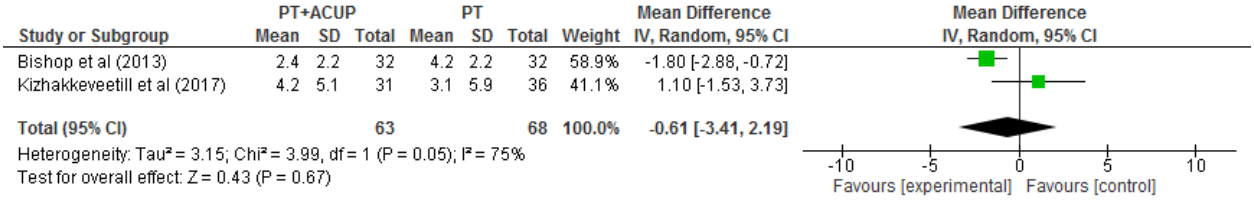

Figure 2 - Comparison of the effects of Physiotherapy (PT) alone versus Physiotherapy combined with Acupuncture (AP) on pain levels

Based on a significant test for heterogeneity, $\chi 2 = 3.99$, $p = 0.05$, $I^2 = 75\%$, there was evidence of heterogeneity. As a result, heterogeneity accounts for around 75% of overall variance among trials.

2) Effects of physiotherapy combined with true acupuncture compared to physiotherapy combined with sham acupuncture on pain levels.

Figure 3 presents the forest plot comparing physiotherapy combined with true acupuncture to physiotherapy combined with sham acupuncture on pain levels. The outcome measures used to evaluate pain were: Brief Pain Inventory (Chen, 2013), WOMAC – pain subscale score (Foster, 2007) and NPRS (Tsang, 2007). The pooled effect was -0.05. It can be observed that the study by Tsang et al. (2007) had a large variability based on the confidence interval of the mean difference. The study did not find a significant difference between the two groups.

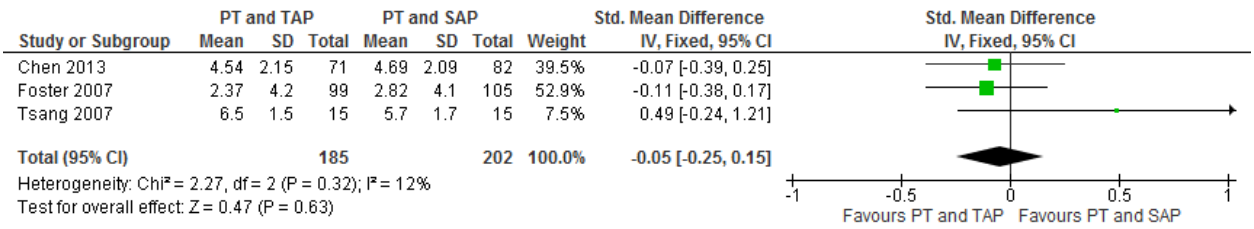

Figure 3 - Effects of Physiotherapy (PT) combined with true Acupuncture (TAP) compared to Physiotherapy combined with sham Acupuncture (SAP) on Pain levels.

QUALITATIVE ANALYSIS ACCORDING TO OUTCOME MEASURES

Range of Movement (ROM)

Despite being one of the key outcome measures for the current study, ROM was only studied in one study done by Tsang (2007). Key to their study, Tsang (2007) compared the outcomes of physiotherapy with true acupuncture and physiotherapy on sham acupuncture on ROM. The results of the comparison indicated no significant changes between the two randomized groups with a p-value of 0.09 and 0.75.

Table 5 - Results of effects on Range of Motion

First Author (Year)	OM	Group	Baseline (Pre-Intervention)				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Mean difference	95% CI of the mean difference
(Tsang, 2007)	AROM (Right Knee)	PT+ACUP	15	100.9	27.3	0.464	15	94.0	15.0	0.745	1	-11.74 to 9.74
		PT+SHAM	15	107.0	16.0		15	93.0	13.7			
	AROM (Left Knee)	PT+ACUP	15	101.7	31.9	0.441	15	96.5	17.1	0.098	-3.2	-8.9 to 15.30
		PT+SHAM	15	109.0	17.3		15	99.7	15.2			
	PROM (Right Knee)	PT+ACUP	15	108.8	29.6	0.462	15	107.9	11.3	0.729	6.4	-15.08 to 2.28
		PT+SHAM	15	115.3	16.5		15	101.5	11.9			
	PROM (Left Knee)	PT+ACUP	15	110.6	35.4	0.434	15	107.3	15.9	0.320	1.3	-12.75 to 10.15
		PT+SHAM	15	118.7	17.2		15	106.0	14.7			

*OM = Outcome measure; ROM = Range of motion; SD = Standard deviation; CI = Confidence Interval; AROM = Active range of Motion; PROM = Passive Range of Motion; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group

Mobility Measure

The effectiveness of combining physiotherapy with acupuncture on Mobility measure was assessed in two studies, Tsang et al. (2007) and Chen et al. (2013). First, pooling the data from the two studies was a challenge because not similar outcomes were used by the researchers. Compared to the findings between Chen et al. (2013) and Tsang (2007), there were significant changes and developments in the TUG intervention after eight7 weeks for Tsang (2007) while no changes were observed for Chen et al. (2013. A closer look of Tsang (2007) results, coupling physiotherapy with acupuncture yielded positive results after 15 weeks.

Table 6 - Results of effects on gait Assessment

First Author (Year)	**OM**		**Int. or Ctrl Group**	**Pre-Intervention**			**8th week post-Intervention**				**15 weeks post-Intervention**					
				N. in group	Mean	SD	N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
(Tsang, 2007)	TUG[1]		PT+ACUP	15	29.9	15.6	15	78.4	30.7	0.028	15	45.8	31.1	0.929	6	-22.46 to 10.46
			PT+SHAM	15	19.4	7.0	15	67.5	48.8		15	39.8	33.4			
				Pre-Intervention							**12 weeks post-Intervention**					
(Chen, 2013)	6MWT		PT+ACUP	105	1032#	314	0.027				71	1119#	Not given	0.562	-28	1046-1195#
			PT+SHAM	109	1126#	289					82	1147#				1086-1209#

OM = Outcome Measure; Int = Intervention group; Ctrl = Control group; SD = Standard Deviation; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group; TUG = Time-up-go test; 6MWT = 6 minutes' walk test

Muscular tension

Muscular tension was assessed by Franca et al. (2008), using VAS_{mt}. After observing the patients for six months, Franca et al. (2008) indicated a good improvement in all of the evaluated parameters ($p<0.000$) (Table 7).

Table 7 - Results on Muscular tension within groups, based on the paired t-test

First Author (Year)	**OM**	**Groups**	**Pre-Intervention**				**After 6 months of treatment**				
(Franca, 2008)			N. in group	Mean	SD	P Value (within group)	N. in group	Mean	SD	P Value (within group)	Effect size
	VAS_{tm}	PT + ACUP	16	90.0	14.81	0.053	16	15.0	14.81	<0.000	PT/ACUP= -5
		ACUP	15	80.0	22.2		15	20.0	14.81	<0.000	ACUP/PT+ACUP= -10
		PT	15	70.0	22.2		15	30.0	14.81	<0.000	PT/PT + ACUP= -15

OM = Outcome Measures; SD = Standard Deviation; VAS = Visual Analogic Scale; PT+ACUP = Physiotherapy group; PT = Acupuncture group; ACUP = Acupuncture group

Functional Disability

Three of the included studies assessed Functional Disability as an outcome measure (Franca, 2008; Kizhakkeveettil, 2017; Bishop, 2016). The results of the Neck Disability Index (NDI) used by Franca et al. (2008) to measure functional disability revealed that after six months a group that received acupuncture and physiotherapy showed an improved outcome (Table 8). Similar findings were reported by Kizhakkeveettil (2017) who found combining acupuncture with physiotherapy reduced functional disability compared to when physiotherapy alone was used. Although negligible difference in functional disability, both KWT and Dunns' multiple comparison test (DMCT) found an improved outcome in functional disability after a period of six months.

Using the Oswestry Disability Index Score (ODI), Bishop et al. (2016) after eight weeks of intervention, there were no significant changes between the two groups. Noteworthy however, the results were inconclusive given that confidence intervals were overlapping (see table 8).

Kizhakkeveettil et al. (2017) using Roland-Morris LBP Disability Questionnaire to examine the disability in patients with Low Back Pain found positive results within the three groups being studied. While there were no specific outcome measures, the results showed that combining acupuncture with

physiotherapy improved the outcomes of the participants. Key to note, Kizhakkeveettil et al. (2017) presented the opportunity for more empirical research in more randomized large-scale research that will examine the outcome on lower back pain when acupuncture is combined with SMT and compared to physiotherapy alone.

Table 8 - Results of effect on Functional Disability

First Author (Year)	**OM**	**Groups**	**Pre-Intervention**				**After 6 months of treatment**				
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size
(Franca , 2008)	NDI-BR (%)	PT +ACUP	16	24.0	8.88	0.5386	16	9.0	4.44	0.0018	PT+ACUP/ACUP = -9
		ACUP	15	30.0	10.37		15	18.0	5.925		ACUP/PT = 2
		PT	15	28.0	14.81		15	16.0	7.407		PT+ACUP/PT = 2

First Author (Year)	**OM**	**Groups**	**Pre-Intervention**			**Post-Intervention**				
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI of the mean
(Bishop, 2016)	ODI	PT	32	34.1	11.4	32	32.2	18.8	PT+ACUP/ACUP = 10.9	25.5-36.9
		PT + ACUP	32	29.1	10.9	32	21.3	17.7	ACUP/PT = -4.9	17.5-28.8
		PT+ SHAM	27	33.9	13.6	27	26.2	14.4	PT+ACUP/PT = 6	19.1-31.3

First Author (Year)	**OM**	**Groups**	**Pre-Intervention**			**After 6 months of treatment**				
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI
(Kizhakkeveettil, 2017)	Disability Level	ACUP	34	10.8	5.6	34	6.3	6.16	ACUP/SMT= 3.2	4.1-8.4
		SMT	36	11.1	6.0	36	3.1	5.9	SMT/ACUP+ SMT = -0.9	1.1-5.1
		ACUP+SMT	31	9.7	6.4	31	4.0	5.18	ACUP/SMT = 2.3	2.1-5.9

*****OM = Outcome Measures; SD = Standard Deviation; NDI-BR(%) = Neck Disability Index: Brazilian Portuguese Version; ODI = Oswestry Disability Index; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group; PT+SHAM = Physiotherapy plus Sham Acupuncture group

Muscular Strength

Franca et al. (2008) used pressure Biofeedback device (Cranio-Cervical Flexion Test) to measure Isometric Neck Muscle Strength (INMS). The results of the measure indicated significant improvements in the group that was engaged with the pressure biofeedback device. With the p< 0.05, Franca et al. (2008) explained that combining physiotherapy and acupuncture improved the overall outcome of those involved after 6 months maintaining a p value of 0.006. Similar findings were also observed in DMCT which also showed a positive improvement in outcome when physiotherapy is combined with acupuncture (P <0.0001) (table 9).

Table 9 - Results of effects on Muscular Strength

First Author (Year)	**OM**	**Groups**	**Pre-Intervention**			**After 10 weeks of treatment**						**After 6 months of treatment**					
			N. in group	Mean	SD	N. in group	Mean	SD	P Value within group	P value between group	Effect size	N. in group	Mean	SD	P Value within group	P value between group	Effect size
(Franca, 2008)	C-CFT (mmHg) Isometric Neck Muscle Strength (INMS)	PT+ACUP	16	22.0	1.41	16	27.1	2	P<0.001	P<0.0001	PT+ACUP/ACUP= 3.4	16	26.1	2.4	P<0.0001	P=0.0006	PT+ACUP/ACUP = 4
		ACUP	15	22.0	1.41	15	23.7	1.4	P<0.001		ACUP/PT = 2.8	15	23.0	1.6	P=0.0004		ACUP/PT = -2
		PT	15	20.0	1.41	15	20.9	1.4	P<0.001		PT/PT+ACUP =6.2	15	23.2	1.4	P<0.0001		PT/PT+ACUP = 2

*****OM = Outcome Measures; SD = Standard Deviation; C-CFT = Cranio-Cervical Flexion Test; INMS = Isometric Neck Muscle Strength; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group

Shoulder Function

In Johansson et al. (2011) study, combining physiotherapy with acupuncture significantly improved shoulder functionality. In particular, the intervention group had considerably better shoulder functioning than the control group (< 0.001) (Table 10). There were no significant variations in shoulder functioning between the physiotherapy plus corticosteroid group and the physiotherapy plus acupuncture group, according to Johansson et al. (2011). As such, the two combinations were both effective techniques for treating MSK complications.

Table 10 - Results of effects on Shoulder Function

First Author (Year)	OM	GROUPS	Pre-Intervention					12-month follow-up					
			N. in group	Mean	SD	P Value between groups	95% CI	N. in group	Mean	SD	P Value between groups	Effect size	95% CI of the mean
(Johansoon, 2011)	Shoulder Function	PT + Corticost	49	69	12	P<0.001	66-73	37	88	-19	P<0.001	-3	84-92
		PT+ACUP	42	70	12		67-74	32	91				88-95

*****OM = Outcome Measures; SD = Standard Deviation; PT = Physiotherapy; ACU = Acupuncture; CI = Confident Interval; PT+Corticost = Physiotherapy plus Corticosteroids group; PT+ACUP = Physiotherapy plus Acupuncture group

WOMAC score

In another study, Chen et al. (2013) examined whether there were differences in reported WOMAC scores between patients treated with a combination of true acupuncture and physiotherapy, and a combination of sham acupuncture and physiotherapy. The target population for Chen's et al. (2013) study was patients with knee and hip osteoarthritis. In their findings, Chen et al. (2013) reported no significant differences between the two groups. Notably, the respective WOMAC scores for the physiotherapy + sham acupuncture group and physiotherapy + true acupuncture group were 30.3% and 31.6%. Based on the ANOVA results reported, the WOMAC scores for the two groups were not significantly different (p = 0.148) (Table 11).

Table 11 - Results of effects on WOMAC score

First Author (Year)	OM	GROUPS	Pre-Intervention				26 weeks post-Intervention				
			N. in group	Mean	SD	P Value	N. in group	Mean	P Value	Effect size	95% CI of the mean
(Chen, 2013)	WOMAC	PT+ACUP	105	47.6	14.7	P=0.097	71	41.5	P=0.148	4.3	37.6-45.4
		PT+SHAM	109	44.0	15.7		82	37.2			32.8-41.6

*****OM = Outcome Measures; SD = Standard Deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group

Constant Shoulder Assessment (CSA)

The Constant Shoulder Assessment (CSA) score is used to evaluate shoulder functionality before and after a treatment has been administered. The CSA scale ranges between 0 and 100, with higher scores representing better shoulder functionality while lower scores representing minimal shoulder functionality. The CSA scale is designed such that it measures four outcomes associated with shoulder functionality: pain, range of motion, strength scores, and activities of daily living. The respective scores of the four indicators of shoulder functionality - pain, range of motion, strength scores, and activities of daily living – are 15, 40, 25, and 20.

In a frozen shoulder study conducted by Sun et al. (2001), the CSA scale was used to assess shoulder functionality following intervention using two treatment modalities: physiotherapy + acupuncture and physiotherapy. Sun et al. (2001) only measured shoulder functionality using two of the four CSA outcomes; activities of daily living and pain. As per Sun et al. (2001) findings, the physiotherapy + acupuncture group showed significantly higher CSA scores as compared to the physiotherapy alone group (p = 0.048) (Table 12).

Table 12 - Results of effects on CSA

First Author (Year)	**OM**	**GROUPS**	**Pre-Intervention**				20 **weeks follow-up**				
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size
(Sun, 2001)	CSA	PT+ACUP	13	41.3	14.9	0.9651	13	67.3	11.5	0.048	9.4
		PT	22	42.8	14.0		22	57.9	15.1		

*****OM = Outcome Measures; SD = Standard Deviation; CSA = Constant Shoulder Assessment; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT = Physiotherapy group

Medication Effects

In another study, Tsang et al. (2007) examined whether significant differences in analgesic consumption existed between two groups of patients. The first group was treated with a combination of true acupuncture + physiotherapy, while the second group was treated with sham acupuncture + physiotherapy. However, there were no significant differences in analgesic consumption between the two groups (p = 0.447). However, the authors did not report the baseline measures of analgesic consumption for both groups hence limiting the interpretability of their findings (Table 13).

Table 13 - Results of effects on Medication Effects

First Author (Year)	OM	Int. or Ctrl Group	Pre-Intervention				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
(Tsang, 2007)	Analgesic Consumption	PT+ACUP	NOT MENTION				15	28.3	11.6	0.447	-3.6	- 13.2 to 6.0
		PT+SHAM					15	24.7	13,8			

*****OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group

QUALITATIVE ANALYSIS ACCORDING TO CONDITIONS

Knee Osteoarthritis

Three of the studies looked at the benefits of physiotherapy combined with acupuncture on knee osteoarthritis patients. (Tsang, 2007; Chen, 2013; Foster, 2007).

There were no significant changes in overall mean pain ratings at rest (p=0.463) or at maximum (p=0.177), according to Tsang et al (2007) (Table 14). Acupuncture was shown to be no better than sham acupuncture for relieving pain in knee osteoarthritis patients in this study. Tsang et al (2007) looked examined analgesic intake (Table 13) and found no significant differences across groups, comparable to the prior findings (p=0.447). The same conclusions were found while assessing TUG, with p=0.929.

Table 14 - Results of effects on overall pain - Tsang et al.(2007)

First Author (Year)	OM	GROUPS	Baseline (Pre-Intervention)				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI
(Tsang, 2007)	Pain level at rest	PT+ACUP	15	2.1	1.7	0.424	15	2.2	1.4	0.463	0.4	- 0.6 to 1.3
		PT+SHAM	15	1.5	1.9		15	2.6	1.2			
	Pain level at maximum	PT+ACUP	15	6.6	1.5	0.536	15	6.5	1.5	0.177	-0.8	- 2.0 to 0.4
		PT+SHAM	15	7.0	2.9		15	5.7	1.7			

*****OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group

Chen et al (2013) also investigated Knee Osteoarthritis, where they compared physiotherapy plus true acupuncture as the intervention group with physiotherapy plus sham acupuncture as the control group, for the outcome pain, assessed by VAS. No differences between the two groups were demonstrated (Table 15). The same result was observed when assessing gait with 6MWT (6-minute walk test) (Table 6), where there were no significant differences between the two groups in terms of 6MWT scores (p = 0.562). Another outcome measure used by Chen et al. (2013) was WOMAC (Table 11). There were no significant differences between the two groups, according to the cumulative distribution curves that depict all potential definitions of clinical reactions on the WOMAC scale.

Table 15 - Results of effects on pain - Chen et al.(2013)

First Author (Year)	**OM**	**GROUPS**	**Baseline (Pre-Intervention)**				26 **weeks post-Intervention**					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI
(Chen, 2013)	BPI/VAS	PT+ACUP	105	5.6	2.0	P=0.528	71	4.54		P=0.780	-0.15	4.03 to 5.04
		PT+SHAM	109	5.7	1.9		82	4.69				4.23 to 5.15

*****OM = Outcome Measures; SD = Standard Deviation; BPI/VAS = Brief Pain Inventory/Visual analogic scale; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group

When compared to counsel and exercise done independently, Foster et al (2007) found that acupuncture administered by physiotherapists as part of an integrated healthcare package that included advice and exercise for individuals with knee osteoarthritis offered no further improvement in pain ratings. The findings can be linked to the understanding that non-penetrating acupuncture helps in obtaining the benefits linked to acupuncture whereas avoiding the negatives impacts experienced under the latter (Foster, 2007) (Table 16).

Table 16 - Results of effects on pain and function - Foster et al.(2007)

First Author (Year)	**OM**	**GROUPS**	**Baseline (Pre-Intervention)**				**After** 12 **months**					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI
(Foster, 2007)	Pain	PT	116	9.1	3.7		98	2.57	4.3	P=0.50	PT/ACUP = -0.42*	-1.5 to 0.7*
		ACUP	117	9.3	4.0		99	2.37	4.2		ACUP/PT+ ACUP = -0.45	
		PT+ACUP	119	8.9	3.3		105	2.82	4.1	P=0.70	PT/PT+ ACUP = -0.23*	-0.9 to 1.3*

	Function	PT	116	29.0	12.9		97	5.36	11.9	P=0.90	PT/ACUP = -0.23*	-3.2 to 3.6*
		ACUP	117	30.8	13.9		100	6.61	13.8		ACUP/PT+ ACUP = -1.63	
		PT+ACUP	119	31.1	12.8		104	8.24	13.5	P=0.10	PT/PT+ ACUP = -2.52*	-0.9 to 6.0*

OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT = Physiotherapy group; ACUP = Acupuncture group; PT+ACUP = Physiotherapy plus Acupuncture group.

Low Back Pain

Two studies have analyzed the effects of physiotherapy in combination with acupuncture in Low back pain (Bishop, 2016; Kizhakkeveettil, 2017). The results of Bishop et al. (2016) study reported that the combined intervention of physiotherapy with true acupuncture was better in reducing the patient's reported disability levels (as measure by ODI) (Table 8), as compared to standard care intervention and standard care plus non-penetrating acupuncture. These improvements in disability were greater after 8 weeks of treatment with physiotherapy and acupuncture.

Furthermore, Bishop et al. (2016) identified that the successful implementation of RCTs, in testing acupuncture, should use three methods that include a brief screening questionnaire, the community midwives who offered the EASE Back Study and the self-referral of the women to research following increased awareness. This assessment was done in women in their early stages of pregnancy. The research by Bishop et al. (2016) further recommended the application of Pelvic Girdle Questionnaire (PGQ) as the recommended primary outcome in conducting the random controlled trial relating to acupuncture. However, the research recommends that a long-term follow-up study be conducted in order to identify evidence of acupuncture's effectiveness and, as a consequence, inform current practice.

In the study conducted by Kizhakkeveettil et al. (2017) (Figure 2), an improvement in healthcare outcomes was reported in all the three groups. However, there were no significant differences in the degree of post-intervention improvement among the three groups. As such, the findings of Kizhakkeveettil et al. (2017) indicated the need for large-scale RCTs that examine the efficacy of combining acupuncture and SMT, as compared to using acupuncture along, in treating lower back pain.

Shoulder Disorders

Sun et al (2001) and Johansson et al (2011) evaluated the effectiveness of combining conventional physiotherapy treatment with acupuncture in Frozen Shoulder and Subacromial Impingement Syndrome, respectively.

Sun et al (2001) found that after 6-weeks follow-up, the intervention group's CSA scores (Table 12) were substantially higher than the control group, with a p-value of 0.048. (Table 12).

For the assessment of shoulder function in Subacromial Impingement Syndrome, Johansson et al. (2011) used the AL-score as an outcome measure (Table 10). With a $p<0.001$ significance, both groups reported a substantial improvement in shoulder function over time.

Tension Neck Syndrome

Franca et al (2008) implemented a comparative clinical trial investigating the impact of acupuncture with physiotherapy in treating Tension Neck syndrome. The findings of the study identified that physiotherapy which is linked with acupuncture contributes to lowered pain intensity and tension of the muscles, other benefits linked with acupuncture include lowering disability and enhancing the isometric neck muscle strength among individuals with tension neck syndrome. The research by Franca et al (2008) also outlines that acupuncture, when implemented in conjunction with physiotherapy, individuals with musculoskeletal diseases benefit from favorable outcomes in rehabilitation. The study indicated that tension neck syndrome is common among women and is also highly related to computer users due to its high prevalence among the office workers, the students, and other professionals in white collar jobs (Table 7, 8 and 9).

Discussion

SUMMARY OF FINDINGS

The goal of this systematic review of RCTs was to look at what is currently known about using acupuncture as an adjuvant therapy to physiotherapy in the treatment of musculoskeletal problems. A total of 960 people with clinical musculoskeletal disorders were included in the systematic review of

literature, which included eight trials (knee osteoarthritis, tension neck syndrome, subacromial impingement, low back pain, and frozen shoulder).

Medication and physiotherapeutic therapy, acupuncture, placebo, and sham were among the therapies used in the investigations. Physiotherapy with acupuncture was compared to physiotherapy with sham acupuncture in two trials (Tsang, 2007; Chen, 2013). Sun et al. (2001) examined the efficacy of physiotherapy alone against physiotherapy coupled with acupuncture in one research. In another study, Johansson et al. (2011) looked at whether there were any significant changes between two groups: one was given corticosteroids and home exercises, while the other was given acupuncture and home exercises. Of the remaining studies, two compared effectiveness of acupuncture among three groups; physiotherapy alone, acupuncture alone, and acupuncture plus physiotherapy (Franca, 2008; Kizhakkeveettil, 2017). Physiotherapy alone, physiotherapy with actual acupuncture, and physiotherapy plus sham acupuncture were the subjects of the last two experiments (Foster, 2007; Bishop, 2016).

The most often evaluated result was pain since it was examined in five of the eight studies reviewed. Pain was measured using various scales such as VAS (Franca, 2008), AL-SCORE (Johansson et al., 2011), the WOMAC score (Chen, 2013; Foster, 2007), and NPRS (Bishop, 2016; Kizhakkeveettil, 2017; Tsang, 2007). Apart from pain, other outcome measures assessed were active and passive ROM, (Tsang, 2007), shoulder assessment using the AL-SCORE (Johansson et al., 2011), the CSA score (Sun et al., 2001), and the quality-of-life measure using EQ-5D-5L scale (Tsang, 2007).

The key findings for this systematic review are that there is no difference between adding acupuncture to physiotherapy when evaluating and treating for different kinds of pain. Despite the negative results on combining acupuncture with physiotherapy in evaluating pain, the combination has yielded several other significant results. For instance, combining acupuncture with physiotherapy was found to relieve muscular tensions, alleviated the effects of osteoarthritis, improved functional disability, and enhanced the mobility of frozen shoulders.

LIMITATIONS OF THE REVIEW AND INCLUDED STUDIES

The PEDro Scale was used to assess the risk of bias in the included studies, which is a factor that has the potential to alter the authenticity and validity of the study findings (Nedel, 2016). While all the studies selected were RCTs, Sun et al. (2001) failed to report on allocation concealment measures they implemented to ensure participants in the control and intervention groups had no way of finding out the

group to which they had been allocated. Similarly, there were other several studies that failed to report on whether blinding was used or not (Bishop et al., 2016; Foster et al., 2007; Kizhakkeveettil et al., 2017). Chen et al. (2013) failed to report their measures at baseline (prior to implementing the interventions). In Johansson's et al. (2011), 85% of outcome measures were not reported.

Sun et al. (2001) and Chen et al. (2013) are the only studies in which blinding of assessors was reported to have been conducted. Blinding in experimental physiotherapy studies is quite challenging since the therapists already have knowledge of physiotherapy and acupuncture, and probably have their own perceptions of the effectiveness of these techniques. According to Chen et al. (2013), although blinding minimizes the risk of bias in experimental studies, therapists' individual perceptions of the technique may influence the study results even with blinding. Two independent reviewers assessed the risk of bias in the current study and determined it to be within acceptable bounds.

The minimal number of papers included in the meta-analysis was another constraint of this research, in addition to the issue of blinding. The minimal number of papers included in the meta-analysis was another constraint of this research, in addition to the issue of blinding (Huedo-Medina, 2006). To calculate the percentage of variability between the studies, the I^2 test was applied in testing the variance (Hollis, 1999). There was evidence of heterogeneity in the two studies (Bishop, 2016; Kizhakkeveettil, 2017) which examined the effect of physiotherapy compared to the combination of physiotherapy and acupuncture on pain. This may indicate that the two populations are not similar, and the results may be affected.

COMPARISON WITH OTHER STUDIES OR REVIEWS

Evidence from other literature also indicates acupuncture works well in conjunction with other treatments (Liu, 2015). However, this is the first systematic research comparing the efficacy of acupuncture alone with acupuncture coupled with physiotherapy. Additionally, the researcher only focused on RCTs whose evidence is more valuable as compared to predictive studies.

RECOMMENDATIONS FOR FUTURE PRACTICE

Based on the findings and limitations of the systematic review conducted, it is recommended that future researchers on the same subject should ensure proper blinding and allocation is conducted. In most

of the studies included in this systematic review, information on how blinding and allocation was conducted was not reported. Additionally, future scholars on the same subject should consider narrowing down their target population to reduce heterogeneity of the study populations. More research on the issue of acupuncture as an auxiliary modality in physiotherapy is also advised to improve evidence for or against the intervention. Although blinding participants and therapists was shown to lessen bias in the literature, additional studies are needed to determine if blinding is effective in physiotherapy and acupuncture sessions. In future research, scholars can reduce the effects of heterogeneity by including participants with specific characteristics either in terms of age, race, education levels or a particular geographic region of a particular country of interest.

IMPLICATIONS FOR CLINICAL PRACTICE

Over the last few decades, there has been a gradual increase in the study and application of acupuncture among physiotherapists across the globe (Dascanio, 2018). However, just a few research on the effectiveness of a combination of acupuncture and physiotherapy for MSK disorders have been undertaken. The findings of this systematic review reveal a significantly larger effect of physiotherapy plus acupuncture as compared to physiotherapy alone. As a result, acupuncture combined with regular physiotherapy might be utilized to treat MSK conditions, particularly in the shoulder and neck. However, more research is needed to provide more evidence on the same.

Conclusion

A comprehensive evaluation of the literature and critical appraisal of evidence for or against the effectiveness of acupuncture as an adjuvant treatment modality to physiotherapy in the treatment of MSK symptoms was part of this study. Evidence reveals acupuncture has been extensively studied and applied as a complementary or integrative therapy for pain management. More study is still needed to determine the effectiveness of combining acupuncture with physiotherapy. In 2012, the United States spent more than $30 billion on alternative medical procedures including acupuncture (Ambrosio, 2012). As a result, more study into the efficacy of acupuncture is required.

CHAPTER 4: SURVEY

Introduction

This chapter will provide the methodology, results and discussion of a survey undertaken among registered physiotherapists in the UAE and SA to:

I. establish the profile of physiotherapists who are using acupuncture in the clinical practice.
II. explore the views of physiotherapists regarding the inclusion of acupuncture in the physiotherapy curriculum.

Specific Objectives

The specific objectives of this study include the following:

I. Investigate whether physiotherapists, in the determined regions, are trained in performing acupuncture.
II. Identify the level of specialization in acupuncture that is more common among physiotherapists.
III. Establish the frequency of the use of acupuncture as a treatment modality among physiotherapists.
IV. Identify the most common conditions treated by physiotherapists using acupuncture as a sole intervention or as an adjunct to physiotherapy treatment.
V. Describe the opinion of physiotherapists regarding the inclusion of acupuncture in the physiotherapy curriculum and at which level.

Methodology

STUDY DESIGN

The study used a quantitative cross-sectional survey approach.

SAMPLING

A convenient sample of physiotherapists registered with the respective physiotherapy societies and associations within South Africa and the UAE were included in the study. The South African Society of Physiotherapy (SASP) and the Physiotherapy Association of South Africa (PASA) and the Emirates Physiotherapy Society (EPS) were approached to distribute the questionnaire, via email through their social networks. These countries were purposively selected based on the language and familiarity the researcher has with the organizations.

ELIGIBILITY

Participants that were eligible for inclusion in the study met the following inclusion criteria:

- All physiotherapists registered with professional authorities in their country of practice
- All active physiotherapists treating patients for the past 6 months and who agree to participate in the Survey.
- Are either practitioners in South Africa or the United Arab Emirates
- There were no exclusion criteria

SAMPLE SIZE CALCULATION

According to WCPT, the number of Physiotherapist registered in 2019 in the South Africa Society of Physiotherapy (SASP) was 7,937, unfortunately that number of register Physiotherapists in Physiotherapy Association of South Africa (PASA) was not disclosed. In the Emirates Physiotherapy Society (EPS) the number was 200 (WCPT, 2019). The total expected population would be 8137 registered Physiotherapists.

We used a known electronic software link method to calculate the sample size (Raosoft, 2019). The samples sizes were calculated based on the assumption that at least 12% of registered physiotherapists will be acupuncture practicing physiotherapists (Dascanio, 2015) with a 5% margin of

error and 95% confidence level. No specific data for UAE and SA was found hence the use of the UK data. The final sample size required was 160 as shown in table 17 below:

Table 17 - Final sample size calculation

Margin of Error	5%
Confidence level	95%
Total Population	8137
Response distribution	12%
Recommended Sample size	160

INSTRUMENTATION

An English self-developed online questionnaire (Attachment 6) using the free version of Survey Monkey (Surveymonkey.inc, 1999) was developed that included the following sections: demographic information; the number of years practicing; qualifications; area of expertise; and the use of acupuncture and the perceived level of agreement for the inclusion of acupuncture in undergraduate curricular. Participants were also allowed to provide qualitative information in a comments section. Justification for the inclusion of each section and/or item of the questionnaire can be found in Attachment 6.1.

For this research survey, different types of questions were chosen such as open-ended questions, multiple-choice, dichotomic, and Likert scale questions.

Open-ended questions

In open questions, respondents are free to respond in their own words, without being limited to choosing among a list of alternatives (Fielding et al., 2013). According to Mattar (1994), the main advantages of the questions are that they allow for a better assessment of attitudes towards the analysis of structured questions; encourage cooperation; require less elaboration time; provide comments; meaningful explanations, and clarifications to interpret and analyze the questions with closed answers avoiding the danger existing in the case of closed questions of the researcher failing to list any significant attempt in the list of options. Its disadvantages, also according to Mattar (1994) are that they give rise to the interviewer's partiality in the compilation of answers since there is no clear pattern of possible answers, thus it is difficult to code the answers and their consequent compilation; when done through

self-completed questionnaires, they bump into the writing difficulties of most people, and even with the "laziness" of writing; they are less objective, as the respondent may digress and even evade the subject; they are more costly and time-consuming to analyze than other types of questions. Taking everything mentioned into account, in the survey used in this research they were only used at the beginning of the questionnaire to collect demographic data and at the end to search for opinions.

Multiple choice

In the multiple-choice questions, used in the questionnaire of this study in questions 1 and 15, respondents might choose one of the options or a limited number of possibilities. (Pope et al., 2010). When preparing multiple answer questions, the researcher is faced with two essential aspects: the number of alternatives offered and position biases (Pope et al., 2010)(Krosnick & Presser, 2009).

Some important considerations related to multiple-choice issues can be pointed out. The alternatives must be collectively exhaustive and mutually exclusive, that is, they must cover all possible answers and one alternative must be totally incompatible with all the others (Mattar, 1994) (Pope et al., 2010) The alternative "Others" used in this questionnaire in question number 15 was a great help in ensuring the exclusion (Mattar, 1994). According to Mattar (1994), the main advantages include improved response speed, ease of application, process, and analysis, and little possibility of errors. The disadvantages are that: they require a lot of care and preparation time to ensure that all answer options are offered; if any important alternatives were not previously included, strong biases can occur, even when the "Others" alternative is being offered (Mattar, 1994).

Dichotomic questions

The dichotomous questions used in this study in questions 1, 2, and 3 are those that have only two answer options, of bipolar character, of the type yes/no; agree/disagree; like/dislike (Krosnick & Presser, 2009). A third option is occasionally presented, implying ignorance or a lack of opinion on the matter. The inclusion of these types of answers is, on the one hand, inadvisable, as it can serve as an escape for those who do not wish to take a stand (Krosnick & Presser, 2009). On the other hand, the lack of this option can cause difficulties for many people, who, seeing themselves forced to choose between one of the bipolar alternatives, end up giving misleading answers (Krosnick & Presser, 2009).

The dichotomous answer is adequate to many questions that refer to questions of fact, as well as problems that are clear and about which there are well-grounded opinions. The key advantages, according to Mattar (1994), are: speed and ease of application, procedure, and analysis; ease and speed in the act of answering; lesser danger of interviewer bias; low probability of error; and they are extremely objective. In terms of drawbacks, Mattar (1994) lists the following: polarization of responses and/or the possibility of forcing responses in relation to a range of opinions; they can lead to medication errors if the topic is

treated in a dichotomous manner when it actually presents several alternatives, such as total agreement and total disagreement; they can lead to systematic errors if the topic is treated in a dichotomous manner when it actually presents several alternatives, such as total agreement and total disagreement; they can lead to medication errors if the topic is treated in a dichotomy (Krosnick & Presser, 2009).

Likert Scale

The Likert scale was employed in this study on questions 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 since it is one of the most common approaches for conducting opinion surveys (Krosnick & Presser, 2009) (Medina, 2011). In contrast to a binary question, the Likert scale questions begin with a self-descriptive statement, followed by a point scale with language descriptors that consider extremes - such as "completely agree" and "absolutely disagree" (Medina, 2011). As a result, different levels of strength of opinion on the same subject or issue might be discovered. The answer categories must account for the plurality of feelings that the respondent should express and, of course, those that the researcher actually wants to map. The structure must be similar in all questions in the questionnaire, which facilitates its completion and subsequent analysis (Medina, 2011). In the case of a 5-point scale, a totally positive item, a partially positive, a neutral, a partially negative, and, finally, a negative item should be elaborated (Krosnick & Presser, 2009) (Medina, 2011). The ease of construction and handling of the scale are advantages; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which is more difficult to answer and could harm the research result; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which is more difficult to answer and could harm the research result; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which could harm the research result; and it Because the scale is quite visible, the respondent immediately grasps the logic of it and can readily compare and edit the filled elements (Medina, 2011) (Mattar, 1994). The disadvantages include the difficulty of working with neutral items, such as "indifferent," where the response provides little practical applicable information; respondents have a tendency to easily agree with their statements without often analyzing their feelings in relation to the question; and there may be a sense of automatism and impulsiveness in the response; the number of scale points can also bring problems, fewer points seem to make the answers easier - that is, safer for the respondents, with the increase in the number of points, you gain in psychometric consistency, but you lose in safety already that people have more difficulty choosing the number that best reflects their opinion about a given statement (Mattar, 1994).

RELIABILITY AND VALIDITY

To ensure content validity, six experts from each country were asked to determine if there is an appropriate representation of questions that reflect the purpose of the research. The experts were

identified by their expertise on the field of survey research in MSK (two experts), by their years of physiotherapy practice, in this case more than five years (two experts) and by physiotherapy that have post graduate studies in acupuncture (two experts).

Face validity was established by piloting the questionnaire with a group of 10 physiotherapists in each country, for the purpose of internal reliability after 48hours the survey were sent again to these 10 physiotherapists to ensure consistency of the responses. The essence of conducting validity and reliability tests is to examine the feasibility of the questionnaire in collecting specific data aimed at addressing the questions in the study. There were no changes made to the original questionnaire in terms of questions and arrangement. However, the experts recommended the use of much easier and direct words to ease participant understanding of the survey questions and answering.

PROCEDURE

The Human Research Ethics Committee Faculty of Health Sciences at the University of Cape Town granted the project ethical permission (HREC REF:641/2018 - Attachment 7). Permission to distribute the questionnaire to their members were obtained from the SASP, PASA and EPS. A pilot study was conducted with 10 people from each country to confirm face validity. The electronic questionnaire link was sent to the head office of PASA, SASP and EPS for distribution to its members. A two-week reminder was sent to associations and societies to resend the questionnaire until the required sample size was achieved. The researcher relied only on the distribution of the questionnaire via the participating organizations.

DATA MANAGEMENT AND STATISTICAL ANALYSIS

Survey Monkey (Surveymonkey.inc, 1999) data was moved to an excel spreadsheet and then exported to SPSS Version 25 for analysis. After exporting the Excel spreadsheet to SPSS, coding was done for statistical analysis.

Numeric data were analyzed using descriptive statistics. In order to display descriptive data, numerical data was presented as frequencies in tables and graphs. Significant differences between country of registration and sex were detected using the Chi-square test, and mean age was determined

using the T-test, with p set at >0.05. Also adjusted z-score was used in order to approximate the difference from the median. Graded questions were recoded into ordinal data.

Generally, all the questions were intended to collect different types of categorical data; dichotomous, ordinal, and nominal data. Descriptive content analysis was used to extract meaning from additional comments made by participants. The comments were read through, and specific units were identified, using terms from the narrative, categories were developed (Cresswell, 2003). These categories were merged into themes for presentation.

ETHICAL CONSIDERATIONS

The study protocol was submitted to the Human Research Ethical Committee of the University of Cape Town for approval (HREC REF: 641/2018). The data collection process did not commence until the proposal was accepted by the Ethical Committee of the University of Cape Town. As such, receiving approval from the committee qualifies the study as adhering to the appropriate ethical standards.

Before completing the online survey, potential participants were asked to read a Participant Information Sheet outlining the objectives of the survey and the nature of the questions included. (Attachment 9). The online survey only started after consent was given. Participants have the option to leave the research at any time. The survey was anonymous, and no personal data allowing identification of participants were included, except for the demographic data needed for analysis: age, sex, country of professional practice, and country of study. The benefit of this study was that researchers could make recommendations concerning the use of acupuncture in physiotherapy practice. There were no personal risk or benefit associated with participation. In terms of Justice every participant that replied to our study, was included in the study.

The information collected was used only for the intended purpose of the study. After data analysis, data were stored on memory sticks and deleted from a personal computer. Stored data are password protected and stored in a locked room, with access restricted to the researcher. Data will remain available for five years, after which data will be destroyed.

This study protocol complies with the principles laid down in the Declaration of Helsinki 2013 (American Medical Association, 2013).

Results of the Survey

DEMOGRAPHIC DETAIL

Based on the SurveyMonkey platform a total of 283 physiotherapists took part in the study but only 64% (181 participants) have completed the entire questionnaire. There was an estimated response time of 6 minutes for the completion of the entire survey by a participant. A greater proportion was from South Africa (60.2%) (Table 18). There were significantly more male participants in UAE (40.3%), that is, more male physiotherapists from the United Arab Emirates responded to the survey questionnaire than those from South Africa compared to South Africa (11%) (Table 18, $p<0.001$). The mean age of the participants was 41.2 years (SD=11.9).

Table 18 - Cross Tabulation of Country of Registration and Sex (n-181)

Sex:	**South Africa**	**UAE**	**Row Totals**
M	12	29	41
	11.0%	40.3%	
F	97	43	140
	89.0%	59.7%	
Total	109	72	181
	60.2%	39.8%	

ChiSq=21.20, p<.001

Most of the Physiotherapists had a Bachelor's level qualification (n=110), followed by a Masters (n=54), seven having a certificate level qualification and four with a PhD. (Figure 4)

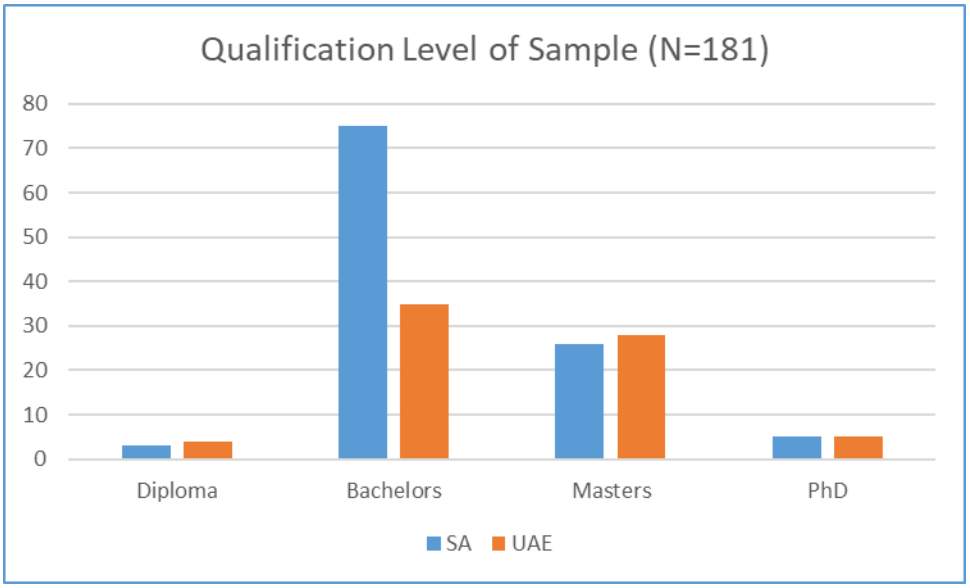

Figure 4 - Qualification level of the sample (n=181)

TRAINING IN ACUPUNCTURE

Sixty-two respondents (34.25%) reported that they had specialized in acupuncture. A higher percentage of respondents working in South Africa reported specialization 39.4% compared to the UAE (26.4%), there was no association between country and specialization (table 19).

Table 19 - Specialization in Acupuncture across country of registration

Country of Work:	Specialized in Acupuncture No	Specialized in Acupuncture Yes	Row Totals
South Africa	66	43	109
	60.6%	39.4%	
UAE	53	19	72
	73.6%	26.4%	
All Grps	119	62	181

Chi-sq=3.28, p=0.07

Among those who have indicated that they had specialized in acupuncture, 71% had gained a certificate, 9.5% a diploma, 19% a MSc and 1 person obtained a PhD. Even though 62 participants indicated to having a qualification, 93 participants said they were practicing acupuncture, with the most practicing for 0-2 years followed by more than 12 years (Fig 5).

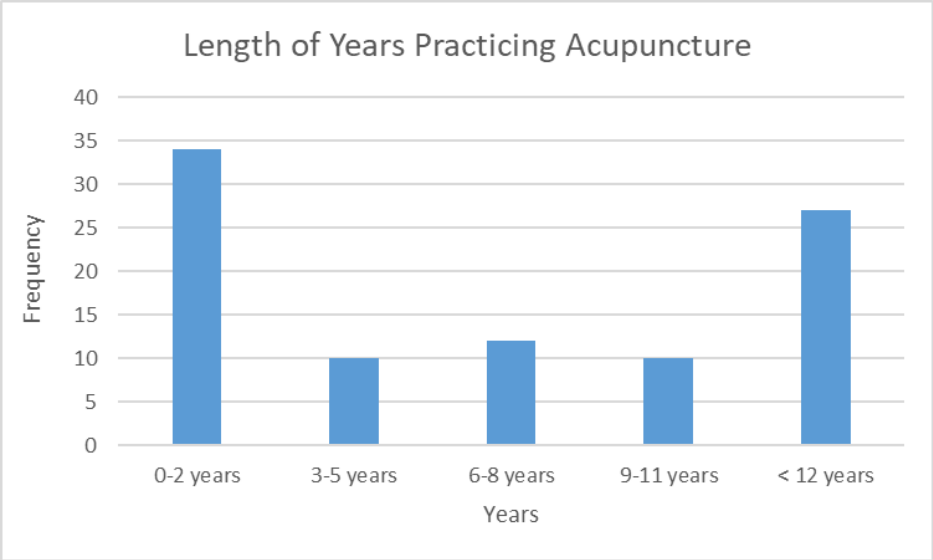

Figure 5 - Length of years Practicing Acupuncture (n=93)

USE OF ACUPUNCTURE BY PHYSIOTHERAPISTS

Most physiotherapists (69%) use acupuncture on a regular basis in their practice, with usage ranging from sometimes to always. As evidenced in the figure 6 below. 16% of physiotherapists always used acupuncture in their treatment practice compared to 21 % that did not use it at all.

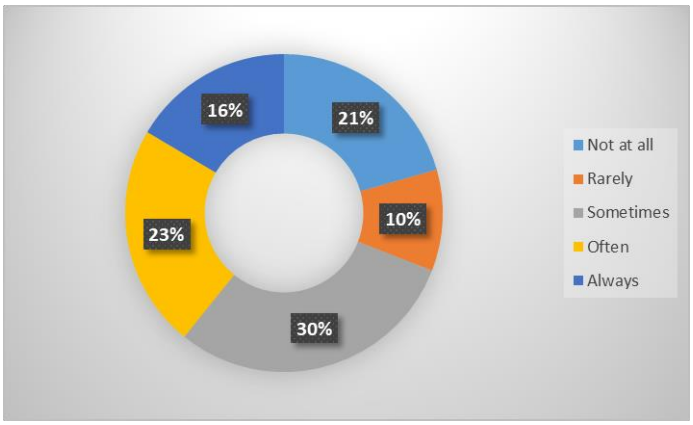

Figure 6 - Frequency of use of acupuncture (n=181)

MOST COMMON CONDITIONS TREATED USING ACUPUNCTURE

The most common conditions treated using acupuncture included.

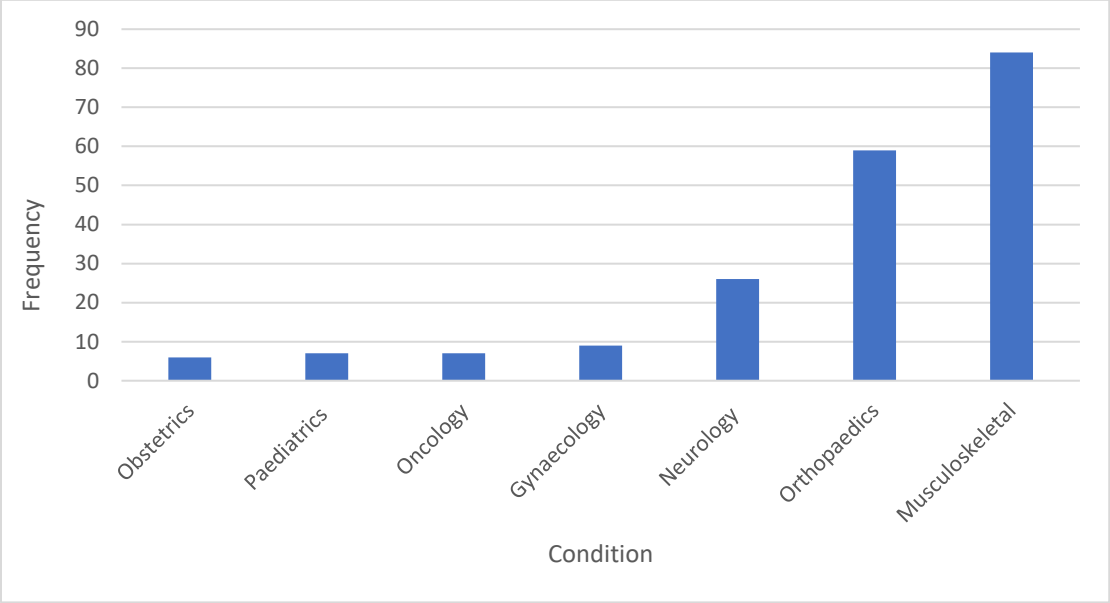

Figure 7 - Frequency of Conditions treated with Acupuncture

INCLUSION IN UNDERGRADUATE CURRICULUM AND PRACTICE

The number of participants who agreed or disagreed with the inclusion of acupuncture in the curriculum did not change significantly (table 20).

Table 20 - Responses to inclusion of Acupuncture in Curriculum (n=147 Missing=34)

	Country of Registration	Acupuncture Y	Acupuncture N	Row Totals
Count	SA	47	40	87
Row Percent		54.02%	45.98%	
Count	UAE	41	19	60
Row Percent		68.33%	31.67%	
Count	Total	88	59	147

Chi-Sq =3.03, p=.082

The rank ordering of replies in the two countries on whether acupuncture should be offered as an option, whether every student should be exposed to acupuncture, and the value of acupuncture in the practice of physiotherapy differed significantly ($p<0.05$) (Table 21). Majority of the participants in South Africa neither supported nor were against the inclusion of acupuncture in physiotherapy curriculum as an elective course. However, in the UAE, majority of the participants were in favor of acupuncture being included as an elective course. In terms of the number of participants, 15.7% for SA and 19.4% were against the inclusion of acupuncture as an elective course. In terms of training, majority of participants agreed that to be a specialist in acupuncture, there is need for more and expansive training and experience. The participants further responded that not being able to practice acupuncture or being trained in acupuncture did not impact their physiotherapy qualification and practice. In SA perhaps, 33.3% did not believe that lack of acupuncture training derailed or negatively impacted their practice. They however agreed that acupuncture training and practice was and is important in physiotherapy practice (34.8% and 27.8% respectively).

Table 21 - Responses related to acupuncture in Physiotherapy

		South Africa		**UAE**		**Adjusted Z-score**	**P**
		Count	Column N %	Count	Column N %		
Acupuncture should be included in the physiotherapy curriculum as an elective course. To what extent do you agree with this statement?	Strongly agree	16	14.8%	19	26.4%		
	Agree	31	28.7%	22	30.6%	-2.406	0.02
	Neither agree nor disagree	21	19.4%	12	16.7%		
	Disagree	17	15.7%	14	19.4%		
	Strongly disagree	23	21.3%	5	6.9%		
Every student pursuing physiotherapy should be given thorough training in	Agree	14	13.0%	19	26.4%	-2.659	0.01
	Strongly agree	20	18.5%	19	26.4%		
	Neither agree nor disagree	23	21.3%	11	15.3%		

acupuncture. To what extent do you agree with this statement?	Disagree	30	27.8%	17	23.6%		
	Strongly disagree	21	19.4%	6	8.3%		
How important is acupuncture to the overall field of physiotherapy?	Important	37	34.3%	14	19.4%		
	Very important	11	10.2%	20	27.8%	-0.517	0.61
	Neither important nor unimportant	34	31.5%	22	30.6%		
	Not important	15	13.9%	12	16.7%		
	Absolutely unimportant	11	10.2%	4	5.6%		
Without acupuncture effective physiotherapy professional practice could be significantly compromised. To what extent do you agree with this statement?	False	36	33.3%	15	20.8%	3.274	0.00
	Absolutely false	33	30.6%	12	16.7%		
	Neither true nor false	21	19.4%	23	31.9%		
	True	13	12.0%	16	22.2%		
	Very true	5	4.6%	6	8.3%		

CONTENT ANALYSIS OF ADDITIONAL COMMENTS RELATED TO THE INCLUSION IN UNDERGRADUATE CURRICULUM

Units	Category	Theme
Dry needling versus acupuncture	Anatomical knowledge, evidence, no place in physiotherapy, very different	Fits better
Treatment modality	Double Advantage, treating patients physically and emotionally, passive treatment	Toolbox
Time	Short courses, post-graduate	Overloaded Curriculum

The emerging themes included: Fits Better, Toolbox and Overloaded curriculum.

Fits Better

Most participants who provided comments felt that dry needling was better suited to physiotherapy than acupuncture. Reasons for this belief were linked to the philosophical bases for acupuncture and the anatomical approach to dry needling

Participant 30: "*It should rather be dry needling than acupuncture. It fits better with physio models of trigger points and massage techniques where one can put needles in the trigger points. Acupuncture is totally different. I have done both."*

Participant 6: *"Dry needling is just as effective, but an acupuncture (Chinese medicine) background opens a whole new way of thinking."*

Toolbox

This theme refers to acupuncture seen as a modality that could be included as part of physiotherapy treatment. Some participants see adding acupuncture as promoting a holistic approach to patient care.

Participant 80: *"Acupuncture is a tool which should be available to the therapist as a treatment modality (amongst others) to compliment all other manual therapy techniques. It does not weight high up on the scale of treatment modalities available."*

Participant 128: *"I think acupuncture will help in treating patients physically and psychologically"*

Participant 36: *"The understanding of how acupuncture might have evolved is interesting and good to explore. Physios should understand the current scientific mechanisms behind the effects of acupuncture. Acupuncture/dry needling is an optional tool. I studied acupuncture before dry needling in a fair amount of depth and found that acupuncture was better knowledge for targeting a treatment at a zone without irritating an already irritable tissue"*

Overloaded Curriculum

The perception is that acupuncture required too intensive training and the undergraduate physiotherapy curriculum was already tough and overloaded. They were not convinced that acupuncture was appropriate for inclusion at undergraduate level and felt it should be a post graduate option.

Participant 37: "*Acupuncture is a useful addition to musculoskeletal treatment, but effective treatment is possible without it. I find it useful for extremely sore patients or highly stressed patients. It is unnecessary to complicate an already full course by adding dry needling and acupuncture"*

Participant 42: *"For my opinion it shouldn't be given in the college, while you're a student. It's a course that physios should take after at least 1-2 years of clinical practice".*

Discussion

SAMPLE

The success rate of a study lay in the number of participants involved and the credibility of the survey answers given. The sample size of 160 was achieved to obtain a 95% confidence level in the results. The complete response rate of 64%, can be questionable based on the total estimated sample. A limitation of the study could be the dependence on the participating societies for distribution of the questionnaire. It is unknown what database or criteria was used for distribution.

More females than males responded to the survey, with a larger proportion of males being from the UAE. However, traditionally, physiotherapy is a predominantly female profession, and studies show a percentage of 70% to 80% of women in the profession (Louw, 2021). According to Moreira (1999), in the history of mankind, male labor relationships were related to physical strength and abstraction, while female relationships were linked to sensitivity and observation. Perhaps this justifies, in part, the great inclusion of women in physiotherapy (Moreira, 1999). There were significantly more physiotherapists females responding to the survey in South Africa than in the UAE. This parity in physiotherapy professionalism may be attributed to the impact of culture on female education; noteworthy, in the UAE compared to South Africa, the nature of the society and responsibilities associated with women limits their exposure and their interest in physiotherapy (Alkaabi, 2018). Moreover, in the UAE some career choices especially careers in medicine are gendered with the female population more likely to follow courses such obstetrics and gynecology (Abdulrahman, 2016).

The minimal qualification for a physiotherapy qualification is set at a bachelor's degree. Countries that offered an initial diploma level course have since upgraded their programme to Bachelor status (WCPT, 2003). The lack of recognition for post graduate qualification by professional boards, could suggest the lower rate of post graduate qualification.

ACUPUNCTURE TRAINING AND SPECIALIZATION

Acupuncture is a form of complementary medicine that has gained traction in contemporary medical practice in different countries in the world. While this research was limited to South Africa and the UAE, there were many other countries in which physiotherapists and other medical practitioners use

acupuncture in treating their patients. Additionally, approximately 40% of general surgery and physiotherapists occasionally utilize acupuncture in their practice (Hay, 2004). In Denmark, acupuncture is practiced by many physiotherapists, although no formal research has documented the exact number of physiotherapists that use this treatment modality in the country (Rittig-Rasmussen, 2011).

For one to be considered as a specialist in acupuncture, one has to show adequate and in-depth training. Scholars have pointed out that with a PhD, one cannot be considered a specialist (Sahi, 2018; Xue, 2015). In addition to competence, training, and experience, there is no need for registration and accreditation. According to Foster et al. (2007), in the United Kingdom, one has to be accredited by the British Acupuncture Accreditation Board to practice acupuncture. In the United States, one has to be a credited by the Accreditation Commission for Acupuncture and Oriental medicine (Xue, 2015). In Australia, to be considered an acupuncture specialist an acupuncture specialist, one has to be accredited by the Australian Health Practitioner Regulation Agency (Zhen, 2014).

In the current study, it was observed that country of practice is strongly and significantly associated with the level of acupuncture training. Physiotherapists from South Africa have a generally higher level of training in acupuncture as compared to physiotherapists in the UAE. According to the survey's findings, South Africa has more acupuncturists than the United Arab Emirates. These findings are novel since no prior research has established the levels of acupuncture training in South Africa and the UAE. One of the most probable reasons for increased likelihood of physiotherapists in South Africa specializing in acupuncture is the availability of resources and infrastructure for acupuncture training and practice (WHO, 2013). South Africa is among the countries that are slowly accommodating acupuncture in adjunct therapy practice and physiotherapy training (Gqaleni, 2007). None of the respondents from the UAE had PhD level training in acupuncture, while there was one South African physiotherapist with PhD level training in acupuncture. Comparing the above findings to other nations practicing acupuncture treatment, Xue et al.(2015) found the number of PhD students in acupuncture treatment was negligible. In their data, Xue et al. (2015) showed, the maximum number of PhD students in acupuncture in a Chinese university were twenty. Examining the same for the United Kingdom, Xue et al. (2015) identified 21 universities accredited with training PhD acupuncture students with a graduation rate of 37%. Xue et al. (2015) however, argued, practical training in acupuncture were offered mostly for master qualification with individuals qualified for PhD programs based on their years of experience with acupuncture. For countries like Canada, US, Australia and Italy, there is a significant number of PhD acupuncture graduates who are all awarded based on their level of exposure and acupuncture experience (Xue, 2015).

FREQUENCY OF ACUPUNCTURE USAGE

From Figure 3, although some professionals (21%) preferred not to associate physiotherapy and acupuncture, none of them reported that they would prefer to work only with Physiotherapy in the future. It is suggested that all experts believe that the complement given by acupuncture should bring real benefits to physical therapy treatment, although many scientific studies still need to be carried out to elucidate the mechanisms of action of acupuncture in the body and when associated with Physiotherapy.

Reiterating on the findings of the systematic review of literature, acupuncture has found application in the treatment of conditions such as knee-osteoarthritis, asthma, non-specific hip-pain (Duffin, 1982), and musculoskeletal conditions as shown in this study. The inconsistency observed in the application of acupuncture and its use in cases where conventional physiotherapy failed is an indication that the use of acupuncture in treatment has become more common and more frequent. The inconsistent use is supported by the qualitative comments of the participants suggesting that they only use acupuncture if conventional physiotherapy does not provide a response. In particular, participant 128 stated: "*I think acupuncture will help in treating patients physically and psychologically"*. The response by participant 128 is such that, acupuncture treatment is seemed to be more holistic than conventional treatment modality hence its application in psychological and physical treatment. These findings are consistent with Chen et al (2013) and Dascanio (2015), who said that the low success rate of traditional physiotherapy treatment necessitates a more sophisticated treatment system that includes acupuncture as a therapeutic method. Nevertheless, considering there were no clear differences in the types of responses selected, a definitive frequency of usage cannot be determined. To examine the responses among the participants further, the researcher measured the extent to which the physiotherapists use acupuncture as a treatment modality.

COMMON CONDITIONS TREATED USING ACUPUNCTURE

It was evident that the most common conditions treated using acupuncture included Musculoskeletal, Orthopedics, and Neurology. Additionally, on the lower periphery, the least common conditions that were treated using acupuncture – whose percentage values were less than 10% – included Peadiatrics, Geriatrics, Neuropediatric, Cardiorespiratory, Oncology, Obstetrics, and Gynecology.

acupuncture has and is being used in the treatment of a wide range of illnesses, including pain relief, according to research evaluated in the literature (Kerr, 2001). For instance, Duffin (1982) reported that physiotherapy with acupuncture was commonly used in treatment of asthma, eczema, knee osteoarthritis, non-specific hip pain, post-patellectomy pain, scar pain, and adhesive capsulitis in cases where conventional physiotherapy failed to yield desired results. In addition, orthopedic and musculoskeletal patients treated with acupuncture reported considerable improvements in health in addition to pain relief, according to Duffin et al. (1982). Furthermore, according to Lovesey et al. (2001), combining acupuncture with pharmaceuticals for musculoskeletal pain improved the outcomes and general health of individuals seeking rapid and long-term relief. Kerr et al. (2001) further observed, combining acupuncture with placebos in the treatment of asthma and eczema showed significant health improvements.

ACUPUNCTURE INCLUSION IN PHYSIOTHERAPY (PT) CURRICULUM

Although more participants agreed (60%) with the inclusion of acupuncture in the undergraduate curriculum, this was contradictory to the qualitative comments provided. Those who provided comments with regard to the potential inclusion, cited curriculum overload and its philosophical basis as issues. In most studies reviewed, researchers have reported increasing adoption of acupuncture in Western colleges and institutions (Abdulrahman, 2016; Barros, 2011; Bodevan, 2004; Brokaw, 2002; CAHCIM, 2004; Chen, 2019; Costi, 2012). However, the most colleges and universities in the Western world provide separate acupuncture courses to interested students rather than including it in standard physiotherapy curriculum (Mann, 2016). In general, there is a paucity of evidence on acupuncture's inclusion in regular physiotherapy education (Mann, 2016). However, the most colleges and universities in the Western world provide separate acupuncture courses to interested students rather than including it in standard physiotherapy curriculum (Mann, 2016). Similar to the suggestions made by participants that courses in acupuncture be offered at post graduate level or as short courses. Studies by Costi et al (2012) and Carnevale (2017) support the inclusion of acupuncture only at post graduate level. The participants included in the study conducted by Costi et al. (2013) reported that the load or the volume of academic work in undergraduate programs limited the amount of time and concentration that students would give in acupuncture training. However, Costi et al. (2013) developed that the research time allocated for post graduate students offered an opportune moment for schools to introduce acupuncture training. Costi and colleagues however noted, acupuncture training and practice in Brazil was still at its infancy. Agreeing

with Costi et al.(2013), Carnevale et al. (2017) reported, large number of undergraduate students in Brazilian campuses were not conversant with acupuncture nor its use in physiotherapy. According to Carnevale et al.(2017), for the students that reported knowing about acupuncture was through personalized reading. The students further presented, the number of units to cover and the volumes of knowledge to amass made it difficult to fully concentrate on acupuncture and its benefits in physiotherapy. However, the students studied by Carnevale et al.(2017) preferred taking the course at post graduate level.

In the United Kingdom, there were also some efforts by acupuncturists to lobby for legalization of acupuncture and subsequent development of standards of practice for acupuncturist (Balogun, 2018). However, the acupuncturists faced significant backlash from the science community as most skeptics tend to believe traditional or alternative medicine had no scientific basis. (Balogun, 2018). Part of the reason's participants disagreed with the inclusion of acupuncture in curriculum was that they felt it lacked scientific evidence: *"I stopped using acupuncture for the last 5 years as I do not find it effective and cannot find scientific evidence on it as well".* There seems to be more of an acceptance of dry needling in physiotherapy curriculum compared to acupuncture. The mechanical basis for its application, is more acceptable *"there is a big difference between acupuncture which is Chinese medicine and dry needling which is anatomically and trigger point within a muscle based. I don't think that acupuncture should form part of the physio curriculum and I feel that DDN should be kept as a post-grad course/training as you should have thorough knowledge and understanding of anatomy to safely and effectively dry needle".*

It is evident that more physiotherapists are using acupuncture as a modality in physiotherapy practice-albeit the concern with its evidence base and finding it effective in treatment of mostly musculoskeletal conditions. Due to the already loaded undergraduate curriculum the general feeling is that it remains as an optional post graduate specialty. This can be seen by the responses given by participants' 37 and 42. For participant 37, "*….It is unnecessary to complicate an already full course by adding dry needling and acupuncture". Similarly, participant 42 asserted, "For my opinion it shouldn't be given in the college, while you're a student. It's a course that physios should take after at least 1-2 years of clinical practice".* While the participants were against acupuncture training in undergraduate studies, acupuncture training was an area of specialization for individuals who were interested and wanted to specialize in acupuncture as an additional skill to conventional medicine. Baloan (2018) argument that many acupuncturists and acupuncture training was being criticized for its lack of scientific basis hence the reason for most students taking it as an optional course or as additional skill.

LIMITATIONS

A major limitation of the current quantitative cross-sectional survey is the risk of bias in the answers provided by study participants considering that the participant pool seems to have been selected by the organizations. Second, given the size of the population in both fields of investigation, the small sample size hampered the generalization of the findings. The third limitation was that in as much as the researcher developed a questionnaire and validated the items therein via use of experts, it posed a limitation in terms of language and length of use. While the questionnaire can be tailed into responding to researchers' objectives, it might not be effective in the study of this magnitude. Individual limited understanding and mixing of dry needling and acupuncture impacted the kind of responses given by the participants. Most participants were in favor of dry needling to acupuncture, hence, there was a possibility that the results could be skewed positively. Face validity is a subjective assessment, thus what could be true for one person might not be true for another, especially when conducting the survey in two countries with different realities, this imposed another limitation on this study because only 10 people were asked to validate the survey. Additionally, the window of 48 hours given to respondents to complete the survey a second time may be viewed as being too short because the survey may still be very prevalent.

RECOMMENDATIONS

Future research should examine extending the sample population size so that the findings may be applied to a larger population. Studies should include in-depth interviews with physiotherapists for better understanding of responses and to avert the confusion between dry needling and acupuncture.

Physiotherapists using acupuncture as an adjunct to treatment should be encouraged to provide an evidence-base for its use and efficacy. This will serve to further promote the possible inclusion of acupuncture as an accepted modality in physiotherapy treatments. Future researchers should also consider an experimental research design to practically design to practically examine the effectiveness of acupuncture inclusion physiotherapy alleviation of pain. From the reviewed studies, I found that, while acupuncture in physiotherapy was effective against frozen shoulder and functional disability, there were no statically relevant findings on pain. Therefore, focusing future research on how effective combining acupuncture and physiotherapy in alleviating pain would be significant addition to literature.

It was decided not to include the systematic review's conclusion in the permission form that was delivered to the respondents in order not to influence their answer; however, it might be incorporated in future studies to see whether it would affect respondents' impressions.

Since no particular data for the UAE and SA could be available, the UK statistics were used instead. As a result, we recommend that future study determine the proportion of registered acupuncturists among physiotherapists in each country.

Conclusion

The goal of performing a cross-sectional survey was to identify the characteristics of physiotherapists who use acupuncture in their relevant practice. The purpose was also to explore what views participants had regarding the inclusion of acupuncture in physiotherapy curriculum. Surveying and analyzing the data from 181 participants, the researcher showed that majority of the respondents were South Africans however, many male respondents were from the United Arab Emirates. Further, a self-developed online questionnaire was developed on the SurveyMonkey platform and validated using pilot studies and a panel of experts prior to collecting the data. Overall, the survey results presented mixed findings with the majority of surveyed participants agreeing on the significance of acupuncture in physiotherapy practice. Most of the participants however disagreed that physiotherapy was not effective on its own. Overall, survey results also showed a number of participants were not of the opinion of including acupuncture curriculum in undergraduate education but rather preferred acupuncture training in post-graduate levels. Noteworthy, the survey information showed, majority of physiotherapists had hands on experience with acupuncture despite majority of practicing physiotherapists having a bachelor's degree, certificate qualification followed by Masters' degree and PhD having a least number of qualified participants.

CHAPTER 5: GENERAL DISCUSSION AND CONCLUSION

Introduction

The purpose of this thesis was to debate acupuncture's inclusion in the PT curriculum. To do this, it was needed to identify the evidence-based literature (via a systematic review) in order to further investigate physiotherapists' perspectives on its inclusion (through the survey). In order to avoid influencing respondents' views, it was also agreed not to present them the evidence-based results of the systematic review in the survey.

Discussion

A thorough assessment of the data found that acupuncture as an adjuvant to physiotherapy treatment is useful for some medical disorders. For instance, the findings showed acupuncture in physiotherapy treatment was effective against frozen shoulder and functional disability and not highly effective against pain. The implication of these findings serves to promote the inclusion and further exploration of the efficacy of acupuncture in physiotherapy. The evidence that a large number of physiotherapists are using acupuncture or dry needling in practice suggests that physiotherapists are exploring alternatives to what is currently being offered in the undergraduate curriculum. This would encourage curriculum advisors to revisit the evidence and efficacy of traditional physiotherapy modalities that are currently included. The objectives of the current quantitative cross-sectional survey were to examine the application, frequency, and impacts of acupuncture in the treatment of various ailments. Moreover, in recent years, physiotherapists have become increasingly interested on the effects and general application of acupuncture in therapy. The increased interest is evident by the studies conducted by Bishop et al. (2016), Kizhakkeveettil et al. (2017), and Foster et al. (2007). Furthermore, the findings of the specific objectives above positively correlated with the physiotherapists increased interest in acupuncture and its overall positive treatment outcomes. As such, although more studies are still needed, the researchers recommends that physiotherapists should consider beginning early training and practice for acupuncture given the findings situating acupuncture as an important component of physiotherapy-based treatment (Duffin, 1982; Costi, 2012; Kohut, 2011). Even though majority of reviewed literature and participants in this study were against the inclusion of acupuncture curriculum in undergraduate studies, it is high time that colleges and universities consider incorporation. Despite the huge amount of work,

assigned individuals in the education sector should consider distributing the curriculum throughout the undergraduate program. While this might be the case, existing literature argued that increased skepticism has hindered the progress and inclusion of acupuncture curriculum in undergraduate studies. Mann et al. (2016) and Balogun et al. (2018) argued, the inclusion of acupuncture curriculum when training undergraduate physiotherapists increased their load and what they needed to cover before graduation and hence would limit the quality of training and depth of skills acquired in the course of training. Therefore, the implication for this study lies in the need for broadened or enhanced debate around the inclusion of acupuncture physiotherapy curriculum in undergraduate education and its overall impact on the quality of skills obtained by undergrads following the curriculum.

Recommendations

Future studies should consider increasing the size of the sample population such that the obtained results can be applicable to a wider population. Studies should include in-depth interviews with physiotherapists for better understanding of responses and to avert the confusion between dry needling and acupuncture.

Physiotherapists using acupuncture as an adjunct to treatment should be encouraged to provide an evidence-base for its use and efficacy. This will serve to further promote the possible inclusion of acupuncture as an accepted modality in physiotherapy treatments. Future researchers should also consider an experimental research design to practically design to practically examine the effectiveness of acupuncture inclusion physiotherapy alleviation of pain. From the reviewed studies, I found that, while acupuncture in physiotherapy was effective against frozen shoulder and functional disability, there were no statically relevant findings on pain. Therefore, focusing future research on how effective combining acupuncture and physiotherapy in alleviating pain would be significant addition to literature.

Conclusion of the Study

The study sought to quantitatively and cross-sectionally investigate the impacts of acupuncture in physiotherapy. A thorough examination of the cross-sectional survey's primary goals reveals that acupuncture has been widely used to treat illnesses such as asthma, eczema, and pain (Kerr, 2001).

Similarly, the systematic review found that the use of acupuncture in physiotherapy treatment has acquired substantial momentum, with many professionals currently using it or planning to use it while caring for their patients. As discussed, acupuncture had been employed in the easing pain and in the treatment of musculoskeletal conditions an indication of its positive use in addressing medical conditions. When looking at the results of the survey that was used for this, it was clear that, similar to the findings of the systematic review, the frequency of use has grown as a result of its good rating in pain relief and its use in the event that conventional therapies fail. Following the increased application of acupuncture in treatment, existing literature supported the development and inclusion of undergraduate PT curriculum to begin early training and specialization of acupuncture. This recommendation is reiterated by the scholar in the sense that 79% of interviewed participants reported having used acupuncture at one point in their treatment process. Even though this is the case, the researcher could locate definite support from existing literature for the inclusion of acupuncture undergraduate PT curriculum. Despite the majority of participants responding positively to the survey and a growing trend of obtaining a qualification in acupuncture practice, there are still uncertainties for its inclusion in undergraduate curriculum. Therefore, more studies are still needed to measure the effectiveness of combining physiotherapy and acupuncture in therapy and their overall outcome on patient health.

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ATTACHMENTS

Attachment 1 – Search Yield

Search Query		Search Results		
		Items found in PubMed	Items found in Cochrane Library	Items found in PEDro databased
1.	Physiotherapy	173562	10342	
2.	Physical Therapy	297357	41375	
3.	Manual Therapy	37783	9826	
4.	Rehabilitation	586242	43354	
5.	(((Physiotherapy) OR Physical Therapy) OR Manual Therapy) OR Rehabilitation	744139	80	
6.	Acupuncture	30241	13289	
7.	Combination	893406	232885	
8.	Plus	263482	87074	
9.	(Plus) OR Combination	1105289	40010	
10.	Neuromuscular disorders	304596	951	
11.	Musculoskeletal conditions	1052554	2827	
12.	(Neuromuscular disorders) OR Musculoskeletal conditions	1245617	76	
13.	#5 AND # 6 AND #9 AND #12	189	9	29

Attachment 2 – Eligibility Checklist

Inclusion Criteria		Yes	No
Type of study			
1.	Paper published in English		
2.	Paper published in a peer-reviewed journal		
3.	Study type is a randomized controlled trial (RCT)		
Type of participants			
4.	Participants are human		
5.	Participants have a musculoskeletal (MSK) condition		
Type of intervention			
6.	Intervention involves physiotherapy treatment combined with (true) acupuncture		
Type of control			
7.	Intervention involved only physiotherapy treatment		
8.	Intervention involves physiotherapy treatment combined with (sham) acupuncture		
Type of outcome			
9.	At least one of Pain, Active Range of Motion (AROM) or Passive Range of Motion (PROM), Gait, Strength, Function, muscular tension		
Paper included (if yes to 1, 2, 3, 4, 5, 6, 9 at least one yes for 7-8)			
Exclusion Criteria			
1.	Paper is a comment, commentary, letter to the editor, conference paper		
2.	Participants have already received acupuncture treatment before the study		
Paper excluded (if yes to 1-2)			

Attachment 3 – Planned Data Extraction

ATTACHMENT 3.1 – STUDY DETAILS

First Author (Year)	Study Design	QA Cochrane Score	Type of Injury	Key Outcomes Measures	Duration of Intervention	Follow up (months from start of intervention
Author (Year) …						

ATTACHMENT 3.2 – PARTICIPANT DETAILS

First Author (Year)	Sample size (n)	Study Group	Average Age (Years) Mean (SD)	Gender (Male, Female %)	Time since Injury
Author (Year) …					

ATTACHMENT 3.3 – OUTCOME MEASURES

First Author (Year)	Outcome Measure	Measurement Toll
Author (Year) …		

ATTACHMENT 3.4 – INTERVENTION DETAILS

First Author (Year)	ST		ST+TA		ST+NPA	
	Type of Intervention	Description	Type of Intervention	Description	Type of Intervention	Description
Author (Year) …						

ATTACHMENT 3.5 – EFFECTS OF INTERVENTION (PRE AND POST INTERVENTIONS)

First Author (Year)	OM	Int. or Ctrl Group	Baseline (Pre-Intervention)						Post-Intervention					
			N. in group	Mean	SD	P Value	Effect size	95% CI	N. in group	Mean	SD	P Value	Effect size	95% CI
Author (Year) …		Int.												
		Ctrl												

OM – Outcome Measures; Int. – Intervention group; Ctrl – Control group; N. – Number; CI – Confidence Interval

Attachment 4 – Quality Assessment of Included Reviews

ATTACHMENT 4.1 – TSANG ET AL. (2007)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	Patients had to meet the following inclusion criteria: (1) being diagnosed with bilateral primary knee osteoarthritis and having undergone bilateral total knee arthroplasty in the orthopedic wards of the Queen Mary Hospital. (2) being able to complete daily postoperative physiotherapy programme for 10 sessions within two weeks and (3) being aged 60 years or above. Patients were excluded if any of the following exclusion criteria were present: (1) Inability to give consent. (2) Postoperative complications such as unstable hemodynamics and deep vein thrombosis. (3) History of neoplasm or stroke or (4) Having associated rheumatological conditions or psychiatric disorders. (5) Deranged clotting profiles or (6) Currently taking anticoagulants. (7) Skin diseases. (8) Unstable cardiac conditions. (9) Sensory deficit at lower limb. (10) Fear of acupuncture and (11) Previous experience with acupuncture.	Pag. 720 Methods Subjects	
2	subjects were randomly allocated to groups	Yes	Block randomization was used to randomly allocate patients to the acupuncture group or the sham acupuncture group using blocks of four by the first author	Pag. 720 Study design	1
3	Allocation was concealed.	Yes	Allocation concealment was maintained using opaque sealed envelopes. Three physiotherapists (PLT, CYK and HTY) who held a diploma in acupuncture and had 2–3 years of experience in acupuncture were responsible for applying the acupuncture or sham acupuncture to the patients.	Pag. 720 Study design	1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	Thirty-six patients were recruited at the start of the study with 18 patients allocated to the acupuncture group and another 18 patients to the sham acupuncture group.	Pag. 719 Abstract	1

5	there was blinding of all subjects	Yes	The study was a patient-blinded and assessor blinded randomized controlled trial	Pag. 720 Study design	1
6	there was blinding of all therapists who administered the therapy	No	Not clear in the article		0
7	there was blinding of all assessors who measured at least one key outcome	Yes	The study was a patient-blinded and assessor blinded randomized controlled trial	Pag. 720 Study design	1
8	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	Yes	A total of 60 patients were screened and 36 patients were enrolled with informed consent obtained. There were 30 patients with complete data for analysis at postoperative day 15, with three dropouts in each group.	Pag. 722 Results	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	All the data were analyzed according to the principle of intention-to-treat.	Pag. 720 Acupuncture Interventions	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	Baseline comparisons of the two groups with reference to demographics, preoperative pain level at rest and at maximum, active and passive ranges of knee motion, timed up-and-go test and postoperative consumption of analgesic tablets were performed using independent t-test or Fisher exact test among completers. Only the descriptive statistics were presented for dropouts and statistical comparisons were not performed as recommended. The overall averages of the mean pain level at rest and mean pain level at maximum of both knees from postoperative day 4 to day 15 were computed as summary measures for comparison among completers between the two groups using independent t-test. Repeated-measures analyses of variance were performed for postoperative active and passive ranges of knee motion, and the timed up-and-go test. Baseline score of the timed up-and-go test was used as the covariate for the repeated-measure analysis of variance as it was observed that there was significant difference in the preoperative timed up-and-go test scores among completers between the two groups. The level of significance for all statistical tests was set at 0.05. All	Pag. 721 Data analysis	1

			statistical tests were performed using SPSS 11.5 (Chicago, IL, USA).		
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	The overall averages (SD) of mean pain scores were 2.2 (1.4) and 2.6 (1.2) at rest, and 6.5 (1.5) and 5.7 (1.7) at maximum from postoperative day 4 to 15 in the acupuncture group and sham acupuncture group respectively	Pag. 722 Results	1
TOTAL					9

ATTACHMENT 4.2 – FRANCA ET AL. (2008)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	The inclusion criteria for the selection of these patients were: age range from 20 to 60 years of age, with a history of TNS with chronic pain (more than 3 months), muscular tension, functional disability of the neck; without radiographic and neurologic changes and were able to understand spoken Portuguese. The exclusion criteria were patient with a previous history of neck disorders involving local trauma, tumor, infection, inflammatory, degenerative conditions, congenital abnormality, and previous surgery of the neck. Patients with radiculopathy or neuropathy of the neck and upper limb, facet joint dysfunction of the neck, herniated cervical disk, were out of the study. Other disorders: psychiatric disturbances, alcohol, or drug users, endocrinopathies, pregnancy and any condition which could compromise direct and indirectly the neck were not included. Patients who could not tolerate needling therapy or who did not complete the protocols were also not accepted to join this trial.	Pag. 270 Allocation	0
2	subjects were randomly allocated to groups	Yes	Patients were randomly allocated into 3 groups.	Pag. 269 Allocation	1
3	Allocation was concealed.	Yes	A sequence of random numbers of code of intervention was created using block randomization, and sealed opaque envelopes by a person not involved with the trial	Pag. 269 Allocation	1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	Table 1 shows that the demographic details of the baseline of the patients allocated into three groups were homogeneous in distribution of number, age, gender, weight, height VASpain, VASmt, NDI-BR and INMS". Moreover, the p values reported for most of the indicators as shown in Table 1 were statistically non-significant.	Pag. 273 Results	1
5	there was blinding of all subjects	No	No evidence of subject blinding		0
6	there was blinding of all therapists who administered the therapy	No	No evidence of therapist blinding		0

7	there was blinding of all assessors who measured at least one key outcome	No	No evidence of assessors blinding		0
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to groups	Yes	There was a total of 49 patients recruited to the study. Three of them did not complete the protocol. This is mentioned in the following excerpt in the article. "Forty-nine replies were received from patients willing to participate in the trial. During the course of the trial three female patients, being one of each group, were withdrawn from treatment protocols due to different reasons of professional activities not related to their clinical conditions".	Pag. 273 Results	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	All the 46 patients received treatments as allocated and were included in the final statistical analysis, as per the statement: "46 patients who completed the protocols were included in this trial".	Pag. 273 Results	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	Between groups statistical differences were mentioned for all the key outcomes as evident from table 6 (Refer table 6)	Pag. 273 Results	1
11	the study provides both point measures and measures of variability for at least one key outcome		Mean and SD were mentioned for intra group differences whereas mean and IQR were mentioned for inter group differences (Refer table 5 and 6)	Pag. 273 Results	1
				TOTAL	7

ATTACHMENT 4.3 – JOHANSSON EL AL (2011)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	In attachment 2 we can find a detail Inclusion and exclusion criteria	Attachment 2	
2	subjects were randomly allocated to groups	Yes	Subjects were randomly allocated in groups either a corticosteroid injection combined with exercises group, or an acupuncture combined with exercises group	Randomization Pg. 356	1
3	Allocation was concealed.	Yes	For the allocation of patients, a computer-generated list random numbers were used by the study coordinator, who was not involved in the treatment or assessments	Randomization Pg. 356	1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	Through the study flow chart, we can understand that there's a balance distribution of patients between both groups	Fig. 1 Study Flow Chart	1
5	there was blinding of all subjects	No	No mention to blindness of the subjects		0
6	there was blinding of all therapists who administered the therapy	No	No mention to blindness of all therapists involved in the study		0
7	there was blinding of all assessors who measured at least one key outcome	Yes	Assessors were also blinded in regard to the treatment perform	Randomization Pg. 356	1
8	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	No	From G1 – only 49 out of 65 subjects were analyzed From G2 – only 42 out of 58 subjects were analyzed	Fig. 1 Study Flow Chart	0
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	"All patients who were compliant with the study protocol were included in the analysis of treatment efficacy, analyzing both the primary and the secondary outcomes. An alternative 'intention-to-treat' (ITT) analysis application model for the analysis of data for clinical trials 24 was also performed. The ITT analysis included patients who changed treatment groups during the study but still continued their assessments per protocol".	Statistical analysis Pg. 357	1

10	the results of between- group statistical comparisons are reported for at least one key outcome	Yes	"To compare demographic data between the two treatments groups, the student's t-test was used for continuous data, a chi-square test for categorical data and a Mann–Whitney U-test for ordinal data. Change over time (in the AL-score, EQ-5D and EQ-VAS) within and between treatment groups was analyzed using analysis of variance repeated measures design."	Statistical analysis Pag. 357	1
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	Mean and standard deviation were used	Table 1	1
				TOTAL	7

ATTACHMENT 4.4 – CHEN ET AL. (2013)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	Inclusion criteria required that patients be age 40 years or older to focus on classic knee OA. Patients had to have pain in 1 or both knee joints for more than 6 months and moderate pain >4/10 for more than 5 out of 7 consecutive days in the week before enrollment. Patients were excluded if they had other diseases known to affect the knee including gout, rheumatoid arthritis, and significant trauma; neurologic, cardiac, or psychiatric disease that would interfere with a standard EPT program; pregnancy; significant coagulopathy or taking anti-coagulants that would interfere with the safe administration of acupuncture; or previous acupuncture treatment within the last 12 months	Methods Pg. 2	1
2	subjects were randomly allocated to groups	Yes	All patients were randomized with a block size of 6, stratified by acupuncturist.	Randomization Pg. 3	1
3	Allocation was concealed.	Yes	The randomization coding was computer generated by an independent statistician, sealed in individual opaque envelopes, and kept in a lock box in a private room only accessible by the acupuncturist at each site.	Randomization Pg. 3	1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	True acupuncture – 105 Non-penetrating acupuncture – 109	Fig. 1 Pg. 12	1
5	there was blinding of all subjects	Yes	The patients, physical therapists, data collectors, and statistician were blinded throughout the study period	Randomization Pg. 3	1
6	there was blinding of all therapists who administered the therapy	No	The acupuncturists were not blinded due to the nature of the intervention but were trained to interact with each patient in a formalized manner to prevent unblinding	Randomization Pg. 3	1
7	there was blinding of all assessors who measured at least one key outcome	Yes	Acupuncture was performed in a separate room to limit the observation by other personnel	Randomization Pg. 3	1
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to	Yes	214 were randomized in 2 groups: G1 – True acupuncture with 105 and G2 – Non-penetrating acupuncture – 109 Initially of all key outcomes were obtained from all patients	Fig. 1 Pg. 12	1

	groups				
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	"The primary outcome analysis was an intention-to-treat comparison between the groups."	Statistical Analysis Pag 4	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	The results of between-groups are represented on table 2a and 2b for Primary and Secondary Outcomes	Pag. 15 (table 2a) Pag 17 (Table 2b)	1
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	Text describes in the result section	All tables	1
				TOTAL	**10**

ATTACHMENT 4.5 – KIZHAKKEVEETTIL ET AL.(2017)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	Inclusion criteria included participants who were 18 years of age or older and had a current episode of LBP. Exclusion criteria included candidates who had received chiropractic or acupuncture treatment within the previous 6 months, or those with the following: visceral, systemic, or joint inflammatory disease; referred pain to the back or pelvis; nonmechanical LBP; history of low back surgery, osteoporosis, spondylolisthesis, coagulation disorder, or use of anticoagulant medication; prolonged use of systemic corticosteroid medication; progressive unilateral lower limb muscle weakness; symptoms or signs of cauda equina syndrome (e.g., bowel or bladder dysfunction); severe concurrent illness (e.g., cancer, heart diseases, psychiatric disorders); and known pregnancy	Pag.202 Participants	
2	subjects were randomly allocated to groups	Yes	"Participants were randomly assigned to 1 of treatment groups—(1) acupuncture, (2) SMT, or (3) integrative acupuncture and SMT—by a research assistant using a computer program that stratified the sample by age, sex, severity of the pain, and presence of pain below the knee"	Pag. 204 Randomization	1
3	Allocation was concealed.	Yes	"Allocation was concealed from the assistant until the group assignment had been made."	Pag. 204 Randomization	1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	Refer to table 2	Pag. 205 Table 2	1
5	there was blinding of all subjects	No	"Participants and providers were not blinded to the assigned treatment intervention. Because all of the outcome measures were self-generated by the participants, these measures were not considered blinded"	Pag.204 Blinding	0
6	there was blinding of all therapists who administered the therapy	No	"Participants and providers were not blinded to the assigned treatment intervention. Because all of the outcome measures were self-generated by the participants, these measures were not considered blinded"	Pag.204 Blinding	0

7	there was blinding of all assessors who measured at least one key outcome	No	Not mention in the article		0
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to groups	Yes	As refer in the article: "Of the 100 participants with baseline data, 14, 30-, 60-, 90-, and 120-days' follow-up assessments were completed by 98 (98%), 93 (93%), 80 (80%), 68 (68%), and 65 (65%), respectively"	Pag. 206 Numbers analyzed	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	This article was based on the initial treatment assignment and not on the treatment eventually received	Pag. 206 Numbers analyzed	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	This data is expressed on the table 3, 4 and 5	Table 3, 4 and 5	1
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	Mean and SD were mentioned (Refer table 1, 2, 6, 7 and 8)	Table 1, 2, 6, 7 and 8	1
				TOTAL	**7**

ATTACHMENT 4.6 – FOSTER EL AL. (2007)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	No	Inclusion criteria were adults aged 50 years or more with knee pain and a clinical diagnosis for knee osteoarthritis. Exclusion criteria Patients that have had acupuncture previously		
2	subjects were randomly allocated to groups	Yes	Patients were randomized to advice and exercise; advice, exercise, and true acupuncture; or advice, exercise plus non-penetrating acupuncture	Pag. 437 Methods	1
3	Allocation was concealed.	No	The article makes no mention that allows to understand if the allocation was concealed or not, so it was marked as NO		1
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	At baseline the groups were very similar with the advice and exercise group with 116 patients, advice, and exercise plus true acupuncture group with 117 patients and advice and exercise group plus non-penetrating acupuncture group with 119 patients	Pag.436 Abstract/ Participants	1
5	there was blinding of all subjects	No	Blinding of the subjects is not mentioned in the article		0
6	there was blinding of all therapists who administered the therapy	No	Blinding of the therapists is not mentioned in the article		0
7	there was blinding of all assessors who measured at least one key outcome	No	Blinding of the assessors is not mentioned in the article		0
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to groups	Yes	Refer to table 1 – Change in pain and function scores	Pag. 438 Table 1	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	"Analysis was by intention to treat"	Pag. 437 Statistical Analysis	1

10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	Refer to table 1	Pag.438 Table 1	1
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	Mean and SD were used	Pag.438 Table 1	1
				TOTAL	7

ATTACHMENT 4.7 – SUN ET AL.(2001)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	Exclusion and Inclusion criteria are well specified in the article	Pag. 382 Methods	
2	subjects were randomly allocated to groups	Yes	As refer in the text: "were randomly allocated to one of the two treatment groups, using the random table method."	Pag. 383 Methods	1
3	Allocation was concealed.	No	There's no reference in the article to whether allocation was concealed or not		0
4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	The table 2 shows that demographic details of the baseline of the patients allocated into the 3 groups were homogeneous in distribution of number, age, gender, duration of symptoms	Table 2 Pag. 386	1
5	there was blinding of all subjects	No	No evidence of subject blinding		0
6	there was blinding of all therapists who administered the therapy	Yes	There are references in the article of blinding of the therapist responsible for administered the therapy	Pag. 384 Exercice plus acup group	1
7	there was blinding of all assessors who measured at least one key outcome	Yes	All the assessors were blinding regarding the allocation of each patient	Pag., 384 Paragraph 4	1
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to groups	Yes	As mentioned in the article: "One patient in the exercise plus acupuncture group discontinued treatment after the second acupuncture session due to fear of needle pain, while four patients withdrew from the exercise group after 6 weeks of exercise practice"	Pag. 386 Paragraph 1	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	As mentioned in the article: "… all patients were considered in the subsequent analysis based on the intention-to-treat analysis"	Pag. 386 Paragraph 1	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	Between groups statistical differences were mentioned for all the key outcomes as evident from Table 3	Pag. 386 Table 3	1

11	the study provides both point measures and measures of variability for at least one key outcome	Yes	Mean and SD were mentioned for intra group differences whereas Friedman's Test was mentioned for inter group differences (Refer table 3)	Pag. 386 Table 3	1
				TOTAL	8

ATTACHMENT 4.8 – BISHOP ET AL. (2016)

Item	Quality Assessment Criteria	Yes/No	Rationale	Where	PEDro Score
1	eligibility criteria were specified	Yes	Women were eligible for participation in the pilot trial if they met the following criteria had pregnancy-related LBP defined as self-reported pain in the lumbar area (between the 12th rib and the gluteal fold) with or without PGP; under the care of participating NHS sites; aged 18 years and over; between 13 to 31 weeks gestation Exclusion criteria were women who had ever received any form of acupuncture previously for any health problem; were at high risk of miscarriage (previously had recurrent miscarriage defined as three or more, abnormalities in the cervix deemed to increase risk of miscarriage, antiphospholipid syndrome, lupus anticoagulant); were at high risk of pre-term labor (previous history of giving birth before 37 weeks gestation, multiple pregnancies, polyhydramnios, pre-term ruptured membranes, history of surgery to the uterine cervix); had diagnosed pre-eclampsia; had a previous history of surgery to the spine or the pelvis; presence of a contra-indication to any of the treatment options (coagulation problems, hemophilia or bleeding disorders, were at increased risk of infection such as skin infections or loss of skin integrity from burns or ulcerations at the site of needling or those with a high needle phobia); had pain in the anterior pelvic girdle region only; and diagnosed with a current urinary tract infection.	Participants Pag. 3	
2	subjects were randomly allocated to groups	Yes	Eligible women who gave written informed consent to participate were randomized in a 1:1:1 ratio to one of the three treatment arms using randomly varying blocks (sizes 3 and 6) and stratified by gestational weeks (dichotomized to less than or at least 24 weeks). Participants were randomized using remote telephone randomization provided by a registered Clinical Trials Unit (CTU registration number 36).	Randomization Pag. 4	1
3	Allocation was concealed.	Yes	A research midwife or research nurse telephoned the CTU administrator who conducted the concealed randomization process and directly informed the participant about their treatment allocation, in writing	Randomization Pag. 4	1

4	the groups were similar at baseline regarding the most important prognostic indicators	Yes	According to the Table 3 G1 – Standard care (SC) – 41 subjects G2 – SC + true acupuncture – 42 subjects G3 – SC + non-penetrating acupuncture – 41 subjects	Table 3 Pag. 10	1
5	there was blinding of all subjects	Yes	To maintain blinding of participants to the type of acupuncture (true or non-penetrating), treatment allocation letters described the interventions as 'usual care' or 'usual care plus acupuncture'.	Randomization Pag. 4	1
6	there was blinding of all therapists who administered the therapy	No	No mention to blindness of therapist in the study		0
7	there was blinding of all assessors who measured at least one key outcome	No	No mention to blindness of assessors in the study		0
8	measures of at least one key outcome was obtained from more than 85% of the subjects initially allocated to groups	Yes	Refer to table 3	Table 3 Pag. 10	1
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"	Yes	"There were no missing data for pain severity at both baseline and follow-up for those who returned the questionnaires, but there were minimal amounts of missing data for both ODI and PGQ. The proportion of the questionnaire items with missing data for all participants at baseline was 2.8 and 6.2% for the ODI and PGQ, respectively".	Pag. 11	1
10	the results of between-group statistical comparisons are reported for at least one key outcome	Yes	Description of participant baseline characteristics allowed an assessment of similarity between treatment arms. Descriptive summaries of the treatments delivered by treatment arm were described to assess treatment delivery and adherence to the protocol.	Pag. 6 Statistical analysis	1
11	the study provides both point measures and measures of variability for at least one key outcome	Yes	SD and mean obtain for all measure according to table 3	Table 3 Pag. 10	1
				TOTAL	8

Attachment 5 – Systematic Review: article

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SYSTEMATIC REVIEW

Exploring the Effectiveness of Acupuncture as an Adjunct to Physiotherapy in the Treatment of Musculoskeletal Conditions: A Systematic Review

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Abstract:

Background:

Acupuncture is one of the most popular forms of complementary and alternative medicine, and its usage is linked to an improvement of physical and psychological symptoms.

Main Objectives:

Determine whether the use of acupuncture as an adjunct to physiotherapy treatment is more effective than physiotherapy alone or acupuncture alone in MSK conditions.

Methodology:

A systematic review of the literature was conducted using three major databases, from March 2019 to May 2019, *i.e.*, Cochrane Library, PubMed, and PEDro (Physiotherapy Evidence Database). The inclusion criteria were limited to randomized controlled trials (RCT) published in English, only studies published within the past decade, and investigating adult populations with MSK conditions.

Results:

From the 227 titles and abstracts that were identified, 75 were duplicates, leaving us with 152 studies for the initial screening. Eight studies [13-20] were included in this review for qualitative analysis. The studies that assessed pain did not found statistically significant results that support the combination of physiotherapy and acupuncture, the same results were also obtained for Range of motion in knee osteoarthritis. Muscular tension was found statistically significant within-group improvements for all parameters in comparison with the baseline. For Isometric Neck Muscle Strength (INMS), the studies reported significant improvements within the groups, with Physiotherapy combined with Acupuncture being more effective than Acupuncture or Physiotherapy alone. The Constant Shoulder Assessment (CSA), for shoulder function, was significantly higher in the exercise plus acupuncture group compared with the exercise group.

Conclusion:

As an integrative or complementary therapy for pain, acupuncture has been increasingly used. However, this review did not find significant evidence to support that the addition of acupuncture to physiotherapy treatment has an added benefit to pain relief. However, this review did find the benefits of adding acupuncture to treatment to reducing neck disability and improving muscular strength and shoulder function.

Prospero Registration Number:

CRD42019122567

Keywords: Acupuncture, Physiotherapy, Manual therapy, Rehabilitation, Combination, Musculoskeletal conditions.

Article History	Received: June 02, 2020	Revised: November 25, 2020	Accepted: December 07, 2020

1. INTRODUCTION

'It is arguable whether a 21st- century physiotherapist should be concerned with the philosophies and beliefs of another culture with more than three thousand years? Arguably, there is no reason at all. Despite this, an increase in the interest in acupuncture among physiotherapists has increased over the last few years [1 - 3]. This is evident in the research conducted by physiotherapists, demonstrating the effectiveness of acupuncture in the management of various clinical conditions, especially musculoskeletal (MSK) conditions, which is a key scope of practice in physiotherapy [2].

Acupuncture emphasizes the analysis of the human body as a whole, and it is considered a set of interdependent, interconnected systems [4, 5]. The existence of acupuncture dates back to the beginnings of Chinese civilization. Its discovery was attributed to the Yellow Emperor in 2797 before Christ (BC), and it is a set of theoretical-empirical knowledge within Traditional Chinese Medicine (TCM) [6]. Despite its antiquity, acupuncture continues to evolve along with modern technological advancement [7, 8].

An initial review of the literature revealed the existence of several gaps in the research, with several questions remaining unanswered that warrants investigation and has therefore motivated the present study. The core purpose of this research was, therefore, to systematically review and critically appraise the evidence for the use of acupuncture as an adjunctive modality to physiotherapy in the treatment of MSK conditions. The aim of this review is to investigate whether acupuncture is an effective strategy that should be incorporated into contemporary physiotherapy. Findings of the current research are essential to practitioners in the field of physiotherapy, in particular, evidence indicating that acupuncture to be an effective strategy, it can also give practitioners more leverage in incorporating the technique in their clinical practice.

2. METHODOLOGY

This study is a systematic review of the literature that was guided by the recommendations of the Collaboration Cochrane [9, 10]. The review question, based on the PICO strategy, was: "Is the use of acupuncture as an adjunct to physiotherapy more effective than physiotherapy alone in MSK conditions"?

The protocol is registered under the number CRD42019122567, in the Prospero – International Prospective Register of Systematic Reviews website.

2.1. Eligibility Criteria

Inclusion Criteria:

- Studies published in English.

- Studies published within the past decades from 2000-2019, this restriction was chosen in order to analyse the most updated studies and in order to have a relevant number of studies,

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- Studies investigating adult populations with MSK conditions.

Exclusion Criteria:

- Studies published in other languages,

- Studies focussing on paediatric populations,

- Studies in non-MSK conditions,

- Studies comparing two different forms of Acupuncture, and animal studies were excluded from the systematic review.

The search began in March 2019, and the last search was in May 2019.

2.2. Information Sources

Data used in this review were obtained from randomized controlled trials (RCTs) and cross-sectional studies. An electronic database search was conducted in PubMed, Cochrane Library and PEDro, using a set of keywords (Mesh and other) combined by Boolean operators AND and OR. The following keywords were used: Acupuncture, Physiotherapy, Manual Therapy, Rehabilitation, Musculoskeletal conditions, Combination. The reason why these databases, PubMed, Cochrane Library and PEDro, were chosen is that they represent sources of primary selection.

2.3. Study Selection

Once PubMed, Cochrane Library and PEDro databases were searched using the keywords, two independent reviewers reviewed titles and abstracts of identified studies for eligibility. The full texts of the studies were then identified for further review, by two independent reviewers. Any dispute experienced in the review was resolved through discussion between the involved parties. In instances where no agreement could be reached between the two parties, a third party was consulted to provide a solution to the issue. This process was repeated for the full-text screening of potentially relevant studies.

2.4. Risk of Bias in Individual Studies

For the various studies included in the systematic review, the risk of bias was assessed using the Pedro Quality Scale [6]. The questions used in the PEDro Quality scale assess the risk of bias and the quality of the included studies. Furthermore, the quality of the outcome measure of each study was assessed by two independent reviewers. That helped in lowering the risk of bias in the current review by ensuring consensus between the reviewers. Disagreement among the reviewers was resolved by communication or contacting the third party.

2.5. Outcome Measures

The current review seeks to identify the impact of Acupuncture and Physiotherapy in managing MSK conditions on pain and range of movement (ROM), which are the primary outcome measures of this review. The secondary outcome measures being investigated by the present review are strength, functional outcomes, and the quality of life, which have been evaluated using a valid questionnaire.

3. RESULTS

3.1. Study Selection

From the electronic search, 227 titles and abstracts were identified, 189 in PubMed, 9 in Cochrane Library and 29 in PEDro. Of these 227 articles, 75 were duplicates, leaving us with 152 studies for the initial screening. After evaluating these 152 abstracts, it was revealed that 21 studies were not related to MSK conditions, and 116 did not combine Physiotherapy with Acupuncture treatment. Fifteen full-text studies were screened by the two independent examiners, of which seven were excluded based on the eligibility criteria (Fig. **1**).

3.2. Study Characteristics

A total of 960 patients were included from 8 studies, from countries such as Hong Kong [13, 19], Brazil [14], Sweden [15], USA [16, 17] and UK [18, 20], 349 of which were in the intervention groups and 611 in the control groups. Gender was specified in all articles accounting for 223 males and 418 females (35% and 65%, respectively). The clinical MSK conditions included in the studies were: knee osteoarthritis (3 studies) (Tsang *et al*. [13] Chen *et al*. [15], Foster *et al*. [18],), tension neck syndrome (1 article) (Franca *et al*. [14], subacromial impingement (1 article) (Johansson *et al*. [15],), low back pain (two studies) (Kizhakkeveettil *et al*. [17], Bishop *et al*. [20],), and frozen shoulder (one article) (Sun *et al*. [19],). The outcome measures used in the respective studies were pain [13, 16 - 18, 20]; range of movement (ROM) [13]; mobility [13, 16]; muscular tension [14]; functional disability [14, 17, 20]; muscular strength [14]; shoulder function [15]; WOMAC score [16]; Constant Shoulder Assessment (CSA) [19] and medication effects [13].

3.3. Quality of Studies

Quality assessment of each study was evaluated based on the PEDro Quality Assessment Scale. All eight included studies were categorized as high quality (three studies graded 9/10, two studies graded 8/10, and three graded 7/10) (Table **3**). The mean PEDro Quality Assessment Scale score of the eight papers was 8.125, which is considered above an average score.

3.4. Interventions used in the Included Studies

The interventions in included studies varied widely, using medication and physiotherapeutic treatment, Acupuncture, placebo and sham. Two studies compared Physiotherapy with Acupuncture to Physiotherapy with Sham Acupuncture (Tsang *et al*. [13]; Franca *et al*., 2008 [14]). One study made a comparison between Physiotherapy as a sole intervention compared to Physiotherapy with Acupuncture [17]. Another study tried to establish a significant difference in outcomes between the intervention groups, which was treated with Corticosteroids plus home exercises, in contrast to a control group that was treated with Acupuncture and home exercises [15]. The remaining four studies compared three groups: two studies compared Acupuncture alone [13, 14], Physiotherapy alone and Acupuncture combined with Physiotherapy [15, 18]; the other two studies compared Physiotherapy alone [16, 19], Physiotherapy plus sham Acupuncture and Physiotherapy plus real Acupuncture [20]. Studies described 16 different Acupuncture points. The decision on Acupuncture points was based on, e.g., the location of the disease, the experience of the team of researchers or reports of evidence based on the use of the chosen points in the treatment of the respective conditions studied.

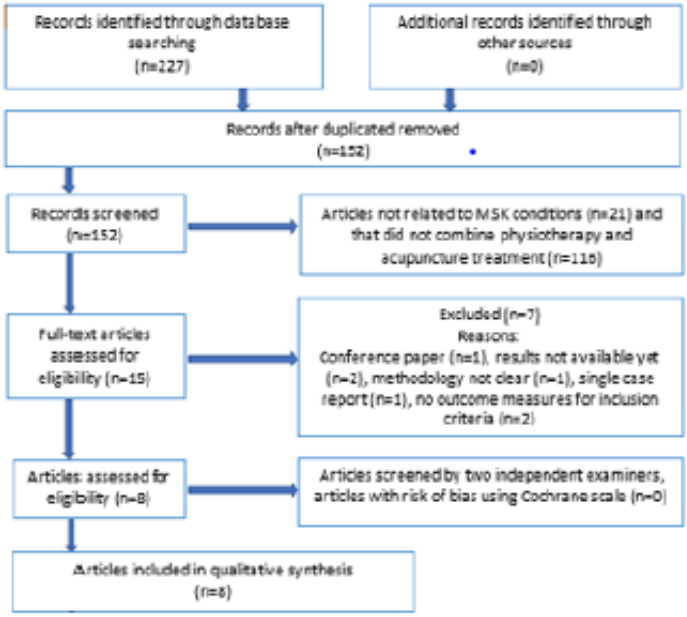

Fig. (1). Flowchart: searcg strategy and relevant yeld studies included in the review.

In one study, both groups received a standard postoperative Physiotherapy program; however, each patient was also given either ten sessions of Acupuncture or sham Acupuncture within two weeks [13]. In a ten-week study, Franca *et al*. [14] classified participants into 3 groups for different treatments. Physiotherapy and Acupuncture were administered to Group-1, Group-2 received Acupuncture only, and Physiotherapy alone was administered to Group-3. In a study by Johansson *et al*. [15], patients diagnosed with subacromial impingement syndrome (SIS) were randomized to either subacromial corticosteroid injection(s) or 10 Acupuncture treatments combined with home-exercises. Chen *et al*. [16] conducted a study in which Acupuncture was performed at the same nine points dictated by the Traditional Chinese "Bi" syndrome approach to knee pain, using either standard needles or Streitberger non-skin puncturing needles. Kizhakkeveettil *et al*. [17] randomized participants with acute or chronic lower back pain to three groups: (1) Acupuncture, (2) spinal manipulative therapy (SMT), or (3) integrative Acupuncture and SMT groups. Foster *et al*. [18] designed a study, which investigated the benefit of adding Acupuncture to a course of advice and exercise delivered by physiotherapists for pain reduction in patients with osteoarthritis of the knee. Interventions included (1) advice and exercise, (2) advice and exercise plus true Acupuncture, and (3) advice and exercise plus non-penetrating Acupuncture. In a separate study by Sun *et al*. [19], 35 patients with frozen shoulder complications were randomly selected for six weeks of Acupuncture group treatment. Lastly, Bishop *et al*. [20] conducted a study in which groups were categorized into three treatments: (1) standard care, (2) standard care plus real Acupuncture or (3) standard care plus non-penetrating Acupuncture.

4. RESULTS OF INDIVIDUAL OUTCOME MEASURES

4.1. Qualitative Analysis

4.1.1. Range of Movement (ROM)

Although ROM was one of our primary outcome measures, it was only assessed in one study [13], comparing physiotherapy with real acupuncture to physiotherapy with sham acupuncture. The study did not find a significant effect on ROM, which was found between the groups, with a P-value ranging between 0.09 and 0.75 (Table **1**).

4.1.2. Mobility Measure

The effectiveness of combining Physiotherapy with Acupuncture on Mobility measures was assessed in two studies [13, 16]; however, they used different outcome measures in their studies, for which pooling of the data was not possible. In the study by Tsang *et al*. [13], using the TUG test, significant differences were found between the groups after eight weeks of intervention, benefiting the group of Physiotherapy treatment in combination with real acupuncture, however, this difference disappeared after 15 weeks of intervention. Furthermore, comparing the results between the 8th and the 15th week, there are no significant differences between the intervention and the control group. The study by Chen *et al*. [16], when analyzing the 6-minute walk test (6MWT), did not find significant differences between the two groups (Table **2**). The non-significance might be because the participants were not equal at baseline, this might have an effect on treatment, and we cannot attribute the non-significance effect to the ineffectiveness of the treatment.

Table 1. Results of effects on range of motion.

First Author (Year)	OM	Group	Baseline (Pre Intervention)				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Mean difference	95% CI of the mean difference
Tsang *et al.*[63]	AROM (Right Knee)	PT+ACUP	15	100.9	27.3	0.464	15	94.0	15.0	0.745	1	-11.74 to 9.74
		PT+SHAM	15	107.0	16.0		15	93.0	13.7			
	AROM (Left Knee)	PT+ACUP	15	101.7	31.9	0.441	15	96.5	17.1	0.098	-3.2	-8.9 to 15.30
		PT+SHAM	15	109.0	17.3		15	99.7	15.2			
	PROM (Right Knee)	PT+ACUP	15	108.8	29.6	0.462	15	107.9	11.3	0.729	6.4	-15.08 to 2.28
		PT+SHAM	15	115.3	16.5		15	101.5	11.9			
	PROM (Left Knee)	PT+ACUP	15	110.6	35.4	0.434	15	107.3	15.9	0.320	1.3	-12.75 to 10.15
		PT+SHAM	15	118.7	17.2		15	106.0	14.7			

*OM = Outcome measure; ROM = Range of motion; SD = Standard deviation; CI = Confidence Interval; AROM = Active range of Motion; PROM = Passive Range of Motion; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group.

Table 2. Results of effects on gait assessment.

First Author (Year)	OM	Int. or Ctrl Group	Pre-Intervention			8th week Post-Intervention				15 weeks Post-Intervention					
			N. in group	Mean	SD	N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
Tsang *et al.* [62]	TUG[1]	PT+ACUP	15	29.9	15.6	15	78.4	30.7	0.028	15	45.8	31.1	0.929	6	-22.46 to 10.46
		PT+SHAM	15	19.4	7.0	15	67.5	48.8		15	39.8	33.4			
			Pre-Intervention							12 weeks Post-Intervention					

(Table 2) contd....

First Author (Year)	OM	Int. or Ctrl Group	Pre-Intervention				8th week Post-Intervention				15 weeks Post-Intervention					
			N. in group	Mean	SD		N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
Chen et al[65]	6MWT	PT+ACUP	105	1032#	314	0.027					71	1119#	Not given	0.562	-28	1046-1195#
		PT+SHAM	109	1126#	289						82	1147#				1086-1209#

OM = Outcome Measure; Int = Intervention group; Ctrl = Control group; SD = Standard Deviation; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group; TUG = Time-up-go test; 6MWT = 6 minutes' walk test.

Table 3. Results on muscular tension within groups, based on the paired t-test.

First Author (Year)	OM	Groups	Pre Intervention				After 6 months of treatment				
Franca *et al.* [16]			N. in group	Mean	SD	P Value (within group)	N. in group	Mean	SD	P Value (within group)	Effect size
	VAS_{mt}	PT + ACUP	16	90.0	14.81	0.053	16	15.0	14.81	<0.000	PT/ACUP= -5
		ACUP	15	80.0	22.2		15	20.0	14.81	<0.000	ACUP/PT+ACUP= -10
		PT	15	70.0	22.2		15	30.0	14.81	<0.000	PT/PT + ACUP= -15

OM = Outcome Measures; SD = Standard Deviation; VAS = Visual Analogic Scale; PT+ACUP = Physiotherapy group; PT = Acupuncture group; ACUP = Acupuncture group.

Table 4. Results of effect on functional disability.

First Author (Year)	OM	Groups	Pre Intervention			Post-Intervention				
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI of the mean
Bishop *et al.*[66]	ODI	PT	32	34.1	11.4	32	32.2	18.8	PT+ACUP/ACUP = 10.9	25.5-36.9
		PT + ACUP	32	29.1	10.9	32	21.3	17.7	ACUP/PT = -4.9	17.5-28.8
		PT+ SHAM	27	33.9	13.6	27	26.2	14.4	PT+ACUP/PT = 6	19.1-31.3
First Author (Year)	**OM**	**Groups**	**Pre Intervention**			**After 6 months of treatment**				
			N. in group	Mean	SD	N. in group	Mean	SD	Effect size	95% CI
Kizhakkeveettil et al[66]	Disability Level	ACUP	34	10.8	5.6	34	6.3	6.16	ACUP/SMT= 3.2	4.1-8.4
		SMT	36	11.1	6.0	36	3.1	5.9	SMT/ACUP+SMT = -0.9	1.1-5.1
		ACUP+SMT	31	9.7	6.4	31	4.0	5.18	ACUP/SMT = 2.3	2.1-5.9

*OM = Outcome Measures; SD = Standard Deviation; NDI-BR(%) = Neck Disability Index: Brazilian Portuguese Version; ODI = Oswestry Disability Index; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

4.1.3. Muscular Tension

Franca *et al.* [16] assessed muscular tension using VAS_{mt}. They observed the patients for six months and found statistically significant improvements within the groups for all parameters in comparison with the baseline ($p<0.000$) (Table **3**).

4.1.4. Functional Disability

Three of the included studies assessed Functional Disability as an outcome measure [14, 17, 20]. Franca *et al.* [14] used the Neck Disability Index (NDI), and found significant differences between groups after 6-months follow-up favouring the Acupuncture + Physiotherapy group (Table **4**). The Kruskal-Wallis test was used to evaluate differences of the medians and of the individual characteristics among them at baseline, which were not significant in this study. The improvements in outcome in the Physiotherapy combined with Acupuncture group were superior to the Acupuncture alone group and Physiotherapy alone group in reducing functional disability ($p<0.05$) in comparison with baseline. Additionally, The Kruskal-Wallis Test (KWT) and Dunn's Multiple Comparison Test (DMCT), as post-test, were used to assess the significant differences of the parameters of the intra-groups among three groups after six months of treatment. There was a significant difference in median functional disability (p = .0018) (Table **4**).

Bishop *et al.* [20] used the Oswestry Disability Index Score (ODI). The results of Bishop *et al.* (2016) [20] seem to be inconclusive since the confidence intervals are overlapping. Therefore, no differences in the ODI can be found between the groups after eight weeks of treatment. These results are presented in Table **4** (21.3 (17.5-28.8)).

Kizhakkeveettil *et al.* [17] resorted to Roland-Morris LBP Disability Questionnaire to evaluate disability in patients with Low Back Pain. The study indicated that there was an improvement in the primary outcomes among the subjects in

the three groups. However, the research did not identify any differences in outcomes between the three groups. The study findings pointed to the feasibility of implementing a large-scale RCT examining the adoption of an integrative care model that involves the combination of SMT and acupuncture in improving the patient outcome in the management of lower back pain when compared to the implementation of the therapy alone (Table **4**).

4.1.5. Muscular Strength

Another outcome measure analyzed by Franca *et al.* [14] was Isometric Neck Muscle Strength (INMS), using a pressure Biofeedback Device (Cranio-Cervical Flexion Test (C-CFT), Stabilizer, Chattanooga South Pacific, Australia). Significant improvements within the groups have been found, based on the paired t-test ($p<0.05$). The DMCT, also showed that the Physiotherapy + Acupuncture group was superior to the Acupuncture group and Physiotherapy group in INMS improvement ($p<0.0001$), after 10 weeks of treatment. The improvements in INMS of all groups were maintained ($p=0.006$) after 6 months of treatment, in comparison with baseline (Table **5**).

4.1.6. Shoulder Function

In the study of Johansson *et al.* (2011) [15], significant improvement of shoulder function over time was found in both groups ($p<0.001$), according to the analysis of variance (ANOVA). However, the between-group variance for the ANOVA test indicated no significant differences in the effectiveness of the two combinations; Physiotherapy+Corticost and Physiotherapy + Acupuncture. These results implied that both techniques are effective in treating MSK complications (Table **6**).

4.1.7. WOMAC Score

Chen *et al.* (2013) [16] evaluate the effectiveness of Physiotherapy combined with real or sham acupuncture in patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. Both treatment groups showed improvement from combined therapy with no difference between real (31.6%) and non-penetrating Acupuncture (30.3%) in WOMAC response rate ($p=0.148$). Based on the cumulative distribution function curves displaying every possible definition of a clinical response on the WOMAC, no appreciable clinical or statistical differences were observed (Table **7**).

Table 5. Results of effects on muscular strength.

First Author (Year)	OM	Groups	Pre Intervention			After 10 weeks of treatment					After 6 months of treatment					
			N. in group	Mean	SD	N. in group	Mean	SD	P Value within group	P value between group	Effect size	N. in group	Mean	SD	P Value within group	P value between group	Effect size
Franca et al [69]	C-CFT (mmHg) Isometric Neck Muscle Strength (INMS)	PT+ACUP	16	22.0	1.41	16	27.1	2	P<0.001	P<0.0001	PT+ACUP/ACUP= 3.4	16	26.1	2.4	P<0.0001	P=0.0006	PT+ACUP/ACUP = 4
		ACUP	15	22.0	1.41	15	23.7	1.4	P<0.001		ACUP/PT = 2.8	15	23.0	1.6	P=0.0004		ACUP/PT = -2
		PT	15	20.0	1.41	15	20.9	1.4	P<0.001		PT/PT+ ACUP =6.2	15	23.2	1.4	P<0.0001		PT/PT+ ACUP = 2

*OM = Outcome Measures; SD = Standard Deviation; C-CFT = Cranio-Cervical Flexion Test; INMS = Isometric Neck Muscle Strength; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group.

Table 6. Results of effects on shoulder function.

First Author (Year)	OM	GROUPS	Pre Intervention					12 month follow-up					
			N. in group	Mean	SD	P Value between groups	95% CI	N. in group	Mean	SD	P Value between groups	Effect size	95% CI of the mean
Johansson et al (2011)[68]	Shoulder Function	PT + Corticost	49	69	12	P<0.001	66-73	37	88	-19	P<0.001	-3	84-92
		PT+ACUP	42	70	12		67-74	32	91				88-95

*OM = Outcome Measures; SD = Standard Deviation; PT = Physiotherapy; ACU = Acupuncture; CI = Confident Interval; PT+Corticost = Physiotherapy plus Corticosteroids group; PT+ACUP = Physiotherapy plus Acupuncture group.

Table 7. Results of effects on WOMAC score.

First Author (Year)	OM	GROUPS	Pre Intervention				26 weeks Post-Intervention				
			N. in group	Mean	SD	P Value	N. in group	Mean	P Value	Effect size	95% CI of the mean
Chen et al (2013)[65]	WOMAC	PT+ACUP	105	47.6	14.7	P=0.097	71	41.5	P=0.148	4.3	37.6-45.4
		PT+SHAM	109	44.0	15.7		82	37.2			32.8-41.6

*OM = Outcome Measures; SD = Standard Deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

Table 8. Results of effects on CSA.

First Author (Year)	OM	GROUPS	Pre Intervention				20 weeks follow-up				
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size
Sun et al (2001)[68]	CSA	PT+ACUP	13	41.3	14.9	0.9651	13	67.3	11.5	0.048	9.4
		PT	22	42.8	14.0		22	57.9	15.1		

*OM = Outcome Measures; SD = Standard Deviation; CSA = Constant Shoulder Assessment; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT = Physiotherapy group.

Table 9. Results of effects on medication effects.

First Author (Year)	OM	Int. or Ctrl Group	Pre Intervention				Post-Intervention					
			N. in group	Mean	SD	P Value	N. in group	Mean	SD	P Value	Effect size	95% CI of the mean difference
Tsang et al (2007)[62]	Analgesic Consumption	PT+ACUP	NOT MENTION				15	28.3	11.6	0.447	-3.6	- 13.2 to 6.0
		PT+SHAM					15	24.7	13,8			

*OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group.

4.1.8. Constant Shoulder Assessment (CSA)

The Constant Shoulder Assessment score is a scale ranging between 0 and 100 that is used to assess the functionality of a shoulder following shoulder injury treatment. The test has four primary outcome measures: activities of daily living, pain, range of motion, and strength with specific maximum scores of 20, 15, 40, and 25, respectively. To interpret the scale, the researcher simply looks at the score value for a specific outcome measure; the higher the outcome measure, the greater the quality of shoulder functionality. The frozen shoulder was studied by Sun *et al.* (2001) [19], using the CSA to evaluate the level of pain and the ability to carry out the usual daily activities of the patient. They have reported that CSA scores were significantly higher in the Physiotherapy plus Acupuncture group (Intervention) compared to the Physiotherapy alone group (Control) at 20 weeks (p=0.048) (). Within each group, there was a significant difference among mean CSA scores measured at baseline, 6 weeks, and 20 weeks (p<0.001 by Friedman's test (Table **8**).

4.1.9. Medication Effects

Tsang *et al.* (2007) [13], measured the analgesic consumption between the two groups. Although no significant difference in the analgesic consumptions between the two groups after the intervention (p=0.447); the authors failed to report baseline results, limiting the interpretability of the results (Table **9**).

5. DISCUSSION

5.1. Summary of Findings

The purpose of this systematic review of RCT was to investigate the current knowledge regarding the application of Acupuncture as adjunctive therapy to Physiotherapy in the treatment of MSK conditions, aiming at improving the patient health outcome. Eight studies were included in this review, accounting for a total of 960 participants with clinical MSK conditions (knee osteoarthritis, tension neck syndrome, subacromial impingement, low back pain, and frozen shoulder).

The pain was the most commonly assessed outcome measure, reported in five of the eight included studies. This was analyzed by using various pain outcome measures: Visual Analogic Scale (VAS) [14], the Numeric Pain Rating Scale (NPRS) (Kizhakkeveettil *et al.*, 2017 [17]; Tsang *et al.* [13], 2007; Bishop, 2016 [20]); Adolfsson-Lysholm shoulder assessment (AL-SCORE) for pain (Johansson *et al.*, 2011) [15]; and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) – pain subscale score (Chen *et al.*, 2013 [16]; Foster *et al.*, 2007) [18]. Other outcome measures used in the included studies were: quality of life using EQ-5D-5L Questionnaire, assessment of active and passive ROM, using a goniometer (Tsang *et al.*, 2007) [13]; ambulation measurement by the timed up and go test (TUG) (Tsang *et al.*, 2007) [13]; muscular tension by the Visual Analogue Scale for muscular tension (VASmt) assessment (Franca *et al.*, 2008) [14]; and shoulder assessment by the AL-SCORE (Johansson *et al.*, 2011) [15]; and the Constant Shoulder Assessment (CSA) (Sun *et al.*, 2001) [19].

5.2. Limitations of the Review and Included Studies

All studies selected for the systematic review were RCTs, with all clearly identifying methods of randomization. However, Sun *et al.* (2001) [19] failed to report concealment of allocation. Chen *et al.* [16] did not report similar groups at baseline. Several studies, such as Franca *et al.* [14], Kizhakkeveettil *et al.* [17], Foster *et al.* [18] and Bishop *et al.* [20] did not report blinding of the assessors; and Johansson *et al.* [15] did not report 85% of the outcome measures. Only Chen *et al.* (2013) [16] and Sun *et al.* (2001) [19] were able to record the blinding of Therapists to group allocation. This is because, for the therapist who performs the therapy, blinding is exceedingly difficult. It can be argued that if data collection is blinded, a bias is minimized; but if the therapist believes more in one of the techniques, he or she can influence the study results. Two independent reviewers assessed the risk of bias. The assessors found the risk of bias to be within acceptable limits. That helped in lowering the risk of bias in the current review by ensuring consensus between the reviewers. Nevertheless, the risks of bias found in the selected studies

reduce the reliability of the evidence found, demonstrating the need for future studies to be conducted on a large scale with representative samples of the population and with a low risk of bias.

5.3. Comparison with other Studies or Reviews

Other research has also shown that acupuncture is synergistic with conventional therapies, which is highly relevant for physiotherapists as they already combine various interventions [23]. However, as far as the literature review conducted is concerned, this is the first systematic review that was conducted specifically on the effectiveness of acupuncture combined with physiotherapy in MSK conditions. The researchers only obtained empirical studies that were used for the systematic assessment, which indicate the effectiveness of acupuncture.

5. RECOMMENDATIONS

Future research should ensure improved allocation and blinding of participants and narrow down their inclusion and exclusion criteria to reduce the heterogeneity of the populations being studied. Increasing the number of studies would increase the sample size and thus the power to study the effects of interest. Proper blinding is crucial to the studies. "Blinded" therapists ensure that therapists were unable to discriminate whether subjects received treatment. When therapists are "blinded", the apparent effect (or lack of effect) of the treatment did not occur due to enthusiasm or lack of enthusiasm for treatment and control conditions. Lastly, including studies with less heterogeneity improves the validity of the findings, and the researcher is assured that the populations being investigated are similar.

6. IMPLICATIONS

The interest in acupuncture among physiotherapists has increased over the last few years [24]. This is evident in the research conducted by physiotherapists, particularly MSK conditions [25]. Only a few studies have investigated Physiotherapy treatment in combination with Acupuncture for MSK conditions. This systematic review found a significantly higher and positive effect in combining acupuncture and physiotherapy versus other interventions on NDI, neck strength, and CSA. Acupuncture, in addition to physiotherapy, could, therefore, be used in the management of neck and shoulder problems. However, more research is needed to confirm these results.

CONCLUSION

This study sought to systematically review and critically appraise the evidence for the use of acupuncture as an adjunctive modality to physiotherapy in the treatment of MSK conditions. As an integrative or complementary therapy for pain, acupuncture has increasingly been used. However, this review did not find significant evidence to support that the addition of acupuncture to physiotherapy treatment has an added benefit to pain relief. This review did, however, find benefits of adding acupuncture to treatment for improving shoulder function, reduce neck disability, low back pain and muscular strength. Notwithstanding this, more research is needed to measure the effectiveness of the combination of acupuncture with physiotherapy. In the United States alone, more than $30 billion were spent on alternative and complementary medicines such as acupuncture in 2012 [26]. Therefore, further research into the effectiveness of acupuncture is warranted.

CONSENT FOR PUBLICATION

Not applicable.

STANDARD OF REPORTING

PRISMA guidelines have been followed for this study.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared None.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the publishers web site along with the published article.

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Attachment 6 – Survey

"The role of Acupuncture in Physiotherapy"

Demographic data:

Sex: ( ) M ( ) F

Age: _____

Country of study: _____

Country of work: _____

SURVEY

*If necessary, identify more than one option

1. **What is your highest level of education within the field of physiotherapy?**
   A. Certificate
   B. Diploma
   C. Bachelor's Degree
   D. Master's Degree
   E. PhD

2. **Have you specialized in acupuncture (if NO, please skip to 10)?**
   A. Yes
   B. No

3. **Are you confident that you are specialist in acupuncture?**
   A. Yes
   B. No

4. **Please indicate your level of professional experience in acupuncture.**
   A. 0-2 years
   B. 3-5 years
   C. 6-8 years
   D. 9-11 years
   E. More than 12 years

5. **Please rate your experience in acupuncture in terms of the acupuncture cases you have handle**
   A. Very many (more than 60)
   B. Many (36-60)
   C. Quite a number (21-35)
   D. Few (11-20)
   E. Very few (0-10)

6. **Which level of training do you specifically have in acupuncture?**
   A. No training/apprenticeship
   B. Certificate
   C. Diploma
   D. Master's degree
   E. PhD

7. **Approximately, for how many years have you been practicing acupuncture?**
   A. 0-2 years
   B. 3-5 years
   C. 6-8 years
   D. 9-11 years
   E. More than 12 years

8. **Approximately how many patients have you applied acupuncture since you started your professional practice in the field of acupuncture**
   A. Very many (more than 60)
   B. Many (36-60)
   C. Quite a number (21-35)
   D. Few (11-20)
   E. Very few (0-10)

9. **Acupuncture should be included in the physiotherapy curriculum as an elective course. To what extent do you agree with this statement?**
   A. Strongly agree
   B. Agree
   C. Neither agree nor disagree
   D. Disagree
   E. Strongly disagree

10. **Every student pursuing physiotherapy should be given thorough training in acupuncture. To what extent do you agree with this statement?**
    A. Strongly agree

B. Agree
C. Neither agree nor disagree
D. Disagree
E. Strongly disagree

11. How important is acupuncture to the overall field of physiotherapy?

A. Very important
B. Important
C. Neither important nor unimportant
D. Unimportant
E. Absolutely unimportant

12. Without acupuncture, effective physiotherapy professional practice could be significantly compromised. To what extent do you agree with this statement?

A. Very true
B. True
C. Neither true nor false
D. False
E. Absolutely false

13. In how many cases have you applied acupuncture in the past three months?

A. Very many (more than 16)
B. Many (12-15)
C. Quite a number (8-11)
D. Few (4-7)
E. Very few (0-3)

14. Do you use acupuncture as an adjunct to physiotherapy techniques?

A. Always
B. Often
C. Sometimes
D. Rarely
E. Not at all

15. In which areas of Physiotherapy? (Multiple selection allowed)

A. Orthopaedics
B. Musculoskeletal
C. Paediatrics
D. Obstetrics
E. Neurology
F. Neuropediatric
G. Gynaecology

H. Oncology
I. Geriatrics
J. Cardiorespiratory
K. Other: _____

Comments:

_____

Email (Optional):

_____

Thank you for your attention, and for your participation in the realization of this Survey

Ana Alexandra Anjos

Physiotherapy Master Student

University of Cape Town, South Africa

ATTACHMENT 6.1 – SURVEY EXPLAINED

JUSTIFICATION	
1. What is your highest level of education within the field of physiotherapy? A. Certificate B. Diploma C. Bachelor's Degree D. Master's Degree E. PhD	This is a general research question designed to assist the research understand the level of education of the population members. Responses represent categorical data.
2. Have you specialized in acupuncture (if NO, please skip to 10)? A. Yes B. No	This research questions will facilitate measurement of the first objective (the number of physiotherapists trained in acupuncture). For internal consistency, this question has been replicated as question number 3. The validity of this question (face validity) is established in existing literature such as Schröder et al. (2015)[64]. Researchers present similar questions when trying to find out whether a respondent belongs to one of the two categories available.
3. Are you confident that you are a specialist in acupuncture? A. Yes B. No	
4. Please indicate your level of professional experience in acupuncture. A. 0 - 2 years B. 3 – 5 years C. 6 – 8 years D. 9 – 11 years E. More than 12 years	Questions 4, 5, and 6 are intended to facilitate measurement of the second variable – the level of specialization in acupuncture. Three constructs of job specialization were extracted from existing literature – number of years of professional practice (experience), number of tasks/cases handled, and the level of training attained within the particular job category[65]. These three contents satisfy the requirements for content validity, given that they fully describe the level of specialization in acupuncture. In order to confirm this validity, factorial validity will be performed in order to determine the degree of correlation among the three constructs[66]. In order to ensure internal consistency reliability, the questions 4 and 5 were replicated as questions 7, and 8. Internal consistency reliability would be attained through determination of the correlation coefficient between each question and its replica.
5. Please rate your experience in acupuncture in terms of the acupuncture cases you have handled. A. Very many (more than 60) B. Many (36 – 60) C. Quite a number (21 – 35) D. Few (11 – 20) E. Very few (0 – 10)	
6. Which level of training do you specifically have in acupuncture? A. No training/apprenticeship B. Certificate C. Diploma D. Master's Degree E. PhD	

7. Approximately, for how many years have you been practicing acupuncture? A. 0 - 2 years B. 3 – 5 years C. 6 – 8 years D. 9 – 11 years E. More than 12 years	
8. Approximately, on how many patients have you applied acupuncture since you started your professional practice in the field of acupuncture? A. Very many (more than 60) B. Many (36 – 60) C. Quite a number (21 – 35) D. Few (11 – 20) E. Very few (0 – 10)	
9. Acupuncture should be included in the physiotherapy curriculum as a compulsory course. To what extent do you agree with this statement? A. Strongly agree B. Agree C. Neither agree nor disagree D. Disagree E. Strongly disagree	Questions 9 and 11 are designed to determine the third objective, whether acupuncture should be included in the Physiotherapy curriculum. Question 10 directly poses this question to the respondents. Question 10 is a replica of question 9 in order to facilitate determination of internal consistency. Question 11 indirectly poses the question to the respondents. The question requests the respondents to indicate the extent to which acupuncture is important to the overall field of physiotherapy. If acupuncture is indeed very important, then it must be included in the Physiotherapy curriculum. If it absolutely unimportant, then including it in the Physiotherapy curriculum is completely unnecessary. Question 12 is a replica of question 11 for internal consistency purposes[66].
10. Every student pursuing physiotherapy should be given thorough training in acupuncture. To what extent do you agree with this statement? A. Strongly agree B. Agree C. Neither agree nor disagree D. Disagree E. Strongly disagree	
11. How important is acupuncture to the overall field of physiotherapy? A. Very important B. Important C. Neither important nor unimportant D. Unimportant E. Absolutely unimportant	
12. Without acupuncture, effective physiotherapy professional practice could be significantly compromised. To what extent do you agree with this statement? A. Very true	

B. True C. Neither true nor false D. False **E.** Absolutely false	
13. In how many cases have you applied acupuncture in the past three months? A. Very many (More than 16) B. Many (12 – 15) C. Quite a number (8 – 11) D. Few (4 – 7) E. Very few (0-3)	This question is intended to measure the frequency of acupuncture usage in physiotherapy. The number of cases in each category are arbitrarily determined. However, a reasonable number of sets for each case.
14. Do you use acupuncture as an adjunct to physiotherapy techniques? A. Always B. Often C. Sometimes D. Rarely E. Not at all	This question is aimed at also answering the four objectives by facilitating measurement of the frequency at which the respondent uses acupuncture as an adjunct physiotherapy technique.
15. In which areas of Physiotherapy? (Multiple selections allowed). A. Orthopedics B. Muscleskeletal C. Pediatrics D. Obstetrics E. Neurology F. Neuropediatrics G. Gynecology H. Oncology I. Getriatrics J. Cardiorespiratory K. Other _____	This is a general question designed to fulfill the last objective. This question generally requests respondents to indicate the fields of practice in which they have employed acupuncture techniques.

Attachment 7 – HREC Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

14 September 2020

HREC REF: 641/2018

A/Prof S Maart
Division of Physiotherapy
Health & Rehab Sciences F-45, OMB
Email: soraya.maart@uct.ac.za
Student: ana.anjos@fchs.ac.ae

Dear A/Prof Maart

PROJECT TITLE: EXPLORING PEDAGOGICAL DISSONANCE IN INCLUDING A TRADITIONAL CHINESE MEDICINE TREATMENT APPROACH INTO A WESTERN BIOMEDICAL EVIDENCE-BASED PHYSIOTHERAPY CURRICULUM (Masters Candidate - Ms A Anjos)

Thank you for your response, addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 and 06 July 2020.

Approval is granted for one year until the 30 September 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: Ms Ana Anjos will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Attachment 8 – Letter for Physiotherapy Councils

Respective Council…

Ana Alexandra da Cunha Pereira Anjos

Physiotherapy Master Student

University of Cape Town

Date: _____/_____/2020

To whom it may concern

My name is Ana Anjos, I'm a student in the Master in Physiotherapy, from the University of Cape Town. I'm doing research that seeks to study the opinion of physiotherapy professionals on the Inclusion of Acupuncture in the undergraduate Physiotherapy Curriculum. Acupuncture is a technique that is increasingly being searched by patients nowadays days as a complement to their treatments. Due to this fact and their own professional curiosity, the interest on these areas, among physiotherapist, have been growing over the years. However, little is known about the performance of this professionals and the reality of their work.

My purpose is to do a field study which aims to collect data on the current work performance of the Physiotherapy professionals that are working with Acupuncture, as well as the expectations of job employability. It is intended to outline a current profile of this professionals, as well as clarify other professionals of the area and students with the intention to specialize in Acupuncture, notions about this area of action and their respective job employability.

This research will involve questionnaires to be sent to all register Physiotherapist from two countries such as United Arab Emirates and South Africa.

All physiotherapists registered with the respective Physiotherapy Council from two countries: United Arab Emirates and South Africa, will be invited.

The information that will be collected from this research will be anonymous and no personal data allowing identification of participants will be included, except for the demographic data needed for analysis: age, sex, country of practicing, country of study. Information about the participant that will be collected during the research will be put away and no-one, but the researchers will be able to see it. The information will

be lock up with a lock and key or protect by password in case of softcopy. It will not be shared with or given to anyone except the parts concerned.

This research has received Ethical Approval with the reference number 641/2018., from the Human Research Ethical Committee from the Faculty of Health Sciences of the University of Cape Town.

If you have any questions, you may ask them now or later, even after the study. If you wish to ask questions after you take part of the study, you may contact:

For pertinent questions about the research:

Ana Alexandra Anjos (Main research) – xananjos@gmail.com

Dr. Soraya Maart (supervisor) - soraya.maart@uct.ac.za

For participant's rights as research subject:

Professor Marc Blockman – marc.blockman@uct.ac.za

Human Research Ethics Committee (HREC) of University of Cape Town - hrec-enquiries@uct.ac.za

HREC phone number - +27 21 650 1236

We kindly ask you to disseminate this survey, through email to your contact list, as an integral part of the study entitled "Exploring pedagogical dissonance in including a Traditional Chinese Medicine treatment approach into a Western biomedical evidence-based physiotherapy curriculum" which is a fundamental part for the completion of the Master's Degree in Physiotherapy work by the University of Cape Town, South Africa, by your associates which the objective of gathering current data and providing information on these subjects to the professionals of the area and to the academics of physiotherapy who have interested in Acupuncture .

If you find it necessary, I will send the final resolution of this study via email and clarify any doubts that may arise regarding the proposed study.

Best regards

_____

Ana Alexandra Anjos

Attachment 9 – Informed Consent

INFORMED AND CLARIFIED CONSENT FORM

Physiotherapist that are currently enrolled in a Representative Council of Physiotherapy, actively treating patients for the past 6 months, are inviting to participate in this research. The title of the research project is: "Exploring pedagogical dissonance in including a Traditional Chinese Medicine treatment approach into a Western biomedical evidence-based physiotherapy curriculum".

Main Researcher: Ana Alexandra da Cunha Pereira Anjos

Name of Organization: University of Cape Town

This Informed Consent Form has two parts:

- Information Sheet

- Certificate of Consent

You will be given a copy of the full Informed Consent Form

PART I: Information Sheet

Introduction

My name is Ana Anjos, I'm a student in a Master in Physiotherapy, from the University of Cape Town. We are doing research in Acupuncture and its inclusion in Physiotherapy Curriculum. Acupuncture (a method of treatment based on influencing the body by inserting needles in the specific points of human body, called acupoints) is a technique that is increasingly being search by patients these days as a complement to their treatments. I am going to give you information and invite you to be a part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research.

There may be words that you do not understand. Please feel free to contact me through my email (xananjos@gmail.com) for any extra clarifications and I will take time to explain. If you have questions later, you can ask me any time.

If you find it necessary, I will send the final resolution of this study via email and clarify any doubts that may arise regarding the proposed study.

Purpose of the research

This is a field study which intends to analyze the response of physiotherapists in general in regard to acupuncture and outline a current profile of physiotherapists that use acupuncture in their field of practice, as well as clarify other professionals of the area and students with the intention to specialize in Acupuncture.

Type of Research Intervention

This research will involve questionnaires to be sent to all register Physiotherapist from two countries such as United Arab Emirates and South Africa.

Duration of the research

This questionnaire will not take more than 5 minutes of your time, it is structure in 9 main questions, with sub questions.

Participant selection

We are inviting all physiotherapists registered with the respective Physiotherapy Council from these two countries: United Arab Emirates and South Africa.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate in this research project, and later change your mind, you can take part at any time. If you choose to participate, you may change your mind later and stop participating even if you agreed earlier.

Risks

The participation on this research doesn't involve any risk.

Benefits

Your participation is likely to help us to make some recommendations in relation to Acupuncture being administered by Physiotherapy is it in combination or used separately. There may not be any benefit to the society at this stage of the research, but future generations are likely to benefit.

Confidentiality

The information that we collect from this research will be anonymous and no personal data allowing identification of participants will be included. Demographic data will be used only for analysis: age, sex, country of practicing and country of study. All the information collected during the research will be put away and no-one, but the researchers will be able to see it. The information will be lock up with a lock and key or protect by password in case of softcopy. It will not be shared with or given to anyone except the parts concerned.

Sharing the results

The knowledge that we get from doing this research will be shared with you through email, if that is your wish, before it is made available to the public. Confidential information will not be shared.

Right to Refuse or Withdraw

Your participation is voluntary. You may stop participating in the research at any time that you choose. It is your choice, and all of your rights will still be respected.

Who to contact?

If you want to request a copy of the study, please email Ana Anjos (xananjos@gmail.com)

If you have any questions, you may ask them now or later, even after the study. If you wish to ask questions after you take part of the study, you may contact:

For pertinent questions about the research:

Ana Alexandra Anjos (Main research) – xananjos@gmail.com

Dr. Soraya Maart (supervisor) - soraya.maart@uct.ac.za

Dr. Lieselotte Corten (co-supervisor) - l.corten@uct.ac.za

For participant's rights as research subject:

Professor Marc Blockman – marc.blockman@uct.ac.za

Human Research Ethics Committee (HREC) of University of Cape Town - hrec-enquiries@uct.ac.za

HREC phone number - +27 21 650 1236

This proposal has been reviewed and approved by the Human Research Ethics Committee (HREC) from the University of Cape Town, with the reference number 641/2018, who is a committee whose task is to make sure that research participants are protected from harm. If you wish to find out more about more about HREC, please contact fhs-pg-admiss@uct.ac.za

PART II: Certificate of Consent

Having received the above information and, having clarified my rights related to the following, I declare to be aware of the above and consent to participate in this research.

I understand that I can request a clarification to any questions that I might not have understood or clarify any doubt that may arise in regard to the procedures, risks, benefits, and others related to the research.

I understand that I have the freedom to withdraw my consent and to stop my participation in the study at any time.

I understand that I will be not identified, and that the confidential nature of the information related to my privacy will be kept.

I understand that I can request updated information during the research, although it may affect my willingness to continue participating.

ACCEPT	DO NOT ACCEPT

Name of the participant: _____

Date: ____/_____/____

Day/Month/Year

Attachment 10 – Turnitin Originality Report

Turnitin Originality Report

Processed on: 21-Dec-2021 20:55 SAST
ID: 1734751087
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anjana001:FINAL_PARA_TURNITIN.docx
By Ana Anjos

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Exploring pedagogical dissonance in including a Traditional Acupuncture treatment approach into a Western biomedical evidence-based physiotherapy curriculum MCs Physiotherapy Student: Ana Alexandra Anjos (ANJANA001) Supervisors: A/Prof. Soraya Maart Dr. Lieselotte Corten "A doctor that only knows medicine not even medicine knows". Dr. Abel Salazar (Portuguese doctor, professor, researcher, painter) "Good it is to fight with determination, embrace life and live with passion, lose with class and win with boldness, For the triumph belongs to those who dare .... And life is too large to be negligible. " Charles Chaplin DECLARATION Date: 26th October I, Ana Alexandra da Cunha Pereira Anjos, UCT student number ANJANA001,confirm that this dissertation contains original content resulting from my incessant effort and extensive research work. I fully understand that plagiarism means using somebody else's ideas, inventions, writings without acknowledging their source, in one's scholarly work. I also understand that plagiarism is an academic fraud that

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To my husband, Nuno Goncalves, for his unconditional support and love, and most of all is patience. I am grateful for having him by my side every day and to be able to share with him all my hopes and dreams and bring them into life, no matter how hard it is sometimes. Without him, our Francisco would not always let me think. To my brother Nuno for always being there for me Especially to my supervisor, Professor Soraya Maart, who has always believed in me, thank for your guidance and wisdom always with the highest scientific level, the continuous interest and critical vision, and to help me to overcome all the necessary steps for the conclusion of this work. To my co-supervisor, Dr. Lieselotte Corten, for the opportunity, encouragement, and confidence. To Dr. Pedro Borrego, my guardian Angel, for the teaching and support, thank you for all the valuable lessons To all my friends and colleagues at Fatima College of health Sciences, Abu Dhabi, UAE, for all the guidance, patience, and support. To everyone that in one way or the other helped me, supported me and believed in my potential. And of course, to my dear son, Francisco, whom I love unconditionally and who came to give a new color to my life, I hope from now on to make up for the hours of attention and fun I owe him. He was my most considerable stimulus on this journey. ABSTRACT Background: We cannot speak about complementary and alternative medicine without speaking about the most popular form of it, Acupuncture, and its connection with health maintenance or forms of intervention to recover it. Over the last few years, acupuncture has been increasingly used for the treatment of pain either as a combined or complementing therapy, and evidence also suggests an increased in physiotherapists interested in acupuncture. The study aimed to 1) explore the scientific support for the combined use of acupuncture and physiotherapy in MSK conditions through a systematic review and 2) to explore the inclusion of acupuncture in undergraduate curricula as an elective course by doing a quantitative descriptive survey. Methods: Three major databases were used for the conduction of the systematic review of literature, taking place from March 2019 to May 2019, i.e., Cochrane Library, PubMed, and PEDro (Physiotherapy Evidence Database). For inclusion criteria were accepted only randomized controlled trials (RCT) published in English, released within the past decade, and using subject's adult population with MSK conditions. A quantitative descriptive survey was conducted among physiotherapists registered with professional societies in the United Arab Emirates and South Africa. A questionnaire was distributed to registered members using an online format to explore demographic information, usage of acupuncture as a treatment modality, and level of agreement for including acupuncture in undergraduate curricula. Results: Systematic Review (CHAPTER 3) The results from the electronic search yielded a total of 227 abstracts and study titles. Eight studies were considered after a detailed screening, in the included studies six of them were considered for a quantitative meta-analysis and all eight were used to perform a qualitative analysis. In total 960 patients were included, with 349 and 611 patients respectively divided into intervention and control groups. No statistically significant results were found in studies assessing pain to back up the combination of physiotherapy and acupuncture, as well in studies assessing range of motion in knee osteoarthritis. When comparing the baseline of physiotherapy combined with acupuncture or physiotherapy alone statistically significant improvements were found within-group. The studies that examined Isometric Neck-Muscle Strength (INMS) expressed noteworthy bettering within groups with Physiotherapy combined with Acupuncture being more viable than Acupuncture or Physiotherapy alone. The Constant Shoulder Assessment (CSA) for shoulder function was altogether superior within the exercise plus acupuncture group compared with the exercise group. Survey (CHAPTER 4) One hundred eighty-one physiotherapists completed the survey, with 35.4% (n=64) from the UAE, while 64.5% (n=117) were from South Africa. Additionally, 78.5% (n=142) of the participants were female, while 21.5% (n=39) were males. The mean (SD) age of the participants was 41.2 (11.9) years, and there was no statistical difference between the two countries (t=0.04, p=0.97). Thirty-five percent had a postgraduate qualification. Sixty-two (34.2%) physiotherapists reported a specialization in acupuncture, with the majority at certificate level. More physiotherapists in the UAE (57%) agreed that acupuncture ought to be included within the undergrad educational curriculum compared to South Africa (44%). Conclusion: There was no noteworthy prove found to back that the addition of acupuncture to physiotherapy treatments includes advantages to pain decrease. This review did, however, observe benefits of including acupuncture together with physiotherapy treatment in the diminishing of neck incapacity, muscle strength and shoulder function. Although physiotherapists are gaining qualification in acupuncture and using in practice, there is not sufficient traction on the inclusion of acupuncture in undergraduate curriculum. Keywords: Acupuncture, Physiotherapy, Manual Therapy, Rehabilitation, Combination, Musculoskeletal conditions. Prospero Registration number: CRD42019122567. Table of Contents Table of Contents.....

and complementary medicines in different illnesses and health conditions. Traditional medicine encompasses beliefs and spiritual practices, western medicine uses evidence-based practices that include changes in lifestyle, different treatment protocols, and pharmacotherapy (WHO, 2013) (WHO, 2021). South Africa and United Arab Emirates (UAE), like other countries, have a pluralistic health system, where traditional medicine is an accepted alternative or complimentary practice ((Siegfried, 2012) (Ghazal, 2017) (MOHAP, 2016) (WHO, 2019)). Interventions can range from, manual techniques or plant- based medicines (Mokgobi, 2014). It is vital to point that traditional medicine is a dynamic and evolving concept due to the various regions, contexts, and cultures from which it is derived. 18 | P a g e The search for "new therapies," referred to as "alternative" or "complementary" biomedicine, has grown among the South African and Emirati patient population (WHO, 2019). Globally patients have pushed this transition to the point where Complementary and Alternative Medicine (CAM) is now the Europe's second fastest expanding business (Garcia-Escamilla, 2017). Experts on new therapies point out that these therapies, including acupuncture, are derived from traditional complex organ systems, the so- called Zang-Fu, and have their rationality, embedded in knowledge from centuries of experiences ((Greten, 2017) (Porkert, 1996)). Acupuncture has become more popular among physiotherapists in recent years ((Dascanio, 2018) (Dascanio, 2015) (Garcia-Escamilla, 2017)). The increased studies of physiotherapists show this, with some benefits being reported of acupuncture in treating a range of medical conditions, particularly musculoskeletal conditions, which is a crucial area of intervention in physiotherapy ((Dascanio, 2018) (Lovesey, 2001) (Kerr, 2001)). Similarly, the inclusion of acupuncture to physiotherapy treatment has shown a significant and rapid reduction of pain with minimal side effects ((Dascanio, 2018) (Kerr, 2001)). South Africa has become one of the first countries to legitimate Chinese Medicine in 2001, recognizing its potential value to the medical system (Huaxia, 2019). In 2019 the Confucius Institute for Chinese Medicine (CICM) was established in South Africa in partnership with the University of Western Cape, with the aim to promote Chinese culture and to study the integration of traditional and modern Chinese Medicine science (Huaxia, 2019). In UAE it was not found any report of any college or University offering Traditional Chinese Medicine. Many universities are offering courses in complementary and alternative medicine/therapies (CAM) globally. In the US, 57 medical schools primarily taught acupuncture (73%) as a topic (Brokaw, 2002). A Korean study recommended a more heterogenous and consistent educational approach to teaching effectively respond to patients who demand CAM by medical practitioners (Kim, 2012). There is, however, the continued debate around the inclusion of non-scientific evidence-based interventions in medical curricular. PEDAGOGICAL DISSONANCE Dissonance Theory refers to psychological tension that can occur as a result of inconsistencies within one`s cognition. In the context of physiotherapy cognition would refer to the knowledge construction within the discipline (Bradburry, 2018). A few decades ago, teaching Acupuncture in university health education in the Western world was practically unimaginable. Currently, in addition to the growing presence of these contents in different courses, there are records of experiences of an integrated nature in which these medicines and practices are inserted throughout the curricula, in order to reduce borders in health care ((Maizes, 2002) (Wetzel M. , 2003) (CAHCIM, 2004) (Taylor, 2011) (Schiff, 2012) (Haramati, 2013) (Wiles, 2013)). The Consortium of Academic Health Centers for Integrative Medicine (CACHIM, 2004) supported Integrative Medicine, through the Implementation Guide for Curriculum in Integrative Medicine, where it defends its importance as a practice and its relationship between professional and service, "focuses the person as a whole makes use of scientific evidence and uses, appropriately, all therapeutic approaches and treatments" (Otani, 2011, pg.49). CAHCIM's (2004) proposal includes healthcare innovation through new clinical frameworks and educational programs capable of integrating "biomedicine, the complexity of the human being, the intrinsic nature of care and the rich diversity of therapeutic systems" (Kligler et al., 2004, pg.523), and emphasizes communication skills, the doctor-user relationship, and the comprehensive approach. The integration of teaching of Acupuncture in health education requires administrative and institutional support for their inclusion in already formatted curricula, with the involvement of teachers, students, and users in this process, use of local resources and respect for laws and cultural values and symbols (Barros, 2011). Thus, it is possible to minimize resistance of ideological, corporate, or epistemological content, which must be identified, debated, and understood ((Broom, 2013) (Teixeira, 2013) (Tesser, 2008)). RATIONALE The literature reviewed so far has shown sufficient evidence for the use of acupuncture by physiotherapists ((Dascanio V, 2015) (Hay, 2004) (Kerr, 2001)). There are references to the teaching of 20 | P a g e complementary and alternative Medicines, such as acupuncture, in undergraduate and postgraduate Medical and Physiotherapy curriculums in the USA, Canada, Mexico, United Kingdom, Germany, Taiwan, Japan, Brazil and Korea ((Broom, 2013) (CAHCIM, 2004) (Teixeira, 2013)). The initiatives of the National Center for Complementary and Alternative Medicine (NCCAM-NIH) in the United States and the National Health System (NHS) in the United Kingdom, in order to meet population demand, in investing in the training of professionals with complementary and alternative medicine education projects in the training (Lee, 2007) (Pearson, 2007) (McDonough, 2013) (Lipman, 2003) (Hehir, 2012)) are worth mentioning. However, there is still a gap in the perceived importance of including acupuncture in the physiotherapy curriculum. Building upon these questions and supported by increased interest from professionals in Acupuncture ((Dascanio, 2015) (Dascanio, 2018) (Garcia-Escamilla, 2017)) and the scarcity of information about their attitudes, beliefs, and practices, this research aimed to explore these concepts among physiotherapists in the UAE and South Africa ((Carnevale, 2017) (Bodevan, 2004) (Khamis N, 2015)). RESEARCH AIM The study's goals were to 1) investigate the evidence of physiotherapists combining physiotherapy and acupuncture treatments, 2) describe the profile of physiotherapists who use acupuncture in their

practice, and 3) describe physiotherapists' attitudes toward its inclusion in the undergraduate curriculum. RESEARCH QUESTIONS Phase 1: (I) In patients with musculoskeletal disorders, how helpful is physiotherapy paired with acupuncture? Phase 2: (I) How many certified physiotherapists in each region utilize acupuncture as a supplement to their physiotherapy treatment? (II) What is the level of Specialization of physiotherapists who use Acupuncture in their practice? (III) In which conditions do these physiotherapists most commonly use acupuncture in their treatment? (IV) Explore the perception of physiotherapy professionals on the inclusion of an elective course in undergraduate physiotherapy curriculum. (V) Explore the opinion of physiotherapists whether they would recommend including Acupuncture as an elective course in undergraduate Physiotherapy curriculum. 21 | P a g e The specific research objectives for this study are to: 1. Determine the evidence for the use of adjunct Acupuncture in Physiotherapy treatment for musculoskeletal conditions by conducting a systematic review 2. Determine the number of physiotherapists trained in Acupuncture in the different regions 3. Identify the level of specialization in Acupuncture that is more common among physiotherapists in the determined regions using a questionnaire 4. Analyse the opinion of physiotherapists regarding the inclusion of Acupuncture in the Physiotherapy Curriculum using a questionnaire 5. Using a questionnaire to determine the frequency with which physiotherapists employ acupuncture as a therapy technique 6. Determine the most common problems that physiotherapists treat with acupuncture, either as a stand-alone treatment or as an adjunct to physiotherapy. THESIS OUTLINE The structure of the thesis will address the specific objectives outlined above. Chapter 1- Introduction and Background to the study Chapter 2- A literature review will provide a conceptual understanding of the two disciplines being explored. It will further provide background for the use of acupuncture in physiotherapy practice and explore the introduction of curriculum Chapter 3- The methods and findings of a systematic review done to offer evidence on the effectiveness of acupuncture and physiotherapy in the treatment of musculoskeletal problems are included. Chapter 4- Describes the methodology and results of a survey undertaken to explore the demographic profile of physiotherapists using acupuncture and the perceived view of its inclusion in undergraduate curriculum. Chapter 5- Will provide a general discussion and conclusion CHAPTER 2: LITERATURE REVIEW This narrative literature review will describe both physiotherapy and acupuncture, explore the curriculum in both disciplines, and provide examples of how acupuncture has been included in biomedical disciplines. Literature was sourced from different databases, such as the indexed libraries of scientific articles, SCIELO, MEDLINE, PUBMED, LILACS, COCHRANE, and textbooks. Search terms included "physiotherapy", "acupuncture" and "curriculum", combining with operators "AND" and "OR". For this particular review, articles that can be accessed freely and published in English, Spanish and Portuguese were reviewed. The intention for this literature review was to include publications as wide as possible, as acupuncture is not a new therapy, hence no limitation was placed during the search on the database. However, the relevant publication for this review was available only from 1980. So, all relevant articles from 1980 to 2021 were included in this review. Physiotherapy From an etymological standpoint, the concept of physiotherapy is derived from the Greek Physis, which means nature, and therapeia, which means treatment. It covers the entire scope of the term "therapy," that incorporates the use physical agents, exercises, hands-on therapy, or advice (WHO, 2005). However, the evolutionary development of this discipline, guided by society and science, has caused fundamental mismatches between the current meaning of the term Physiotherapy and its etymological root (WHO, 2005). Just as the name suggests, physiotherapy involves treating ailments using physical approaches such as exercises, massage, or heat treatment rather than using conventional drugs and surgery (World Physiotherapy, 2021). According to Setchell et al (2017), physiotherapy treatment is tailored to help individuals and the general population restore, maintain, develop, and optimize their health. Generally, Setchell et al (2017) contended, physiotherapy as a mode of treatment encompasses a holistic approach whereby the persons involved in the treatment process actively participate. Through the promotion of physical activities, prevention, hands-on-treatment, and rehabilitation, physiotherapy attempts to restore the emotional, physical, psychological, and social well-being of everyone involved (Wahl, 2018). It's important to note that besides physiotherapy being a science that is built with a person- 26 | P a g e centered care approach, based in evidence and protocol interventions, this is not always in accordance with clinical guidelines, as despite the use of therapeutic exercises being backed by scientific proof, the use of electrotherapy, in general, is not recommended by current guidelines (McAlindon, 2014). Therefore, there is still room for techniques which are found clinically useful but not evidence or protocol based, such as more alternative interventions if found to be clinically relevant and/or fit in with person centered care, it is paramount that, in addition to consuming scientific research, physiotherapists look for techniques that help to treat their patients' problems and illnesses although not being based on evidence. In this context, it is reflected that Physiotherapy has been adapted to social needs, evolving from a purely therapeutic end to participating in health promotion, i.e., it not only deals with people with established health problems, but also ensures that they "stay healthy." In short, it is understood that Physiotherapy is "... the profession that helps, avoiding, modifying, correcting, or adapting the factors that limit the good functioning or behavior of people, using both physical means and instruments, to facilitate the highest degree of independence and self- sufficiency" (WCPT, 1999). SCOPE OF PRACTICE The application of physiotherapy in the medical sector is vast. For instance, physiotherapy is used to alleviate and treat the conditions related to problems with the bones, soft tissues, joints, and the nervous system, including problems with movement due to the problem with the nervous system. Physiotherapy is also used to treat heart conditions and lungs to hasten recovery, especially after a heart attack or in the event of Chronic Obstructive Pulmonary Disease (COPD). Grammatopoulou et al. (2017) in a cross-sectional

study, established that physiotherapists were important in helping Intensive Care Unit (ICU) patients with motion exercises. In a different study, Hall et al. (2021) investigated the scope of practice when physiotherapists are incorporated in the care for adults with cystic fibrosis. In a cross- sectional study that included 1058 participants, Hall et al. (2021) found physiotherapists effective in respiratory and exercise treatments assigned to patients. The scope of physiotherapy practice differs by country, it incorporates the competency and effective application of physiotherapy skills (Kirsch, 2018). In the United states, the scope of physiotherapy practice is anchored in three pillars: personal; professional and legal. The legal practice of physiotherapy is governed by what is permitted by law such as the rules that guide the use of physiotherapy treatment (Kirsch, 2018). Professionally, physiotherapy practice is anchored on the available educational system and emerging frameworks guiding its application. Under personal scope, physiotherapy practice is dependent on the ability of a physiotherapist to perform their duties effectively and competently (Kirsch, 2018). In the United Arab Emirates (UAE), the Scope of Practice for Physiotherapy as announced by the Emirates Physiotherapy Society, states that: "Physiotherapists with relevant continuing education may provide: Orthopaedic manipulative therapy, Acupuncture/meridian therapy, Intervention for people with high risk and infectious diseases…" (EPS, 2018). Examples of other countries include, for example, Spain where the Associacion Espanola De Fisioterapia Invasiva (AEF-IV - Spanish Association of Invasive Physiotherapy), a subgroup of the Associacion Espanola de Fisioterapia (AEF - Spanish Association of Physiotherapy) states: "However, the incorporation of these techniques (dry needling, percutaneous electrolysis or acupuncture) into the daily clinical practice of the physiotherapist has created several fronts due to the heterogeneity of therapeutic and formative criteria that are too varied. To unify these criteria and increase global recognition by the scientific community, the scientific career of the AEF-INV started on February 13, 2017, becoming an independent subgroup of the Association Fisioterapeuta Espanola (AEF)." (AEFINV, n.d.), which allows us to assume that physiotherapists can work with acupuncture. Due to this scenario, it is important to explore how effective acupuncture treatment will be on musculoskeletal condition when used as an adjunct physiotherapy. Acupuncture In simple definitions, puncturing with needles is acupuncture. The term acupuncture, used in a broader sense, includes body surface needling, heat treatment (moxibustion) applied superficially, electroacupuncture with direct needle stimulation or transcutaneous electrical nerve stimulation (TENS), laser-acupuncture with a superficial application, microsystemic acupuncture with superficial needling (ear, face, hand, and scalp) and acupressure (massage and pressure in selected places) ((Wu, 1996) (Porkert, 1996). Acupuncture is an integral part of a more comprehensive concept, Traditional Chinese Medicine (TCM), in which the treatment of diseases and functional disorders seeks to restore health by promoting balance and functional harmony ((Wu, 1996) (Porkert, 1996). In TCM, the disease is seen as a functional disorder in the human body, and the treatment is directed at regulating and harmonizing the vital dysfunctions in the most acceptable and lasting way. In this way, acupuncture points have to harmonize, calming, facilitating, benefiting, and adjusting the organic functions (Gallego, 2007). In acupuncture, a model of acupuncture on the body's surface is joined by lines, named channels, conduits, or meridians. These systems of lines or channels are in turn connected with the internal organs ((Greten, 2017; Porkert, 1996; Maciocia, 1996). According to TCM, one of the health needs is having the ability to balance the environment and the human body. This balance is in a state of constant adjustment, and thus the normal physiological activities of the body are maintained. If external influences are more significant than the adaptive power of the organism, or if the body is unable to adjust to the conditions of change, equilibrium is lost, hence dysfunctions and diseases develop (Greten, 2017; Maciocia, 1996; Quiroz-Gonzalez, 2017). When external influences are responsible for the induction of diseases, these agents are exogenous pathogenic factors, generating the so-called external or exogenous diseases. In addition to the diseases caused by the exogenous pathogenic factors, there are several diseases determined by emotional and dysfunctional disorders of the internal organs with their clinical manifestations, generating the so-called internal or endogenous diseases ((Greten, 2017) ; Porkert, 1996; Maciocia, 1996). The literature reveals that acupuncture on its own may have the following effects on the body ((Greten, 2017) (Porkert, 1996) (Maciocia, 1996)): A. Analgesia Acupoint can be defined as a sensitive region on the body with the highest concentration of nerve endings; this region is in intimate relation with nerves, blood vessels, tendons, and jointcapsules (Quiroz-Gonzalez, 2017). Morpho functional studies have identified nerve plexuses, vascular elements, and muscle bundles as the most likely receptor sites of acupoints (Quiroz-Gonzalez, 2017). Acupuncture points are areas where there are histologically more significant amounts of nerve receptors such as accessible nerve endings, muscle spindles, Golgi tendon organs, mastocytes, and capillaries, compared to surrounding makes the electrical potential of these areas different when compared to neighboring areas. Consequently, this facilitates the action potential in the local nerve fibers, which drive the stimuli to the central nervous system, mainly through the fibers A-delta and C (Yin, 2018). On the other hand, the analgesic and anesthetic effects of Acupuncture are now conceived from scientific research as a process of excitation that releases endorphins (Mayor, 29 | P a g e 2013) in response to intense and vigorous stimuli on the needle inserted at the acupuncture points. This acts at the level of the A-delta fibers, situated at a more superficial level (Beissner, 2010). Over the years, different studies have been conducted to describe the processes, actions and the neurochemical phenomena that occur during analgesia and anesthesia by acupuncture, which leads to an understanding of the importance of spinal reflexes as important mechanisms of action of this modality of treatment (Quiroz-Gonzalez, 2017). The research from Yin (2018) highlights the physiology of the nerve fibers and reflex arches as one of the actions due to action. According to Quiroz-Gonzalez (2017), the specific points selected for the treatment of a particular disease are found in the innervated somatic tissue of the same spinal

segments that supply the visceral organism related to the cause of the disease. B. Protection against infections Although acupuncture seems to benefit modulation of the immune system, there are still several gaps in knowledge. For instance, the information available on acupuncture and its significance in treatment is scarce both electronically and in hard copy. The unavailability of empirical literature on acupuncture has limited its overall use in clinical treatments as medical practitioners and clinicians cannot fully ascertain or conclusively comment on its effectiveness. Overall, Li (2013) and Kou (2005) without certainty tried to explain how acupuncture could be used to restore the circulation of blood. According to the scholars, acupuncture excites the autonomic nervous system that activate or restore the normal circulation of blood. Recently, the effect of acupuncture on the populations of leukocytes and lymphocytes in human peripheral blood has been demonstrated ((Li, 2013; Kou, 2005) Acupuncture is associated with several immunological alterations. As an example, Kou (2005), Takashi (2009) and Pavao (2010) described that acupuncture modulated the activities of lymphocytes, natural killer cells, macrophages and neutrophils critical in the body' overall immunity. It has been demonstrated that the stimulation of specific points results in both immunological and functional changes at the cellular level that are significant, such as the alteration of the lymphocyte numbers (Pavao, 2010). C. Regulation of various physiological functions Ferreira (2010) and White (2008) defined psychological response as the use of acupuncture to activate the automated self-regulation mechanisms of the immune and 30 | P a g e endocrine systems. Stimulating and activating the immune and the endocrine systems is achieved by stimulating the systems at four levels: supraspinal or supra-segmental level, local level, segmental level and extra-segmental or spinal level ((Ferreira, 2010) (Duarte, 2011). - Segmental or medullary action: key to understanding segmental action and effect of acupuncture can best be described by the theory of portal control suggested by Melzack and Wall. According to Melzack and Will, compared to the unmyelinated sensory nerves, the myelinated and high velocity fiber transmits its information to the central nervous system much faster when the activation occurs around an injured area rather than an area experiencing local pain. Critical to note is that the myelinated fibers tend to block the nerve impulses transmitted via the unmyelinated C fibers when the stimuli reaches the posterior horn of the spinal cord by releasing enkephalins and Gamma-Aminobutyric Acid (GABA), inhibitory neurotransmitters ((Ferreira, 2010) (Cheng, 2014)). The various organ tissues of our body may have the same innervation. To obtain an effect, the needles are placed at the same innervations on the root nerve as in the affected site, of the posterior horn of the spinal cord similar to the level of the stimulated medullary segment ((Ferreira, 2010) (Zhou W. L., 2010)). - Extra-segmental or spinal action: According to Ferreira (2010) and Cheng (2014), it is not clear how extra-segmental spinal action works since it can only be explained by the strength of stimulus rather than the location of the stimulus. The extra-segmental action is controlled by the periaqueductal matter of the brain by suppressing the activities of nerve cells located in the descending region of the posterior horn of the spinal cord. - Supra-spinal or central action: The activation and stimulation of the Supra-spinal level occurs at the cerebral cortex of the brain, which is related to the spinal cord by the descending inhibitory bundles, as opposed to the other levels of acupuncture stimulation, which occur at the posterior horn of the spinal cord. The thalamus and the reticular system process the impulses created by acupuncture therapy before distributing them to the cerebellum, the somatosensory cortex, the prefrontal cortex, and the limbic system. The responses by each of the system will depend by the intensity of the stimuli. Overall, the actions of supra-spinal action is observed by its control of the periaqueductal grey matter in the brainstem and suppressing the activities of the nerve cells located the brainstem (Duarte Ferreira, 2010).). According to Mayor (2013) the supraspinal impacts or outcomes of acupuncture can be improved by electrostimulation. - Local Action: Acupuncture stimulates sensitive peripheral neurological receptors, namely 31 | P a g e free nerve endings, composed predominantly of A delta fibres in the skin, and in the muscle of type II and III fibres, which forms a network responsible for the propagation of nerve stimulation to blood vessels and local immune cells ((Li, 2013) (Ferreira, 2010)). According to Ferreira (2010), the axonal reflex will induce an increase in local blood supply due to the release of several vasoactive substances such as substance P, bradykinins, Calcitonin gene- related peptide (CGRP) (polypeptide related to the colcitonin gene), vasoactive intestinal peptide (VIP), Histamine, Serotonin, neural growth factor (NGF), vascular growth factor (VGF), etc. These substances are responsible for some of the effects observed at the time of puncture, namely heat and redness around the needle, paraesthesia, pruritus, or a sensation of heaviness or grinding – these act as promoters of healing either by vasodilation or by neurogenesis of blood vessels ((Quiroz-Gonzalez, 2017) (Ferreira, 2010)). In addition to the local effects as described, there is also the release of biochemical analgesic substances such as β endorphin in large quantities, thus blocking nociception ((Ferreira, 2010) (Taffarel, 2009)). These substances are released by the local inflammatory cells (granulocytes), demonstrating a type of activation of the immune system by Acupuncture. Physiotherapy and Acupuncture Pain can present clinically in different ways and associated with multiple symptoms and as such examining the pain from different angles including from the central and the peripheral angles coupled with the manifested clinical symptoms would help alleviate the pain much easier((Gifford, 1997; Kumar, 2011.) The understanding and identification of these mechanisms help in clinical judgment and reasoning when clinicians and other medical practitioners diagnose and assesses the kind of pain experienced by the patient ((Nijs, 2009) (Smart, 2006)). The choice of treatment plan and pain alleviation technique, the physiotherapist must have scientific and practical knowledge of the technique they are to perform given that each available technique is unique and contains a neurophysiological description of how it works (Smart, 2006). To determine the most effective therapeutic and physiotherapy technique, Smart (2006) suggested that thorough background search on the application and use of technique to alleviate pain. With intense

stimulation in the medullary laminae of the posterior horn interneurons are stimulated to inhibit the feelings of pain. The action displayed by interneurons can be explained by 32 | P a g e the gate control of pain that the competition between the stimuli and noxious describe the mechanism of actions of interneurons. A more analysis of this stimulation yields that the arrival of the stimuli at the posterior horn of the spinal cord and taking into account the speed and intensity of the stimuli, it is arguable that the activations of interneurons stimulate the release of GABA and opioid substances (Nijis, 2009; Smart, 2006). Aside from acupuncture, the gate control theory also guides other pain-relieving methods such as manual therapy, myofascial release, transcutaneous electrical nerve stimulation and cold spray ((Curatolo, 2006) (Galeotti, 2002)). The regulation of the different physiological functions and processes can be used to explain the role of analgesia in protecting the body against infections. On the therapeutic effects of acupuncture, Kerr (2001) assumed that the actions were regulated by the actions of several organ systems described as being non-specific although with significant applications in addressing different functional disorders as explained by Kerr (2009) and Zhuo (1982). Thus, considering the broad acupuncture approach, it is possible to assume that physiotherapy treatment supplemented with acupuncture could be beneficial. In as early as 1982, good results in a range of conditions treated using acupuncture to complement physiotherapy treatment was reported (Duffin, 1982). Conditions treated included asthma, knee osteoarthritis, non-specific hip pain, post-patellectomy pain, scar pain, adhesive capsulitis, and eczema. Acupuncture was used to complement whenever conventional physiotherapy failed to provide effectiveness or if a plateau of improvement was achieved. Patients reported mainly a decrease in pain outcomes and improvements infunction (Duffin, 1982). Acupuncture has been widely used in physiotherapy for pain relief (Kerr, 2001). Acupuncture' analgesic effects have been area of research since the 1970s, revealing a positive relationship between stimulation of acupoints and improvement of function (Wen, 1995). According to Lovesey et al. (2001), physiotherapeutic modalities, such as Transcutaneous Electrical Neurostimulation (TENS), Ultrasounds (US), Cryotherapy, Extracorporeal Shockwave Therapy (ESWT) can decrease inflammation and increase local healing (Gosling, 2012), while acupuncture is administered to increase Qi (Vital Energy) in the meridian and the related organ or for local analgesia (Greten, 2017). In the United Kingdom (UK), the use of acupuncture to supplement the professional skills of physiotherapists has been applied since the early 1980s and accepted as a standard modality to be used as part of the physiotherapeutic treatment (Lovesey, 2001). When speaking about acupuncture and Physiotherapy, it is essential to also distinguish between 33|Page acupuncture and dry needling. Dry needling is a technique that may be used to treat a number of ailments, including muscular soreness, trigger points, spasms, and other muscle issues ((Cagnie, 2013) (Kalichman, 2010)). Acupuncture is governed by TCM doctrines and works with meridian lines. As such, the needles must be inserted into specific acupuncture points that refer to different regions and organs of the body. On the other hand, during dry needling, the needles are inserted into points of muscular activation ((Dommerholt, 2013) (Zhou, 2015)). Dry needling is a technique that may be used to treat a wide range of issues, including muscular soreness, trigger points, spasms, and other muscle issues ((Dommerholt, 2013)(Zhou, 2015)). The effects of acupuncture compared to those of dry needling are that acupuncturists believe acupuncture points stimulate the nervous system. Gattie et al. (2017) claim that activating the central nervous system sends chemicals into the muscles, spinal cord, and brain, promoting the body's natural healing process. The outcome of these natural substances stimulated at acupuncture points enhances the emotional and physical wellbeing of those under treatment (Rose, 2018). Physiotherapy Curriculum The actual contents of an average Physiotherapy Course, according to the guidelines of WCPT, are related to the whole process of individual, community and family health-disease process. The epidemiological, social, and professional training reality provides the necessary care actions associated with Physiotherapy (WCPT, 2003). The basis of these is in learning experiences in the biological, physical sciences, and clinical sciences. The curricular organization of the Physiotherapy course has an articulated and facilitating vision among the components and curricular activities with a technical, humanized, and resolute concern in the development of the professional (WCPT, 2003). The Physiotherapy departments actively participate in constructing knowledge, supporting the biotechnological, psychosocial, and specific physiotherapist training (WCPT, 2003). The Physiotherapy departments around the globe, following the WCPT Curriculum Guidelines, are constantly building and reshaping their content, when necessary, to meet the needs that may arise within their training and health contexts (WCPT, 2003). The course on Physiotherapy according to the WCPT Curriculum Guidelines, has to include the 34 | P a g e following aspects (WCPT, 2003): ? Biological and Physical Sciences ? Social/Behavioural/Technological Sciences ? Clinical Sciences ? Biodynamics of Human Motricity ? Health, Training, and Society The curriculum should also include characteristics that are inherent to practice as a professional physiotherapist (WCPT, 2003): ? Patient/Client Care/Management through: ? Communication ? Consultation/Screening ? Critical analysis/clinical reasoning/clinical decision making ? Education ? Management/Administration/Supervision ? Research ? Accountability ? Altruism ? Compassion/Caring ? Cultural Competence ? Ethical Behaviour ? Integrity ? Personal/Professional development ? Professional duty ? Social responsibility and advocacy 35 | P a g e ? Teamwork When exploring the physiotherapy scope of practice in South Africa (SA) and United Arab Emirates (UAE) countries it was noticeable that there is no reference to acupuncture in the physiotherapy scope of practice. However, the WCPT website refers to a subgroup, the "International Acupuncture Association of Physical Therapists," founded in 1991, which became a member of WCPT in 1999. Physiotherapists originally formed this subgroup from 5 countries - Australia, South Africa (represented by the South African Society of Physiotherapy Acupuncture in Physiotherapy Group), New Zealand, Sweden, and the United Kingdom. With these professionals practicing acupuncture

since the 1980s, members from other countries - Hong Kong, Ireland, Greece, Macau, Canada, Denmark, Cyprus, and Argentina-have since joined the subgroup and individual members (WCPT, n.d.). Acupuncture Curriculum The WHO Guidelines on Basic Education and Safety in Acupuncture stated that "high-quality training should be attained to acquire a profile of clinical competence for the autonomous practice of acupuncture" (WHO, 1999). For instance, the education system should first and foremost promote a culture of self-reflection in addition to being tailored to meet specific students' needs. Additionally, the education system or curriculum should be designed in such a way that it promotes lifelong and continuous learning besides striving to integrate principles of acupuncture training and practice with the basic and clinical skills (WHO, 1999). It is intended that students acquire professional skills in primary care and in specific intervention areas of the different medical specialties, with a view to their future professional practice (WHO, 1999). EXISTING RESEARCH ON ACUPUNCTURE INCLUSION IN PHYSIOTHERAPY CURRICULUM Acupuncture, which is a subsection of the broader area of TCM, had been adopted in some educational institutions in the Western World ((Carnevale, 2017) (Bodevan, 2004) (Brokaw, 2002) (Kim, 2012) (Bodevan, 2004) (Machado, 2012)). However, the level of acceptance of such complementary or alternative medicine is still uncommon in Western colleges and universities. Despite the scarcity of literature on the inclusion of Acupuncture in the physiotherapy curriculum, existing studies show that western colleges are becoming more interested in adopting the acupuncture curriculum. Carnevale et al. (2017) and Bodevan & Sant'Ana (2004) reported that despite Western colleges' adoption of acupuncture courses, most colleges and universities have opted to provide acupuncture courses separately to interested students rather than including them in the standard curriculum. In a study conducted in Brazil, the Higher Education Institutions (HEIs) of the State of Paraná that currently offer the undergraduate course in Physiotherapy were surveyed, a questionnaire on the subject was sent to 24 Institutions , 50% return was received. It was note that none of the undergraduate courses have a specific discipline for this theme and, when this is addressed, it is inserted in other disciplines of the undergraduate curriculum (75%), the other 25% do not allocate any workload to teaching this theme. As for the opinion of course coordinators regarding the insertion of Acupuncture in the curriculum, they found that 58.3% of them considered this insertion necessary. When it was asked about the existence of physiotherapists specializing in acupuncture in the institution's faculty, we obtained the answer that in 91.6% of the courses that responded, they have at least one acupuncturist physiotherapist, it was also reported that most students believed that acupuncture was a critical adjunct therapy that should be included in the standard physiotherapy curriculum (Bodevan, 2004). Additionally, the study reported that acupuncture teaching in the Brazilian institution was only given to fourth- and fifth-year students and was not mandatory (Bodevan, 2004). In another study conducted in Brazil, it was reported that acupuncture received a positive response in Brazil where legislation was passed by the Brazilian government in 1988, legalizing the use of acupuncture in standard physiotherapy practice (Carnevale, 2017). Since then, the passage of the legislation, acupuncture in medical practice has improved significantly ((Bodevan, 2004) (Machado, 2012)). A proliferation in the use of acupuncture in physiotherapy practice has also compelled most physiotherapy colleges and institutions to include it in physiotherapy training (Carnevale, 2017). Brazil has approved a standard training program for acupuncture in physiotherapy, which takes approximately two years or 5760 training hours (Bodevan, 2004). One of the essential requirements for training learners on acupuncture is possessing profound knowledge and experience in both traditional medicine and Western medicine. This is a model can be implemented in other countries, the UAE do not currently have any such mode of training. However, SA has a professional qualification in Chinese medicine as an exclusive course (Huaxia, 2019) but is not integrated into physiotherapy curriculum nor recognized by the physiotherapy council. In the UK, acupuncturists also made some efforts to lobby for the legalization of acupuncture and subsequent development of standards of practice for acupuncture. However, the acupuncturists faced significant backlash from the science community as most skeptics believe traditional or alternative medicine is not scientifically plausible (Dascanio, 2015). In brief, the inclusion of acupuncture in the standard physiotherapy curriculum has not had much traction even in countries where it has been legalized, such as Brazil ((Carnevale, 2017) (Dascanio, 2018) (Bodevan, 2004)). In Brazil, for instance, acupuncture is offered as a separate elective course to physiotherapy students (Carnevale, 2017) (Bodevan, 2004). There is also a paucity of research on acupuncture's inclusion in conventional physiotherapy curriculum. Noteworthy, when examining the acupuncture curriculum, the World Health Organization (WHO) in 1999 suggested that individuals interested in acupuncture practice needed to receive high-quality training to enhance competence and autonomy in acupuncture practice. Additionally, in the same report, the WHO noted that acupuncture training and education should be student-centered in colleges and universities focused on imparting the most relevant and up-to-date skills on acupuncture research, learning, teaching, and overall student reflection, knowledge, and skills. Following the success of a combination of physiotherapy and acupuncture in relieving pain as illustrated in literature ((Lovesey, 2001) (Kerr, 2001)) , Lovesey et al. (2001) and Kerr et al. (2001) concluded that physiotherapists thought that acupuncture should be incorporated early in professional training of physiotherapists. In another study, Anderson et al. (2020) studied how an evidenced based Chinese medicine program could be developed and integrated into the overall existing learning programs. According to Anderson et al. (2020), developing and integrating evidence-based practice in Chinese medicine is a critical step in basing a vital biomedical education and practice among medical practitioners. The foundational principles of evidence-based practice and training are anchored on facilitating critical thinking in enhancing scientific evidence, understanding patients' preferences, and improving the clinical experience. The results by Anderson et al. (2020) reiterated

student's positive perception of the inclusion of acupuncture or evidence-based practice in medical practice. A similar conclusion was reached by Chen (2019), who established that effective treatment of acute ischemic stroke and other medical conditions required an in-depth and extensive use of the evidence-based practice. Even though Chen (2019) reported contradicting results on the acceptance and use of acupuncture in treating acute ischemic stroke, they demonstrated the effectiveness of acupuncture treatment in improving neurological deficits, cognitive impairment, and swallowing disorder. Similar to Anderson et al. (2020), Chen (2019) concluded that introducing acupuncture courses in the physiotherapy curriculum would see improved biomedical training and education and the use of critical thinking skills when attending to patients. In the United States, the history of acupuncture is almost 50 years old (Chen, 2019). Examining Chinese medical history, Chen (2019) contended that acupuncture had been used for over three thousand years. In the United States, the rapid acceptance and use of acupuncture have seen the practice act passed by 47 states and the District of Columbia. In recent data, Chen (2019) reported more than 37000 licensed acupuncturists in the United States. Examining medical education in the United States, Chen (2019) reported that many medical students were highly interested in learning and applying acupuncture in their medical practice. Chen (2019) contended that legislation regulating the application of acupuncture had attracted high enrolments. For instance, a relative number of students have enrolled in Oriental medicine programs that include acupuncture and Chinese herbal education. Despite the significance of acupuncture education in American medical training, Chen (2019) established that the majority of acupuncture training schools were low in resources. Additionally, the acupuncture curricula in the United States lacked the basic practical biomedical, clinical training but instead focused on theoretically training acupuncture. Inadequate infrastructure for acupuncture training results in half-baked acupuncturists with limited practical acupuncture experience. The continued acceptance and adoption of acupuncture in university and college curriculum indicates its significance in patient treatment. For instance, Anderson et al. (2020) found acupuncture to effectively alleviate pain from patient's findings that were supported by Chen (2019) . In addition to alleviating the effects of acute ischemic stroke, Chen (2019) found acupuncture to improve neurological deficit and cognitive impairment. The positive outcome of acupuncture has been supported by increased positive perception and interest among students wishing to specialize in acupuncture (Chen, 2019) (Qu, 2021). CHAPTER 3: SYSTEMATIC REVIEW Introduction Guyatt (2008) and Higgins (2019) classified the review of literature as an important step toward the development of scientific and academic work. At its core, review of literature helps the academic and scientific field in that it limits the reproduction or duplication of an existing research, allows scholars and researchers to identify gaps and limitations in existing research that form the base for more empirical research (Higgins, 2019). In addition to the above, conducting a literature review also helps in supporting the existence of a particular scientific problem, propose themes guiding the scientific analysis of the problem in addition to making the consolidated study material available in community and academic libraries for learning purposes and as a subsidy to science ((Higgins, 2019) (Higgins, 2011)). It is not by chance that articles that present literature reviews are usually among the most sought after by readers of scientific publications (Baek, 2018). This systematic review has the main goal to serve as a base for a wider study, with an objective to pursue an PhD to study the possibility of the implementation of acupuncture course in undergraduate curriculum in physiotherapy, and also with the goal to develop such curriculum, the first step required, is to understand what the existing literature, mainly randomized control trials (RCT) have to say, in order to 40 | P a g e be able understand the effectiveness of combining Physiotherapy with Acupuncture. Musculoskeletal was the condition chosen, because it is one of the most frequently treated conditions with acupuncture ((Hopton, 2012) (White, 2009)). Methodology STUDY DESIGN According to the Cochrane Foundation, a systematic review performs comprehensive and non- biased literature summaries, i.e., following an explicit method and selection criteria (Higgins, 2011). The researcher does not collect primary data in the current study rather analyses previously conducted research studies (Higgins, 2011). According to Bastian et al. (2010), in the field of health sciences, roughly 75 randomized control trials and 11 systematic reviews are published per day. Thus, reliable, and accurate revision of available evidence is essential and crucial for decision-making by researchers and practitioners in the performance of their work (Higgins, 2011). Due to this constant need to update available scientific knowledge, systematic reviews are increasingly valued by the scientific community (Moher, 2009). The quality of systematic review, according to Moher et al. (2009), is not restricted to the end output, but must be ensured throughout the review process. Because this study attempted to combine the data of existing properly conducted studies (controlled trials) addressing the efficacy of acupuncture treatment, a systematic review was employed. Additionally, a systematic review of literature will present an opportunity for the scholar to highlight or at glance tell the effectiveness of acupuncture in treatment based on previous findings. Moreover, the results of the systematic review may be used by the scholar to support the existence of the problem and also help in the drafting of recommendations for practice or future research. AIMS AND OBJECTIVES Given the above, the main objective of this systematic review is to synthesize the current body of knowledge in rehabilitation science in which Physiotherapy is used in combination with Acupuncture treatments. 41 | P a g e Specific Objectives: (I) Identify the level of Specialization in Acupuncture that is more common among physiotherapists. (II) Analyze the opinion of physiotherapists regarding the inclusion of Acupuncture in the Curriculum of Physiotherapy. (III) Determine the frequency with which physiotherapists employ acupuncture as a therapy method (IV) Identify the most prevalent conditions that are treated with acupuncture as a stand- alone intervention or as a supplement to physiotherapy treatment (V) Identify the most prevalent conditions treated using Acupuncture as a stand-alone intervention or as a supplement to

physiotherapy treatment. A systematic review of randomized controlled trials was conducted to assess the efficacy and efficiency of acupuncture treatment as an adjunct to physiotherapy in the treatment of musculoskeletal conditions using existing literature, with the sole goal of improving the quality of life of those involved. The review also reviews the cross-sectional studies that seek to identify the variance between the application of the two interventions and the respective impact on the health outcomes. INCLUSION AND EXCLUSION CRITERIA The review only included studies published in the English language to enable an accurate review. Only studies published during the last decade that looked at adult populations with musculoskeletal (MSK) disorders were included in the review. Studies published in non-English languages, focusing on a pediatric population, studies that included non-cross-sectional design or non-randomized study were not included in the systematic review. Furthermore, the scholar omitted any material that compared or contrasted different types of acupuncture. In addition, animal research was left out of the systematic review. OUTCOME MEASURES The primary outcome of this particular systematic research review is to examine the efficacy of acupuncture in the treating and managing MSK while being used as an adjunct therapy. Specifically, the study reviews how well acupuncture alleviates pain and facilitates the acquisition of range of movements (ROM). In addition to pain and ROM as primary outcome measures, secondary outcome measures that the researcher will also seek to address in the current systematic review include the quality of life, 42 | P a g e functional outcomes, and strength of acupuncture. The secondary outcome measures will be examined using a valid questionnaire developed by the researcher. DATA SOURCES The data used to accomplish the current systematic review included previous randomized control study cross-sectional studies. The randomized controlled studies/literature were obtained from search databases and engines including in the PubMed, Cochrane Library, and PEDro were scoured for literature. In essence, to maximize on the search, , keywords combined by Boolean operators AND and OR. The following keywords were used: Acupuncture, Physiotherapy, Physical Therapy, Manual Therapy, Rehabilitation, Neuromuscular disorders, Musculoskeletal (MSK) conditions (Attachment 1). STUDY SELECTION After completing the search for material in the identified databases, , independent reviewers (two) will be selected to give their expert opinion on whether the studies can be used to successfully respond to both the primary and secondary outcomes. Upon approval, the researcher will embark on other important areas of research. However, in the case where the experts rise question concerning the ability the research study to meet the outcomes, the researcher will be forced to re-examine and find a study that will help meet both primary and secondary study outcomes. DATA EXTRACTION The data contained in the reviewed systematic studies will be extracted by the two reviewers responsible for implementing the study selection (Attachment 2). An extraction table was developed to guide the data extraction to ensure that the relevant data has been included for the systematic review (Attachment 3). The following information was extracted: publication details, study design, sampling, participants, inclusion and exclusion criteria, intervention or treatment criteria, control and intervention group, the findings, and implication of the research. ASSESSMENT OF RISK OF BIAS OF INCLUDED STUDIES PEDro Quality Scale assess the authenticity and the validity of the findings of the studies included in the systematic research review, also known as risk of bias, through a number of questions (Shiwa, 2011). Several aspects of the studies are used in quality assessment criteria. The PEDro Quality Scale was created to aid PEDro database users in assessing the methodological quality of RCTs (internal validity, criteria 2– 9), as well as the statistical description (if the research has a minimum of statistical information to allow the findings to be interpreted) (criteria 10 and 11) (Shiwa, 2011). The external validity of the study (criterion 1), generalization of results, or magnitude of treatment effect (i.e., whether the results are clinically relevant or not) are not included in the numerical analysis of the PEDro Quality Scale (Shiwa, 2011). Besides the risks of bias, the quality scale also allowed the measurement of quality outcomes. Assessing the risks of bias, the researcher used two independent reviewers to assess and identify cases of bias that might impact and lower the quality of the identified outcomes. The identified reviewers will ensure there is a consensus between the reviewers and any disagreement is addressed by the introduction of a third party. MEASURING RISK AND BIAS The following eleven criteria were used in the evaluation of the quality of each study: 1. Eligibility criteria were specified: no/yes When the report indicates the source of the participants and the list of criteria used to identify who was qualifies to participate in the study, this criterion (criterion 1) can be regarded met (Pedro.org, 1999). For the final score, this criterion is not considered (Schulz, 1995), since it does not evaluate internal validity or statistical validity of the study, but with external validity (Nedel, 2016). 2. Participants were arbitrarily grouped and assigned an order based on how treatments were administered): no/yes If the report states that the subject distribution was random, it is assumed that there was random allocation in the research (Pedro.org, 1999), however, the method of randomness does not need to be explicitly described (Schulz, 1995). Procedures such as utilizing a random number generator (i.e., computers, random number tables.) or coin tossing should be considered random distribution. The condition is not met by quasi-random distribution approaches such as allocation by hospital record number or birth date, or alternation (Pedro.org, 1999). Randomization guarantees that treatment and control groups are similar within the restrictions imposed by chance (Pedro.org, 1999). 3. Allocation was concealed: no/yes Blind/concealed distribution implies that who was responsible to establish the subject's eligibility to participate in the clinical study was unaware of the group to which the subject would belong when the decision was made (Pedro.org, 1999) (Schulz, 1995). "Blind" or "hidden" refers to the fact that the person who determined the eligibility for inclusion of participants in the study did not know at that time in the allocation of the participant (Pedro.org, 1999) (Hollis, 1999). If the distribution is not hidden (or blinded), the decision to include the participant can be influenced by prior knowledge of the group to

which the participant would be allocated. This can produce systematic deviations in the random distribution ((Schulz, 1995) (Hollis, 1999)). There is empirical evidence that hidden distribution is a predictive factor in the therapeutic effect ((Schulz, 1995) (Hollis, 1999)). 4. The randomized groups were maintained identical at the baseline regarding key prognostic indicators: no/yes Studies involving therapeutic interventions require the report to state a minimum of one measure for treating medical complications, and its primary outcome measure characterizes the starting point (Schulz, 1995). The investigator must guarantee that it is impossible to predict clinically significant differences in the results for the various groups based on the predictive starting conditions. This criterion is reached even if only the initial study data are presented (Schulz, 1995). 45 | P a g e This criterion is likely to predict potential bias that occurred at random in the random distribution (Schulz, 1995). Large disparities across groups might indicate faulty randomization processes (PEdro.org, 1999). 5. There was blinding of all subjects: no/yes The term "blinding" refers to the fact that the person in issue (the patient, the therapist, or the assessor) had no idea which group the subject had been assigned to. Furthermore, patients are only termed "blind" if it is believed that they would be unable to discern between treatment groups (PEdro.org, 1999) "Blinding" subjects ensures the there is no possibility for them to differentiate if they have or not received treatment (PEdro.org, 1999) (Schulz, 1995). The subjects were required to attest that the treatment's success or lack of efficacy was not attributable to placebo or the Hawthorne effect (PEdro.org, 1999) (Schulz, 1995). The most significant difficulty of these studies in reaching higher scores is associates closely with the blinding of evaluator, participants, and physiotherapists (Schulz, 1995). Although this difficulty may only be the result of the writing of the scientific text, in which information may have been suppressed or not presented to the reader, often, especially in a physiotherapy setting, the lack of this information can be attributed to the fact that subjects cannot be wholly blinded in this environment, due to the nature of the treatment in itself (Nedel, 2016). 6. The investigator blinded therapists who were recruited to administer the therapy: no/yes "Blind" therapists presented them the opportunity to treat all participants equally as they would not tell who among them had received treatment. In blinding, the researcher seeks to lower or block the effects of the treatment procedure by ensuring the conditions are not right to record the effects or lack thereof on the condition being investigated (Schulz, 1995). 7. Assessors who measured more than one outcome were blinded: no/yes "Blinding" the assessors are to ensure that they could not discriminate whether study participants received treatment (Schulz, 1995). When the assessors are "blind," the reader makes ensures that the treatment's apparent impact (or lack thereof) is not attributable to the influence of the assessors who assessed the treatments' outcomes (Schulz, 1995). If the patient was blind, the assessor is deemed blind in trials where critical outcomes are self-reported (e.g., visual analogue scale, pain diary) (PEdro.org, 1999). 8. Key outcomes measures were obtained from more than 85% of the total participants previously allocated to various groups: no/yes Only if the report explicitly mentions both the number of subjects initially assigned to groups and the number of subjects from whom critical outcome measures were acquired, is this condition met. (PEdro.org, 1999). In clinical studies, that measure the outcomes at different points in time, a key outcome must be derived from a minimum of 85% of the subjects at one time (PEdro.org, 1999) (Schulz, 1995). Outcome measures must be performed on all subjects that have been distributed to groups (Schulz, 1995). Subjects who did not respond to the assessments may be systematically different from those who responded, introducing bias into the study (Schulz, 1995). The magnitude of this bias increases as the number of participants who did not respond increases (Schulz, 1995). 9. Participants whose outcome measures were determined received control conditions, and in case this situation was unachievable, more than one key outcome was examined for treatment: no/yes When individuals did not get treatment (or the control condition) as assigned and outcome measures were available, an intention to treat analysis was done as if subjects got the treatment (or control condition) they were assigned to. Eventhough there is no mention of analysis by intention to treat, this requirement is met if the report expressly says that all participants got the treatment or control conditions as assigned (PEdro.org, 2011). It is almost inevitable that there will be no breaches of the research protocol in clinical trials (Schulz, 1995). Problems are considered protocol violations, such as subjects not receiving the treatments they should or receiving treatments they should not receive (Schulz, 1995). Analyzing the data according to the interventions that the subjects received (instead of analyzing according to the treatments that the subjects should receive) can influence the results. It is also essential that it is done according to the planned conditions in the random distribution when the analysis is done (Schulz, 1995). This is commonly called "intention-to-treat analysis" (Schulz, 1995). 10. Between-group statistical results were compared and reported for more than one key outcome: no/yes A statistical comparison between groups entails a statistical comparison between 2 groups (Nedel, 2016). This might include comparing two or more treatments or comparing the treatment to the control condition, depending on the study's design. (PEdro.org, 1999). A simple comparison of after-treatment outcomes or a comparison of changes in one group to changes in the other might be used in the analysis (when data is analyzed using a factor analysis of variance, the latter is frequently presented as group x time interaction). The comparison can take the form of hypothesis testing (it gives a "p" value showing how likely it is that the groups differed purely due to chance) or an estimate (the mean or median difference, for example, or a proportional difference, or the number needed to treat, or the relative risk or hazard ratio) and its confidence interval. (PEdro.org, 1999). Statistical tests should be used in clinical trials to evaluate if the difference between groups happened "by chance". (Schulz, 1995). 11. The study has point and variability measures for more than one key outcome no/yes The magnitude of the therapeutic effect is measured by a measure of accuracy (PEdro.org, 1999) (Schulz, 1995). The treatment's effect might be expressed as a difference in

group outcomes or as the outcome in (all) groups (PEdro.org, 1999). Standard deviations (SDs), standard errors, confidence intervals, interquartile ranges (or other quantum ranges), and ranges are examples of variability measures (PEdro.org, 1999)). Precision measurements and measures of variability can be presented graphically (Schulz, 1995). When the results are related to categorical variables, the criterion is considered to be fulfilled if the number of participants in groups and categories is identifiable (Schulz, 1995). Clinical studies provide accurate estimates of the effect of a given treatment (Nedel, 2016). "The best estimate (point estimate) of the treatment is the difference between (or ratio of) the outcomes between the treatment and control groups. A measure of the degree of uncertainty associated with this estimate can only be calculated if the study presents measures of variability" (PEdro.org, 1999). ASSESSMENT OF HETEROGENEITY The statistical heterogeneity across the reviewed studies, attributable to the clinical and methodological heterogeneity, was assessed to determine the variance between the assessed sources. The I2 test was applied to test the variance with 0% reflecting lack of heterogeneity, 25% reflecting low heterogeneity, 50 % variance reflecting moderate heterogeneity, whereas a value close to 75% reflects the risk of heterogeneity (Huedo-Medina, 2006). The I^2 value is the percentage of variance across studies that is due to heterogeneity rather than chance. When $p<0.05$ in Q statistics and $I^2>40\%$, heterogeneity is deemed significant (Huedo-Medina, 2006). META-ANALYSIS Meta-analysis is adopted in the review to pool the data of various research studies where possible (Hedges, 1986). A meta-analysis is a method of combining quantitative data from several studies to evaluate the degree to which the independent variable influences the dependent variable (Hedges, 1986). In a comprehensive research, it employs statistical data from individual quantitative investigations as the units of measurement (Hedges, 1986). Impact size indices or mean differences are used to summarize the findings, which "may then be averaged to produce an overall assessment of effect magnitude" (Hedges, 1986). The meta-analysis' strength stems from the fact that the effect size indicators are called-free. It is feasible to aggregate the findings of studies that assess the same construct by using a scale-free index of impact magnitude. (Hedges, 1986). The impacts of group type on the outcomes of each of the numerous experimental methods were evaluated in this study to assess the size of the overall effect, as evidenced by the findings of individual experiments. Q and I2 tests were used to assess study heterogeneity. Q, sometimes known as Cochran's Q, is a traditional measure of heterogeneity. The weighted sum of squares of individual measurements and the total weights of all measures in the research are used to generate the figure. The findings of the meta-analysis will be provided as a weighted mean difference with a 95% confidence interval and a 49 | P a g e significance level of 0.05. Forest plots will be used to summarize the data from each research and meta- analysis. Furthermore, because each study provided several types of estimates, a general inverse-variance method to the meta-analysis was required. As the name suggests, the inverse variance method entails initially determining the standard error of the effect estimate of a study and then using the reciprocal of the standard error as the weight for that particular study. As such, greater weights are assigned to more extensive studies whose standard errors are relatively small. Conversely, smaller weights are assigned to smaller studies whose standard errors are relatively huge. In addition, the evidence of heterogeneity was subjected to a random model based on a significant test for heterogeneity. Since we were insignificant heterogeneity, the random effect model was chosen (Higgins, 2019). MEASURING OF TREATMENT EFFECT In order to maximize the generality of the study outcomes, the mean is used to analyze continuous data with a confidence interval of 95% (Schulz, 1995). The risk ratio is also applied in assessing the dichotomous data. T corresponding statistics were reported with the 95% confidence interval (Schulz, 1995). UNIT OF ANALYSIS ISSUE The long-term studies that involve follow-up for over two months are repeatedly evaluated to help in classifying the results based on the time frame ((Huedo-Medina, 2006) (Hedges, 1986)). The research that tests the intervention in more than one intervention group is categorized differently in the meta-analysis. Attachment 3 (3.1-3.5) details precisely how the groups in each study were categorized. SUB-GROUP ANALYSIS The studies will be further grouped into subgroups, to facilitate the analysis as it becomes more homogeneous. Such subgroups include the category of age, gender, the duration of the intervention, MSK conditions, follow-up, and key outcome measures. Results RESULTS OF THE SEARCH The results from the electronic search yielded a total of 227 abstracts and study titles as illustrated in figure 1 below. Breaking down the electronic results, 29 of the obtained results were retrieved from PEDro, 189 from PUBMed and were retrieved from Cochcrane. A closer examination of the retrieved studies revealed that 75 of them were duplicates and as a result were discarded leaving the researcher with 152 studies. In the second screening process that followed the study' inclusion criteria, it was found that 21 studies did not include or were not reporting on MSK conditions while 116 of other studies lacked information on physiotherapy and acupuncture treatment. Therefore, of the selected 227 studies, only fifteen made to the last stage of screening whereby seven were discarded for failing to meet the eligibility set by the researcher. Therefore, only eight studies were included in the current research with six included in a quantitative meta-analysis and all eight were used to perform a qualitative analysis (Fig 1). Figure 1 – Flowchart of the search DESCRIPTION OF THE INCLUDED STUDIES The current study utilized a quantitative cross-sectional research design with an extensive section of systematic literature review supported by the above flowchart. An analysis of the included studies revealed that the total participants included in the current quantitative study were 960 participants with 611 participants included in the control group while 349 patients were placed in the intervention group ((Tsang, 2007) (Franca, 2008) (Johansson, 2011) (Chen, 2013) (Kizhakkeveettil, 2017) (Foster, 2007) (Sun, 2001) (Bishop, 2016). In terms of gender, 418 of the participants were female (65%) while 223 were male (35%). Knee osteoarthritis (3 studies) ((Tsang, 2007) (Chen, 2013) (Foster, 2007)), tension neck syndrome (1 article) (Franca,

2008), subacromial impingement (1 article) (Johansson, 2011), low back pain (2 studies) ((Kizhakkeveettil, 2017) (Bishop, 2016)), and frozen shoulder (1 article) ((Sun, 2001) are the main clinical MSK disorders studied in the research (Table 1). Majority of reviewed acupuncture studies employed randomized control trials. For this particular review, six studies were randomized control trials as shown in table 1 below. There were no cross-over trials. Table 1 – Study details First Author (Year)/ Study location Study Design/Length of study Type of Injury Sample size (n) (Tsang, 2007) Randomized Control Trial/Two weeks Knee osteoarthritis 30 (Franca, 2008) Prospective, comparative clinical trial/10 weeks with follow up after six months Tension neck syndrome 46 (Johansoon, 2011) Randomized Controlled Trial/12 months Subacromial Impingement 91 (Chen, 2013) Randomized double-blind controlled trial/12 weeks Knee osteoarthritis 214 (Kizhakkeveettil, 2017) Randomized Control Trial/60 days Low Back Pain 101 (Foster, 2007) Multicenter, Randomized Control Trial/3 weeks Osteoarthritis of the knee 352 (Sun, 2001) Randomized Control Trial/6 weeks Frozen shoulder 35 (Bishop, 2016) Randomized controlled trial/6 weeks Pregnant women with back pain 91 INTERVENTIONS USED IN THE INCLUDED STUDIES Medication and physiotherapy, acupuncture, placebo, and sham were all used in the trials that were included. Two studies compared Physiotherapy with Acupuncture to Physiotherapy with Sham Acupuncture ((Tsang, 2007) (Franca, 2008)). One research examined the effects of physiotherapy alone with physiotherapy combined with acupuncture. (Kizhakkeveettil, 2017). Another research aimed to see if there was a significant difference in outcomes between the intervention groups, who were given corticosteroids and home exercises, and the control group, who were given acupuncture and home exercises (Johansoon, 2011). The final four investigations compared three different groups: acupuncture alone was compared in two trials (Tsang, 2007) (Franca, 2008), Physiotherapy alone, and Acupuncture combined with Physiotherapy ((Chen, 2013) (Foster, 2007)); the other two studies compared Physiotherapy alone ((Chen, 2013) (Sun, 2001)), Physiotherapy plus sham Acupuncture and Physiotherapy plus true Acupuncture (Bishop, 2016) (Table 2). Studies described 16 different Acupuncture points. Acupuncture points were chosen based on the location of the disorder, the team's experience, or reports of evidence based on the usage of the chosen sites in the treatment of the disorders researched (Table 2). In one trial, all groups received a conventional postoperative physiotherapy program, as well as 10 sessions of either acupuncture or sham acupuncture within 2 weeks (Tsang, 2007). In a ten-week trial Franca et al. (2008) divided participants into three groups for various treatments: Group-1 received both physiotherapy and acupuncture, Group-2 received just acupuncture, and Group-3 received only physiotherapy. Patients with subacromial impingement syndrome (SIS) were randomized to either subacromial corticosteroid injections or ten acupuncture sessions combined with home exercises in research by Johansson et al. (2011). Acupuncture was done at the same nine spots suggested by the Traditional Chinese "Bi" syndrome approach to knee pain, using either regular needles or Streitberger non-skin puncturing needles, in a study conducted by Chen et al (2013). Participants with acute or chronic lower back pain were divided into three groups by Kizhakkeveettil et al. (2017): Group-1 received acupuncture; Group-2 spinal manipulative therapy (SMT); and Group-3 integrative Acupuncture and SMT. Foster et al (2007) conducted a trial to see if adding acupuncture to a physiotherapy-administered course of advice and exercise for pain relief in people with osteoarthritis of the knee was beneficial. Advice and exercise (Group-1), advice and exercise plus real acupuncture (Group-2), and advice and exercise plus non-penetrating acupuncture (Group-3) were among the interventions. Sun et al. (2001) conducted a different trial in which 35 patients with frozen shoulder problems were randomly assigned to a six-week acupuncture group therapy. Finally, Bishop et al. (2016) conducted research in which participants were divided into three groups and given one of three treatment: Group-1 received conventional medicine; Group-2 conventional medicine plus genuine acupuncture, or Group-3 conventional medicine with non- penetrating acupuncture (Table 2). Table 2 – General Intervention details First Author (Year)/Location study Intervention Group Control Group (Tsang, 2007) N= 15 (3 males, 12 females) Physiotherapy + Acupuncture Post-operative days 1-2 (1) Deep breathing exercise (2) Ankle and toes exercise (3) Active assisted knee flexion and extension exercise (4) Limb maintenance exercises. Postoperative days 3–7 + (1) Ice therapy (2) Self-assisted knee flexion exercise (3 Passive stretching of the hamstring (4) Strengthening exercise of quadriceps N= 15 (3 males, 12 females) Physiotherapy + Sham Acupuncture Post-operative days 1-2 (1) Deep breathing exercise (2) Ankle and toes exercise (3) Active assisted knee flexion and extension exercise (4) Limb maintenance exercises. Postoperative days 3–7 + (1) Ice therapy (2) Self-assisted knee flexion exercise (3) Passive stretching of the hamstring (4) Strengthening exercise of quadriceps (5) Full weight-bearing walking exercise with frame Postoperative day 7 onwards + (1) Eccentric control of quadriceps training (2) Stairs ascending and descending training (3) Proprioceptive training (4) Cardiovascular training + True Acupuncture points = ST32, ST33, GB31, GB35, GB34, ST36 (5) Full weight-bearing walking exercise with frame Postoperative day 7 onwards + (1) Eccentric control of quadriceps training (2) Stairs ascending and descending training (3) Proprioceptive training (4) Cardiovascular training + Sham Acupuncture (acupuncture needles were put less than 5mm superficially and roughly 2 cm distant from the same acupoints as the acupuncture group) (Johansoon, 2011) N= 49 (27 females, 22 males) Physiotherapy + Corticosteroids Within one week of being included, the patients were sent to a GP for an injection of 1 mL Depomedrone + 8–10 mL 1% prilocaine. Patients were instructed to avoid heavy arm activities for the following two weeks after receiving the injection. Patients were then permitted to resume regular activities, although they were advised to avoid behaviors that may cause impingement N= 42 (26 females, 16 males) Physiotherapy + Acupuncture Within one week of being enrolled, the patients began manual acupuncture as well as a home exercise regimen. For five weeks, the procedure was done twice weekly. The two-step home

exercise regimen was based on clinical experience and previous effectiveness studies. To minimize causing discomfort to the afflicted tissues, the first segment used low-intensity repetitions to preserve mobility and increase circulation in the rotator cuff. The second half, on the other hand, avoided impingement by keeping the rotator cuff in a neutral posture. All of the tasks are detailed in a previous research. (Chen, 2013) N= 104 (53 females, 51 males) Physiotherapy + Acupuncture ROM exercises, muscular strengthening, and cardiovascular conditioning (bike and treadmill apparatus) were all part of the physiotherapy treatment Acupuncture included primary acupoints such as GB34, SP9, ST36, ST35, and Xiyan and distal points such as UB60, GB39, SP6 and KI3 N= 109 (57 females, 52 males) Physiotherapy + Sham Acupuncture ROM exercises, muscular strengthening, and cardiovascular conditioning (bike and treadmill apparatus) were all part of the physiotherapy treatment Streitberger Non-penetration needle was used on the same points Except for the acupuncturist, who wasn't blinded owing to the nature of the intervention, all of the intervenient (patients, physical therapists, data collectors, and statistician) were blinded for this study. They went to training sessions to learn how to communicate with each patient in a structured way to avoid unblinding. (Sun, 2001) N= 13 (9 females, 4 male) N=22 (15 females, 7 male) Physiotherapy + Acupuncture Physiotherapy Pendular exercises included flexion, abduction, Exercise and home exercise programs were horizontal abduction, elevation with elbow conducted in the same way as for the flexed, depression/elevation in lying position, Physiotherapy group. elevation with stick, abduction with stick, elevation with stick behind head, crawling fingers for flexion and abduction, retraction, and external rotation with hand behind back/neck in standing position, and weight- bearing shoulder extension in sitting position. Participants were asked to perform selected shoulder exercises. For Acupuncture, the extra point of Zhongping was chosen. First Author Physiotherapy Acupuncture Physiotherapy + True (Year)/Location Acupuncture study Physiotherapy + Sham Acupuncture (Bishop, 2016) N= 32 (32 females) N/A N= 32 (32 females) Women were allowed to seek back physiotherapy care, comprising a personalized assessment and 2 to 4 treatment sessions for six weeks. The sessions mainly consisted of advice, exercise tactics, massage, and manual therapy, among others. However, group sessions, Acupuncture, and hydrotherapy were not applicable when SC is concerned. The same self- management pamphlet for physiotherapy plus true acupuncture. Besides, trained physiotherapists in EASE Back management administered Acupuncture. The Acupuncture therapy consists of six to eight sessions spread out over six weeks. Physiotherapy comprises a minimum of 6 and a maximum of 10 bilateral sites employing Western and trigger point acupuncture principles N= 27 (27 females) Physiotherapy+ Non- penetrating Acupuncture Physiotherapy plus non- penetrating Acupuncture. The non- penetrating needles seem like actual needles, but the tips are dulled and the shaft slides freely in the handle, giving the sensation of penetration. (Franca, 2008) Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3 + Physiotherapy: i) Stretching exercises of the deep cervical flexion muscles (DCFM). ii) recruitment exercises. of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) N= 15 Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises. of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) N=15 (12 females, 3 males) Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3 N= 16 (12 females, 3 males) Yamamoto New Scalp Acupuncture + LR3, ST36, LI4, SP6, K3 + Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) Physiotherapy: i) Stretching exercises of the DCFM. ii) recruitment exercises of the DCFM. iii) strengthening exercises of the muscles of the neck (DCFM) and upper limbs) N/A (Kizhakkeveettil, 2017) N= 36 (17 females, 19 male) N= 33 (10 females 23 male) N= 31 (17 females, 14 male) N/A Spinal Manipulation Techniques were used in specific contact points on vertebral processes + Passive articulatory mobilization of the lumbosacral spinal joints, paraspinal soft tissue stretching, digital pressure on painful sites, and post-isometric muscle relaxation techniques are all examples of passive articulatory mobilization. Physical Treatment involved Acupuncture needling, moxibustion, electrical Acupuncture, Tui Na, and cupping. Participants in the Acupuncture and Physiotherapy care group received both Acupuncture and Physiotherapy from separate practitioners using the previously described protocols. treatment techniques such as heat, cold, ultrasound, and electrical muscle stimulation were employed as needed, as well as active care activities. (Foster, 2007) N= 116 Patients received advice supplemented by a leaflet and individualized, progressed exercises N/A N= 117 Patients received advice supplemented by a leaflet and individualized, progressed exercises plus acupuncture on traditional Chinese acupuncture points N= 119 Patients received advice supplemented by a leaflet and individualized, progressed exercises plus received acupuncture through a needle with a blunt tip and a shaft that collapses into the handle, giving the appearance of insertion (same protocol from true Acupuncture) DFCM – Deep Cervical Flexion Muscles; ROM – Range of Motion; N/A – Not Applicable; EASE – Evaluating Acupuncture and Standard of CarE. OUTCOME MEASURES USED IN THE INCLUDED STUDIES An analysis of the included studies revealed that five out of the eight studies assessed pain as the most outcome measure. In measuring pain as an outcome each study employed its own technique with Franca (2008) measuring pain using Visual Analogic Scale (VAS), Kizhakkeveettil (2017) used the Numeric Pain Rating Scale (NPRS) while Tsang (2007) used Roland-Morris LBP Disability Questionnaire. In another study, Bishop (2016) used Adolfsson-Lysholm shoulder assessment (AL-SCORE). Chen (2013) and Foster (2007) used the Western Ontario and McMaster Universities Osteoarthritis index (WOMAC) pain subscale score as shown in table 3. Besides pain as the most assessed outcome in the studies examined, other outcome measures that were examined by existing scholars included active and passive ROM as investigated by Tsang (2007) and measured using goniometer, quality of life measured by EuroQol-five-dimension self-report

questionnaire (EQ-5D-5L). Other outcomes included ambulation measurement as investigated by Tsang (2007) and measured by timed-up and go test (TUG) shoulder assessment score measured by the AL- SCORE by Johanson (2011), VAS used in assessing the outcomes of muscular tension (VASmt) by Franca (2008) and Sun (2001) constant shoulder assessment. Table 3 - Outcome measure and measurement tools First Author (Year) Outcome Measure Measurement Tool (Tsang, 2007) - Pain - Active and Passive Knee ROM - Ambulation - Numeric Pain rating scale - Goniometer - TUG (Franca, 2008) - Pain - Isometric Neck Muscle Strength - Muscular tension of the neck - Functional Disability - VASpain - Pressure Biofeedback Device (Stabilizer, Chattanooga South Pacific, Australia) - VASmt - Neck Disability Index (NDI-BR) (Johansoon, 2011) - Pain - Shoulder function - Patient's Global Assessment of change - AL-score - EQ-5D - Unaltered, minor improvement, huge improvement, or recovered on a five-point ordinal scale with fixed alternatives: unchanged, moderate improvement, large improvement, or recovered (Chen, 2013) - Change in WOMAC score - Brief Pain Inventory (BPI) - Patients can easily walk for 6 minutes on a level surface. - WOMAC Index - 36-item Short Form Health Survey - 6 minutes-walk-test (6MWT) (Kizhakkeveettil, 2017) - Level of Disability - Pain - Roland-Morris LBP Disability Questionnaire - Numeric Rating Scale (NRS) (Foster, 2007) - Pain - Function - WOMAC – Pain sub-scale score - WOMAC – Function sub-scale score (Sun, 2001) - Functional mobility - Power - Pain - Constant Shoulder Assessment (Bishop, 2016) - Pain intensity - Functioning - NPRS - Pelvic Girdle Questionnaire (PGQ), - Oswestry Disability Index (ODI), TUG – Time-up-go; EQ-5D – European Quality of Life Five Dimension; WOMAC – Western Ontario and McMaster Universities Arthritis Index; NPRS – Numerical Pain Rating Scale QUALITY OF INCLUDED STUDIES The quality of each study included in the research process was measured or assessed using the PEDro Quality Assessment Scale (Table 4). Using the scale, all the eight studies that were graded with three studies scoring 9/10, three other studies scoring 7/10 while two studies scored 8/10. Based on the PEDro scale rating, the eight selected studies had an average of score of 8.125 an indication of their quality and their key role in achieving the objectives of the study. Overall, the explanations behind each trial's ratings were very similar. Only Chen et al. (2013) and Sun et al. (2001) were able to document blinding of therapists to group allocation, whereas Sun et al. (2001) failed to disclose concealment of allocation. The lack of blinding of the therapists in other studies could be linked to the challenges of blinding the therapist who administers the physical treatment. According to Nedel (2016) while a researcher believing or trusting in a single technique for better results, his/her belief is likely to influence the outcome of the results with blinding of the data collection process minimizing the risks of doubt. If the physical treatment technique is identical between groups and the intervention group receives some additional non-physical interventions, it may be possible to blind the therapist. In regard to blinding of the participants, five studies were unable to report on this ((Franca, 2008) (Johansoon, 2011) (Kizhakkeveettil, 2017) (Foster, 2007) (Sun, 2001)). The blinding of outcome assessors had also the same results with four articles failing to report blinding of the assessors ((Franca, 2008) (Kizhakkeveettil, 2017) (Foster, 2007) (Bishop, 2016)). For all experiments, randomization was done using a variety of approaches. Tsang et al. (2007) employed block randomization to assign patients to the acupuncture or sham acupuncture groups at random using four-block randomization. Patients were randomly assigned to three groups in the study by Franca et al. (2008), and a series of random numbers of intervention codes was established using block randomization and sealed opaque envelopes by a person not engaged with the trial. Patients who volunteered to participate in the Johansson et al. (2011) trial were randomly assigned to receive a corticosteroid injection or acupuncture mixed with home exercises. A study coordinator who did not participate in the assessment process arbitrarily allocated participants to various groups using computer-generated numbers or list. The treatment options were placed in envelopes that were numbered according to the randomization list and kept hidden. Chen et al. (2013) performed randomization by initially allocating patients to groups without following any prescribed pattern. The purpose of randomization was to reduce allocation bias. For instance, Kizhakkeveettil et al. (2017) used a computer software to randomly assign individuals based on sex, presence of discomfort below the knee, degree of pain, and sex. Aside from the computer software, an adaptive randomization strategy that inquiries about the number of participants within every group in order to achieve balance in both the control and intervention groups is also used. In a study by Foster et al. (2007), participants were randomized. Initially, Foster et al. (2007) selected a sample of participants to be used in the study. They then assigned the participants to groups without adherence to any prescribed pattern in order to reduce researcher bias. Sun et al. (2001) using the random table method to randomize patients into either of the formed group. In the study by Bishop et al. (2016), a ratio of 1.1.1 was used to randomize women who were recruited for the study to the three arm treatment assessments using varying sizes of blocks that were unsystematically selected for a period of 24 weeks. A registered Clinical Trials Unit used remote telephone randomization to assign participants to groups. Table 4 - Quality assessment of each study evaluated based on the PEDro Quality Assessment Scale Criteria Article 1. Eligibility 2. Randomization 3. Allocation concealment 4. Similar groups 5. Blinding (Subjects) 6. Blinding (Therapists) 7. Blinding (Assessors) 8. 85% outcome measures 9. All participants assigned to Control or treatment 10. Statistical Comparisons 11. Variability measures TOTAL (/10) (Tsang, 2007) Yes Yes Yes Yes Yes No Yes Yes Yes Yes Yes 9 (Franca, 2008) Yes Yes Yes Yes No No No Yes Yes Yes Yes 7 (Johansoon, 2011) Yes Yes Yes Yes No No Yes No Yes Yes Yes 7 (Chen, 2013) Yes Yes Yes No Yes Yes Yes Yes Yes Yes Yes 9 (Kizhakkeveettil, 2017) Yes Yes Yes Yes No No No Yes Yes Yes Yes 7 (Foster, 2007) Yes Yes Yes Yes No No No Yes Yes Yes Yes 9 (Sun, 2001) Yes Yes No Yes No Yes1 Yes Yes Yes Yes Yes 8 (Bishop, 2016) Yes Yes Yes Yes Yes No No Yes Yes Yes Yes 8 1 Even though the study mentions that the therapists were blinded, they do not explain how the process was done. This is a limitation of the study 61|Page

QUANTITATIVE ANALYSIS Effects on Pain Pain was the most used outcome measure, for which pooling of data was possible. 1) Comparison of the effects of Physiotherapy alone to Physiotherapy combined with Acupuncture The effect of Physiotherapy compared to the combination of Physiotherapy and Acupuncture on pain was evaluated using the NPRS in two studies ((Kizhakkeveettil, 2017) (Bishop, 2016)). Figure 2 summarizes the results, revealing a non-significant pooled effect of -0.61 (p= 0.67). Figure 2 - Comparison of the effects of Physiotherapy (PT) alone versus Physiotherapy combined with Acupuncture (AP) on pain levels Based on a significant test for heterogeneity, $\chi 2 = 3.99$, $p = 0.05$, $I2 = 75\%$, there was evidence of heterogeneity. As a result, heterogeneity accounts for around 75% of overall variance among trials. 2) Effects of Physiotherapy combined with true Acupuncture compared to Physiotherapy combined with sham Acupuncture on Pain levels. Figure 3 presents the forest plot comparing Physiotherapy combined with true Acupuncture to Physiotherapy combined with Sham Acupuncture on pain levels. The outcome measures used to evaluate pain were: Brief Pain Inventory (Chen, 2013), WOMAC – pain subscale score (Foster, 2007) and NPRS (Tsang, 2007). The pooled effect was -0.05. It can be observed that the study by Tsang et al. (2007) had a large variability based on the confidence interval of the mean difference. The study did not find a significant difference between the two groups. Figure 3 - Effects of Physiotherapy (PT) combined with true Acupuncture (TAP) compared to Physiotherapy combined with sham Acupuncture (SAP) on Pain levels. QUALITATIVE ANALYSIS ACCORDING TO OUTCOME MEASURES Range of Movement (ROM) Despite being one of the key outcome measures for the current study, ROM was only studied in one study done by Tsang (2007). Key to their study, Tsang (2007) compared the outcomes of physiotherapy with true acupuncture and physiotherapy on sham acupuncture on ROM. The results of the comparison indicated no significant changes between the two randomized groups with a p-value of 0.09 and 0.75. Table 5 - Results of effects on Range of Motion First Author OM Group Baseline (Pre-Intervention) Post-Intervention (Year) N. in grou p Mean SD P Value N. in group Mean SD P Value Mean differ ence 95% CI of the mean difference (Tsang, 2007) AROM (Right Knee) PT+ACUP PT+SHAM 15 15 100.9 107.0 27.3 16.0 0.464 15 15 94.0 93.0 15.0 13.7 0.745 1 -11.74 to 9.74 AROM (Left Knee) PT+ACUP PT+SHAM 15 15 101.7 109.0 31.9 17.3 0.441 15 15 96.5 99.7 17.1 15.2 0.098 -3.2 -8.9 to 15.30 PROM (Right Knee) PT+ACUP PT+SHAM 15 15 108.8 115.3 29.6 16.5 0.462 15 15 107.9 101.5 11.3 11.9 0.729 6.4 -15.08 to 2.28 PROM (Left Knee) PT+ACUP PT+SHAM 15 15 110.6 118.7 35.4 17.2 0.434 15 15 107.3 106.0 15.9 14.7 0.320 1.3 -12.75 to 10.15 *OM = Outcome measure; ROM = Range of motion; SD = Standard deviation; CI = Confidence Interval; AROM = Active range of Motion; PROM = Passive Range of Motion; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group Mobility Measure The effectiveness of combining Physiotherapy with Acupuncture on Mobility measure was assessed in two studies, Tsang et al. (2007) and Chen et al. (2013). First, pooling the data from the two studies was a challenge because not similar outcomes were used by the researchers. Compared to the findings between Chen et al. (2013) and Tsang (2007), there were significant changes and developments in the TUG intervention after eight7 weeks for Tsang (2007) while no changes were observed for Chen et al. (2013. A closer look of Tsang (2007) results, coupling physiotherapy with acupuncture yielded positive results after 15 weeks. Table 6 - Results of effects on gait Assessment First Author OM Ctrl Int. or Pre-Intervention 8th week Post-Intervention 15 weeks Post-Intervention (Year) Group N. in group Mean SD N. in gro up Mean SD P Value N. in group Mean SD P Value Effect size 95% CI of the mean difference (Tsang, 2007) TUG1 PT+ACU P PT+SHA M 15 15 29.9 19.4 15.6 7.0 15 15 78.4 67.5 30.7 48.8 0.028 15 15 45.8 39.8 31.1 33.4 0.929 6 -22.46 to 10.46 (Chen, 2013) 6MWT PT+ACU P PT+SHA M 105 109 Pre-Intervention 1032 314 # 1126 289 # 0.02 7 71 82 1119# 1147# 12 weeks Post-Intervention Not given 0.562 -28 1046-1195# 1086-1209# OM = Outcome Measure; Int = Intervention group; Ctrl = Control group; SD = Standard Deviation; PT+ACUP = Physiotherapy plus Acupuncture Group; PT+SHAM = Physiotherapy plus Sham Acupuncture Group; TUG = Time-up-go test; 6MWT = 6 minutes' walk test 64|Page Muscular tension Muscular tension was assessed by Franca et al. (2008), using VASmt. After observing the patients for six months, Franca et al. (2008) indicated a good improvement in all of the evaluated parameters ($p<0.000$) (Table 7). Table 7 - Results on Muscular tension within groups, based on the paired t-test First Author (Year) OM Groups Pre-Intervention After 6 months of treatment (Franca, 2008) N. in group Mean SD P Value (within group) N. in group Mean SD P Value (within group) Effect size VAStm PT + ACUP ACUP PT 16 15 15 90.0 80.0 70.0 14.81 22.2 22.2 0.053 16 15 15 15.0 20.0 30.0 14.81 14.81 14.81 <0.000 <0.000 <0.000 PT/ACUP= -5 ACUP/PT+AC UP= -10 PT/PT + ACUP= -15 OM = Outcome Measures; SD = Standard Deviation; VAS = Visual Analogic Scale; PT+ACUP = Physiotherapy group; PT = Acupuncture group; ACUP = Acupuncture group Functional Disability Three of the included studies assessed Functional Disability as an outcome measure ((Franca, 2008) (Kizhakkeveettil, 2017) (Bishop, 2016)). The results of the Neck Disability Index (NDI) used by Franca et al. (2008) to measure functional disability revealed that after six months a group that received acupuncture and physiotherapy showed an improved outcome (Table 8). Similar findings were reported by Kizhakkeveettil (2017) who found combining acupuncture with physiotherapy reduced functional disability compared to when physiotherapy alone was used. Although negligible difference in functional disability, both KWT and Dunns' multiple comparison test (DMCT) found an improved outcome in functional disability after a period of six months. Using the Oswestry Disability Index Score (ODI), Bishop et al. (2016) after eight weeks of intervention, there were no significant changes between the two groups. Noteworthy however, the results were inconclusive given that confidence intervals were overlapping (see table 8). Kizhakkeveettil et al. (2017) using Roland-Morris LBP Disability Questionnaire to examine the disability in patients with Low Back Pain found positive results within the three groups being studied.

While there were no specific outcome measures, the results showed that combining acupuncture with physiotherapy improved the outcomes of the participants. Key to note, Kizhakkeveettil et al. (2017) presented the opportunity for more empirical research in more randomized large-scale research that will examine the outcome on lower back pain when acupuncture is combined with SMT and compared to physiotherapy alone. Table 8 - Results of effect on Functional Disability First Author OM Groups Pre-Intervention After 6 months of treatment (Year) N. in Mean SD group P Value N. in group Mean SD P Value Effect size (Franca , 2008) NDI-BR (%) PT +ACUP ACUP PT 16 24.0 8.88 15 30.0 10.37 15 28.0 14.81 0.5386 16 15 15 9.0 4.4 4 18.0 5.9 0.001 25 8 16.0 7.4 07 PT+ACUP/A CUP = -9 ACUP/PT = 2 PT+ACUP/PT = 2 First Author OM Groups Pre-Intervention Post-Intervention (Year) N. in Mean SD group N. in group Mean SD Effect size 95% CI of the mean (Bishop, 2016) ODI PT 32 34.1 11.4 32 32.2 18.8 PT+ACUP/AC UP = 10.9 25.5-36.9 PT + ACUP 32 29.1 10.9 32 21.3 17.7 ACUP/PT = -4.9 17.5-28.8 PT+ SHAM 27 33.9 13.6 27 26.2 14.4 PT+ACUP/PT = 6 19.1-31.3 First Author OM Groups Pre-Intervention After 6 months of treatment (Year) N. in Mean SD group N. in group Mean SD Effect size 95% CI (Kizhak keveett Disability Level ACUP 34 10.8 5.6 34 6.3 6.16 ACUP/SMT= 3.2 4.1-8.4 il, 2017) SMT 36 11.1 6.0 36 3.1 5.9 SMT/ACUP+ SMT = -0.9 1.1-5.1 ACUP +SM T 31 9.7 6.4 31 4.0 5.18 ACUP/SMT = 2.3 2.1-5.9 *OM = Outcome Measures; SD = Standard Deviation; NDI-BR(%) = Neck Disability Index: Brazilian Portuguese Version; ODI = Oswestry Disability Index; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group; PT+SHAM = Physiotherapy plus Sham Acupuncture group Muscular Strength Franca et al. (2008) used pressure Biofeedback device (Cranio-Cervical Flexion Test) to measure Isometric Neck Muscle Strength (INMS). The results of the measure indicated significant improvements in the group that was engaged with the pressure biofeedback device. With the p< 0.05, Franca et al. (2008) explained that combining physiotherapy and acupuncture improved the overall outcome of those involved after 6 months maintaining a p value of 0.006. Similar findings were also observed in DMCT which also showed a positive improvement in outcome when physiotherapy is combined with acupuncture (P <0.0001) (table 9). Table 9 - Results of effects on Muscular Strength First Author OM s Group Pre-Intervention After 10 weeks of treatment After 6 months of treatment (Year) N. in grou p Mea n SD N. in grou p Mea n SD P Value within group P value betwee n group Effect size N. in group Mean SD P Value within group P value betwee n group Effect size (Franca , 2008) C-CFT (mmHg) Isometric Neck Muscle Strength (INMS) PT+AC UP ACUP PT 16 15 15 22.0 22.0 20.0 1.4 1 1.4 1 1.4 1 16 15 15 27.1 23.7 20.9 2 1.4 1.4 P<0.00 1 P<0.00 1 P<0.00 1 P<0.00 01 PT+ACUP /ACUP= 3.4 ACUP/PT = 2.8 PT/PT+ ACUP =6.2 16 15 15 26.1 23.0 23.2 2.4 1.6 1.4 P<0.00 01 P=0.00 04 P<0.00 01 P=0.00 06 PT+AC UP/AC UP = 4 ACUP/ PT = -2 PT/PT+ ACUP = 2 *OM = Outcome Measures; SD = Standard Deviation; C-CFT = Cranio-Cervical Flexion Test; INMS = Isometric Neck Muscle Strength; PT+ACUP = Physiotherapy plus Acupuncture group; ACUP = Acupuncture group; PT = Physiotherapy group Shoulder Function In Johansson et al. (2011) study, combining physiotherapy with acupuncture significantly improved shoulder functionality. In particular, the intervention group had considerably better shoulder functioning than the control group (< 0.001) (Table 10). There were no significant variations in shoulder functioning between the physiotherapy plus corticosteroid group and the physiotherapy plus acupuncture group, according to Johansson et al. (2011). As such, the two combinations were both effective techniques for treating MSK complications. Table 10 - Results of effects on Shoulder Function First OM GROUPS Pre-Intervention 12-mon th follow-up Author (Year) N. in grou p Mean SD P Value between groups 95% CI N. in group Mean SD P Value between groups Effec t size 95% CI of the mean (Johansoon , 2011) Shoulder Function PT + Corticost PT+ACUP 49 42 69 70 12 12 P<0.001 66-73 67-74 37 32 88 91 -19 P<0.001 -3 84-92 88-95 *OM = Outcome Measures; SD = Standard Deviation; PT = Physiotherapy; ACU = Acupuncture; CI = Confident Interval; PT+Corticost = Physiotherapy plus Corticosteroids group; PT+ACUP = Physiotherapy plus Acupuncture group WOMAC score In another study, Chen et al. (2013) examined whether there were differences in reported WOMAC scores between patients treated with a combination of true acupuncture and physiotherapy, and a combination of sham acupuncture and physiotherapy. The target population for Chen's et al. (2013) study was patients with knee and hip osteoarthritis. In their findings, Chen et al. (2013) reported no significant differences between the two groups. Notably, the respective WOMAC scores for the physiotherapy + sham acupuncture group and physiotherapy + true acupuncture group were 30.3% and 31.6%. Based on the ANOVA results reported, the WOMAC scores for the two groups were not significantly different (p = 0.148) (Table 11). Table 11 - Results of effects on WOMAC score First OM GROUPS Pre-Intervention 26 weeks Post-Intervention Author (Year) N. in group Mean SD P Value N. in group Mean P Value Effect size 95% CI of the mean (Chen, 2013) WOMAC PT+ACUP PT+SHAM 105 109 47.6 44.0 14.7 15.7 P=0.097 71 82 41.5 37.2 P=0.148 4.3 37.6-45.4 32.8-41.6 *OM = Outcome Measures; SD = Standard Deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group Constant Shoulder Assessment (CSA) The Constant Shoulder Assessment (CSA) score is used to evaluate shoulder functionality before and after a treatment has been administered. The CSA scale ranges between 0 and 100, with higher scores representing better shoulder functionality while lower scores representing minimal shoulder functionality. The CSA scale is designed such that it measures four outcomes associated with shoulder functionality: pain, range of motion, strength scores, and activities of daily living. The respective scores of the four indicators of shoulder functionality - pain, range of motion, strength scores, and activities of daily living – are 15, 40, 25, and 20. In a frozen shoulder study conducted by Sun et al. (2001), the CSA scale was used to assess shoulder functionality following intervention using two treatment modalities: physiotherapy + acupuncture and physiotherapy. Sun et al. (2001) only

measured shoulder functionality using two of the four CSA outcomes; activities of daily living and pain. As per Sun et al. (2001) findings, the physiotherapy + acupuncture group showed significantly higher CSA scores as compared to the physiotherapy alone group (p = 0.048) (Table 12). Table 12 - Results of effects on CSA First OM GROUPS Pre-Intervention 20 weeks follow-up Author (Year) N. in group Mean SD P Value N. in group Mean SD P Value Effect size (Sun, 2001) CSA PT+ACUP PT 13 22 41.3 42.8 14.9 14.0 0.9651 13 22 67.3 57.9 11.5 15.1 0.048 9.4 *OM = Outcome Measures; SD = Standard Deviation; CSA = Constant Shoulder Assessment; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT = Physiotherapy group Medication Effects In another study, Tsang et al. (2007) examined whether significant differences in analgesic consumption existed between two groups of patients. The first group was treated with a combination of true acupuncture + physiotherapy, while the second group was treated with sham acupuncture + physiotherapy. However, there were no significant differences in analgesic consumption between the two groups (p = 0.447). However, the authors did not report the baseline measures of analgesic consumption for both groups hence limiting the interpretability of their findings (Table 13). Table 13 - Results of effects on Medication Effects First Author OM Group Int. or Ctrl Pre-Intervention Post-Intervention (Year) N. in group Mean SD P Value N. in group Mean SD P Value Effect size 95% CI of the mean difference (Tsang, 2007) Analgesic Consumpt ion PT+ACUP PT+SHAM NOT MENTION 15 15 28.3 24.7 11.6 13,8 0.447 -3.6 - 13.2 to 6.0 *OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group QUALITATIVE ANALYSIS ACCORDING TO CONDITIONS Knee Osteoarthritis Three of the studies looked at the benefits of physiotherapy combined with acupuncture on knee osteoarthritis patients. ((Tsang, 2007) (Chen, 2013) (Foster, 2007)). There were no significant changes in overall mean pain ratings at rest (p=0.463) or at maximum (p=0.177), according to Tsang et al (2007) (Table 14). Acupuncture was shown to be no better than sham acupuncture for relieving pain in knee osteoarthritis patients in this study. Tsang et al (2007) looked examined analgesic intake (Table 13) and found no significant differences across groups, comparable to the prior findings (p=0.447). The same conclusions were found while assessing TUG, with p=0.929. Table 14 - Results of effects on overall pain - Tsang et al.(2007) First OM GROUPS Baseline (Pre-Intervention) Post-Intervention Author (Year) N. in group Mea n SD P Value N. in group Mea n SD P Value Effect size 95% CI (Tsang, 2007) Pain level at rest PT+ACUP PT+SHAM 15 15 2.1 1.5 1.7 1.9 0.424 15 15 2.2 2.6 1.4 1.2 0.463 0.4 - 0.6 to 1.3 Pain level at maximum PT+ACUP PT+SHAM 15 15 6.6 7.0 1.5 2.9 0.536 15 15 6.5 5.7 1.5 1.7 0.177 -0.8 - 2.0 to 0.4 *OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group Chen et al (2013) also investigated Knee Osteoarthritis, where they compared Physiotherapy Plus True Acupuncture as the intervention group with Physiotherapy plus Sham Acupuncture as the Control group, for the outcome pain, assessed by VAS. No differences between the two groups were demonstrated (Table 15). The same result was observed when assessing gait with 6MWT (6-minute walk test) (Table 6), where there were no significant differences between the two groups in terms of 6MWT scores (p = 0.562). Another outcome measure used by Chen et al. (2013) was WOMAC (Table 11). There were no significant differences between the two groups, according to the cumulative distribution curves that depict all potential definitions of clinical reactions on the WOMAC scale. Table 15 - Results of effects on pain - Chen et al.(2013) First OM GROUPS Baseline (Pre-Intervention) 26 weeks Post-Intervention Author (Year) N. in grou pMea n SD P Value N. in group Mea n SD P Value Effect size 95% CI (Chen, 2013) BPI/VAS PT+ACUP PT+SHAM 105 109 5.6 5.7 2.0 1.9 P=0.528 71 82 4.54 4.69 P=0.78 0 -0.15 4.03 to 5.04 4.23 to 5.15 *OM = Outcome Measures; SD = Standard Deviation; BPI/VAS = Brief Pain Inventory/Visual analogic scale; CI = Confident Interval; PT+ACUP = Physiotherapy plus Acupuncture group; PT+SHAM = Physiotherapy plus Sham Acupuncture group When compared to counsel and exercise done independently, Foster et al (2007) found that acupuncture administered by physiotherapists as part of an integrated healthcare package that included advice and exercise for individuals with knee osteoarthritis offered no further improvement in pain ratings. The findings can be linked to the understanding that non-penetrating acupuncture helps in obtaining the benefits linked to acupuncture whereas avoiding the negatives impacts experienced under the latter (Foster, 2007) (Table 16). Table 16 - Results of effects on pain and function - Foster et al.(2007) First Author OM GROUPS Baseline (Pre-Intervention) After 12 months (Year) N. in group Mean SD P Value N. in group Mean SD P Value Effect size 95% CI (Foster, 2007) Pain PT ACUP 116 117 9.1 9.3 3.7 4.0 98 99 2.57 2.37 4.3 4.2 P=0.50 PT/ACUP = -0.42* ACUP/PT+ ACUP = -0.45 -1.5 to 0.7* PT+ACUP 119 8.9 3.3 105 2.82 4.1 P=0.70 PT/PT+ ACUP = -0.23* -0.9 to 1.3* Function PT ACUP 116 117 29.0 30.8 12.9 13.9 97 100 5.36 6.61 11.9 13.8 P=0.90 PT/ACUP = -0.23* ACUP/PT+ ACUP = -1.63 -3.2 to 3.6* PT+ACUP 119 31.1 12.8 104 8.24 13.5 P=0.10 PT/PT+ ACUP = -2.52* -0.9 to 6.0* OM = Outcome Measures; SD = Standard Deviation; CI = Confident Interval; PT = Physiotherapy group; ACUP = Acupuncture group; PT+ACUP = Physiotherapy plus Acupuncture group. Low Back Pain Two studies have analyzed the effects of Physiotherapy in combination with Acupuncture in Low back pain ((Bishop, 2016) (Kizhakkeveettil, 2017)). The results of Bishop et al. (2016) study reported that the combined intervention of physiotherapy with true acupuncture was better in reducing the patient's reported disability levels (as measure by ODI) (Table 8), as compared to standard care intervention and standard care plus non-penetrating acupuncture. These improvements in disability were greater after 8 weeks of treatment with physiotherapy and acupuncture. Furthermore, Bishop et al. (2016) identified that the successful implementation of RCTs, in testing acupuncture, should use three methods that include a brief screening questionnaire, the community midwives who offered the EASE Back Study and the self-

referral of the women to research following increased awareness. This assessment was done in women in their early stages of pregnancy. The research by Bishop et al. (2016) further recommended the application of Pelvic Girdle Questionnaire (PGQ) as the recommended primary outcome in conducting the random controlled trial relating to acupuncture. However, the research recommends that a long-term follow-up study be conducted in order to identify evidence of acupuncture's effectiveness and, as a consequence, inform current practice. In the study conducted by Kizhakkeveettil et al. (2017) (Figure 2), an improvement in healthcare outcomes was reported in all the three groups. However, there were no significant differences in the degree of post-intervention improvement among the three groups. As such, the findings of Kizhakkeveettil et al. (2017) indicated the need for large-scale RCTs that examine the efficacy of combining acupuncture and SMT, as compared to using acupuncture along, in treating lower back pain. Shoulder Disorders Sun et al (2001) and Johansson et al (2011) evaluated the effectiveness of combining conventional physiotherapy treatment with acupuncture in Frozen Shoulder and Subacromial Impingement Syndrome, respectively. Sun et al (2001) found that after 6-weeks follow-up, the intervention group's CSA scores (Table 12) were substantially higher than the control group, with a p-value of 0.048. (Table 12). For the assessment of shoulder function in Subacromial Impingement Syndrome, Johansson et al. (2011) used the AL-score as an outcome measure (Table 10). With a $p<0.001$ significance, both groups reported a substantial improvement in shoulder function over time. Tension Neck Syndrome Franca et al (2008) implemented a comparative clinical trial investigating the impact of acupuncture with physiotherapy in treating Tension Neck syndrome. The findings of the study identified that physiotherapy which is linked with acupuncture contributes to lowered pain intensity and tension of the muscles, other benefits linked with acupuncture include lowering disability and enhancing the isometric neck muscle strength among individuals with tension neck syndrome. The research by Franca et al (2008) also outlines that acupuncture, when implemented in conjunction with physiotherapy, individuals with musculoskeletal diseases benefit from favorable outcomes in rehabilitation. The study indicated that tension neck syndrome is common among women and is also highly related to computer users due to its high prevalence among the office workers, the students, and other professionals in white collar jobs (Table 7, 8 and 9). Discussion SUMMARY OF FINDINGS The goal of this systematic review of RCTs was to look at what is currently known about using acupuncture as an adjuvant therapy to physiotherapy in the treatment of musculoskeletal problems. A total of 960 people with clinical musculoskeletal disorders were included in the systematic review of literature, which included eight trials (knee osteoarthritis, tension neck syndrome, subacromial impingement, low back pain, and frozen shoulder). Medication and physiotherapeutic therapy, acupuncture, placebo, and sham were among the therapies used in the investigations. Physiotherapy with acupuncture was compared to Physiotherapy with Sham Acupuncture in two trials ((Tsang, 2007) (Chen, 2013)). Sun et al. (2001) examined the efficacy of physiotherapy alone against physiotherapy coupled with acupuncture in one research. In another study, Johansson et al. (2011) looked at whether there were any significant changes between two groups: one was given corticosteroids and home exercises, while the other was given acupuncture and home exercises. Of the remaining studies, two compared effectiveness of acupuncture among three groups; physiotherapy alone, acupuncture alone, and acupuncture plus physiotherapy (Franca, 2008; Kizhakkeveettil, 2017). Physiotherapy alone, physiotherapy with actual acupuncture, and physiotherapy plus sham acupuncture were the subjects of the last two experiments (Foster, 2007; Bishop, 2016). The most often evaluated result was pain since it was examined in five of the eight studies reviewed. Pain was measured using various scales such as VAS (Franca, 2008), AL-SCORE (Johansson et al., 2011), the WOMAC score (Chen, 2013; Foster, 2007), and NPRS (Bishop, 2016; Kizhakkeveettil, 2017; Tsang, 2007). Apart from pain, other outcome measures assessed were active and passive ROM, (Tsang, 2007), shoulder assessment using the AL-SCORE (Johansson et al., 2011), the CSA score (Sun et al., 2001), and the quality-of-life measure using EQ-5D-5L scale (Tsang, 2007). The key findings for this systematic review are that there is no difference between adding Acupuncture to Physiotherapy when evaluating and treating for different kinds of pain. Despite the negative results on combining Acupuncture with Physiotherapy in evaluating pain, the combination has yielded several other significant results. For instance, combining Acupuncture with Physiotherapy was found to relieve muscular tensions, alleviated the effects of osteoarthritis, improved functional disability, and enhanced the mobility of frozen shoulders. LIMITATIONS OF THE REVIEW AND INCLUDED STUDIES The PEDro Scale was used to assess the risk of bias in the included studies, which is a factor that has the potential to alter the authenticity and validity of the study findings (Nedel, 2016). While all the studies selected were RCTs, Sun et al. (2001) failed to report on allocation concealment measures they implemented to ensure participants in the control and intervention groups had no way of finding out the 74 | P a g e group to which they had been allocated. Similarly, there were other several studies that failed to report on whether blinding was used or not (Bishop et al., 2016; Foster et al., 2007; Kizhakkeveettil et al., 2017). Chen et al. (2013) failed to report their measures at baseline (prior to implementing the interventions). In Johansson's et al. (2011), 85% of outcome measures were not reported. Sun et al. (2001) and Chen et al. (2013) are the only studies in which blinding of assessors was reported to have been conducted. Blinding in experimental physiotherapy studies is quite challenging since the therapists already have knowledge of physiotherapy and acupuncture, and probably have their own perceptions of the effectiveness of these techniques. According to Chen et al. (2013), although blinding minimizes the risk of bias in experimental studies, therapists' individual perceptions of the technique may influence the study results even with blinding. Two independent reviewers assessed the risk of bias in the current study and determined it to be within acceptable bounds. The minimal number of papers

included in the meta-analysis was another constraint of this research, in addition to the issue of blinding. The minimal number of papers included in the meta-analysis was another constraint of this research, in addition to the issue of blinding (Huedo-Medina, 2006). To calculate the percentage of variability between the studies, the I2 test was applied in testing the variance (Hollis, 1999). There was evidence of heterogeneity in the two studies ((Bishop, 2016); (Kizhakkeveettil, 2017)) which examined the effect of Physiotherapy compared to the combination of Physiotherapy and Acupuncture on pain. This may indicate that the two populations are not similar, and the results may be affected. COMPARISON WITH OTHER STUDIES OR REVIEWS Evidence from other literature also indicates acupuncture works well in conjunction with other treatments (Liu, 2015). However, this is the first systematic research comparing the efficacy of acupuncture alone with acupuncture coupled with physiotherapy. Additionally, the researcher only focused on RCTs whose evidence is more valuable as compared to predictive studies. RECOMMENDATIONS FOR FUTURE PRACTICE Based on the findings and limitations of the systematic review conducted, it is recommended that future researchers on the same subject should ensure proper blinding and allocation is conducted. In most 75 | P a g e of the studies included in this systematic review, information on how blinding and allocation was conducted was not reported. Additionally, future scholars on the same subject should consider narrowing down their target population to reduce heterogeneity of the study populations. More research on the issue of acupuncture as an auxiliary modality in physiotherapy is also advised to improve evidence for or against the intervention. Although blinding participants and therapists was shown to lessen bias in the literature, additional studies are needed to determine if blinding is effective in physiotherapy and acupuncture sessions. In future research, scholars can reduce the effects of heterogeneity by including participants with specific characteristics either in terms of age, race, education levels or a particular geographic region of a particular country of interest. IMPLICATIONS FOR CLINICAL PRACTICE Over the last few decades, there has been a gradual increase in the study and application of acupuncture among physiotherapists across the globe (Dascanio, 2018). However, just a few researches on the effectiveness of a combination of acupuncture and physiotherapy for MSK disorders have been undertaken. The findings of this systematic review reveal a significantly larger effect of physiotherapy plus acupuncture as compared to physiotherapy alone. As a result, acupuncture combined with regular physiotherapy might be utilized to treat MSK conditions, particularly in the shoulder and neck. However, more research is needed to provide more evidence on the same. Conclusion A comprehensive evaluation of the literature and critical appraisal of evidence for or against the effectiveness of acupuncture as an adjuvant treatment modality to physiotherapy in the treatment of MSK symptoms was part of this study. Evidence reveals acupuncture has been extensively studied and applied as a complementary or integrative therapy for pain management. More study is still needed to determine the effectiveness of combining acupuncture with physiotherapy. In 2012, the United States spent more than $30 billion on alternative medical procedures including acupuncture (Ambrosio, 2012). As a result, more study into the efficacy of acupuncture is required. CHAPTER 4: SURVEY This chapter will provide the methodology, results and discussion of a survey undertaken among registered physiotherapists in the UAE and SA to: I. establish the profile of physiotherapists who are using acupuncture in the clinical practice. II. explore the views of physiotherapists regarding the inclusion of Acupuncture in the Physiotherapy Curriculum. Specific Objectives The specific objectives of this study include the following: I. Investigate whether physiotherapists, in the determined regions, are trained in performing acupuncture. II. III. Identify the level of specialization in acupuncture that is more common among physiotherapists. Establish the frequency of the use of acupuncture as a treatment modality among IV. V. physiotherapists. Identify the most common conditions treated by physiotherapists using acupuncture as a sole intervention or as an adjunct to physiotherapy treatment. Describe the opinion of physiotherapists regarding the inclusion of acupuncture in the physiotherapy curriculum and at which level. Methodology STUDY DESIGN The study used a quantitative cross-sectional survey approach. SAMPLING A convenient sample of physiotherapists registered with the respective Physiotherapy Societies and Associations within South Africa and the UAE were included in the study. The South African Society of Physiotherapy (SASP) and the Physiotherapy Association of South Africa (PASA) and the Emirates Physiotherapy Society (EPS) were approached to distribute the questionnaire, via email through their social networks. These countries were purposively selected based on the language and familiarity the researcher has with the organizations. ELIGIBILITY Participants that were eligible for inclusion in the study met the following inclusion criteria: ? All physiotherapists registered with professional authorities in their country of practice ? All active physiotherapists treating patients for the past 6 months and who agree to participate in the Survey. ? Are either practitioners in South Africa or the United Arab Emirates ? There were no exclusion criteria SAMPLE SIZE CALCULATION According to WCPT, the number of Physiotherapist registered in 2019 in the South Africa Society of Physiotherapy (SASP) was 7,937, unfortunately that number of register Physiotherapists in Physiotherapy Association of South Africa (PASA) was not disclosed. In the Emirates Physiotherapy Society (EPS) the number was 200 (WCPT, 2019). The total expected population would be 8137 registered Physiotherapists. We used a known electronic software link method to calculate the sample size (Raosoft, 2019). The samples sizes were calculated based on the assumption that at least 12% of registered physiotherapists will be acupuncture practicing physiotherapists (Therdoost, 2017) with a 5% margin of error and 95% confidence level. The final sample size required was 160 as shown in table 17 below: Table 17 - Final sample size calculation Margin of Error Confidence level Total Population Response distribution Recommended Sample size 5% 95% 8137 12% 160 INSTRUMENTATION An English self-developed online questionnaire (Attachment 6) using the free version of Survey Monkey (Surveymonkey.inc,

1999) was developed that included the following sections: demographic information; the number of years practicing; qualifications; area of expertise; and the use of acupuncture and the perceived level of agreement for the inclusion of acupuncture in undergraduate curricular. Participants were also allowed to provide qualitative information in a comments section. Justification for the inclusion of each section and/or item of the questionnaire can be found in Attachment 6.1. For this research survey, different types of questions were chosen such as open-ended questions, multiple-choice, dichotomic, and Likert scale questions. Open-ended questions In open questions, respondents are free to respond in their own words, without being limited to choosing among a list of alternatives (Fielding et al., 2013). According to Mattar (1994), the main advantages of the questions are that they allow for a better assessment of attitudes towards the analysis of structured questions; encourage cooperation; require less elaboration time; provide comments; meaningful explanations, and clarifications to interpret and analyze the questions with closed answers avoiding the danger existing in the case of closed questions of the researcher failing to list any significant attempt in the list of options. Its disadvantages, also according to Mattar (1994) are that they give rise to the interviewer's partiality in the compilation of answers since there is no clear pattern of possible answers, thus it is difficult to code the answers and their consequent compilation; when done through self-completed questionnaires, they bump into the writing difficulties of most people, and even with the "laziness" of writing; they are less objective, as the respondent may digress and even evade the subject; they are more costly and time-consuming to analyze than other types of questions. Taking everything mentioned into account, in the survey used in this research they were only used at the beginning of the questionnaire to collect demographic data and at the end to search for opinions. Multiple choice In the multiple-choice questions, used in the questionnaire of this study in questions 1 and 15, respondents might choose one of the options or a limited number of possibilities. (Pope et al., 2010). When preparing multiple answer questions, the researcher is faced with two essential aspects: the number of alternatives offered and position biases (Pope et al., 2010)(Krosnick & Presser, 2009). Some important considerations related to multiple-choice issues can be pointed out. The alternatives must be collectively exhaustive and mutually exclusive, that is, they must cover all possible answers and one alternative must be totally incompatible with all the others (Mattar, 1994) (Pope et al., 2010) The alternative "Others" used in this questionnaire in question number 15 was a great help in ensuring the exclusion (Mattar, 1994). According to Mattar (1994), the main advantages include improved response speed, ease of application, process, and analysis, and little possibility of errors. The disadvantages are that: they require a lot of care and preparation time to ensure that all answer options are offered; if any important alternatives were not previously included, strong biases can occur, even when the "Others" alternative is being offered (Mattar, 1994). Dichotomic questions The dichotomous questions used in this study in questions 1, 2, and 3 are those that have only two answer options, of bipolar character, of the type yes/no; agree/disagree; like/dislike (Krosnick & Presser, 2009). A third option is occasionally presented, implying ignorance or a lack of opinion on the matter. The inclusion of these types of answers is, on the one hand, inadvisable, as it can serve as an escape for those who do not wish to take a stand (Krosnick & Presser, 2009). On the other hand, the lack of this option can cause difficulties for many people, who, seeing themselves forced to choose between one of the bipolar alternatives, end up giving misleading answers (Krosnick & Presser, 2009). The dichotomous answer is adequate to many questions that refer to questions of fact, as well as problems that are clear and about which there are well-grounded opinions. The key advantages, according to Mattar (1994), are: speed and ease of application, procedure, and analysis; ease and speed in the act of answering; lesser danger of interviewer bias; low probability of error; and they are extremely objective. In terms of drawbacks, Mattar (1994) lists the following: polarization of responses and/or the possibility of forcing responses in relation to a range of opinions ; they can lead to medication errors if the topic is treated in a dichotomous manner when it actually presents several alternatives, such as total agreement and total disagreement; they can lead to systematic errors if the topic is treated in a dichotomous manner when it actually presents several alternatives, such as total agreement and total disagreement; they can lead to medication errors if the topic is treated in a dichotomy (Krosnick & Presser, 2009). Likert Scale The Likert scale was employed in this study on questions 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 since it is one of the most common approaches for conducting opinion surveys (Krosnick & Presser, 2009) (Medina, C., 2011). In contrast to a binary question, the Likert scale questions begin with a self-descriptive statement, followed by a point scale with language descriptors that consider extremes - such as "completely agree" and "absolutely disagree" (Medina, C., 2011). As a result, different levels of strength of opinion on the same subject or issue might be discovered. The answer categories must account for the plurality of feelings that the respondent should express and, of course, those that the researcher actually wants to map. The structure must be similar in all questions in the questionnaire, which facilitates its completion and subsequent analysis (Medina, C., 2011). In the case of a 5-point scale, a totally positive item, a partially positive, a neutral, a partially negative, and, finally, a negative item should be elaborated (Krosnick & Presser, 2009) (Medina, C., 2011). The ease of construction and handling of the scale are advantages; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which is more difficult to answer and could harm the research result; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which is more difficult to answer and could harm the research result; it reduces the risk of asking very broad questions or only having the option of answering "Yes/No," which could harm the research result; and it Because the scale is quite visible, the respondent immediately grasps the logic of it and can readily compare and edit the filled elements (Medina, C., 2011) (Mattar, 1994). The disadvantages include the difficulty of working with neutral items, such as "indifferent,"

where the response provides little practical applicable information; respondents have a tendency to easily agree with their statements without often analyzing their feelings in relation to the question; and there may be a sense of automatism and impulsiveness in the response; the number of scale points can also bring problems, fewer points seem to make the answers easier - that is, safer for the respondents, with the increase in the number of points, you gain in psychometric consistency, but you lose in safety already that people have more difficulty choosing the number that best reflects their opinion about a given statement (Mattar, 1994). RELIABILITY AND VALIDITY To ensure content validity, six experts from each country were asked to determine if there is an appropriate representation of questions that reflect the purpose of the research. The experts were identified by their expertise on the field of survey research in MSK (two experts), by their years of physiotherapy practice, in this case more than five years (two experts) and by physiotherapy that have post graduate studies in acupuncture (two experts). Face validity was established by piloting the questionnaire with a group of 10 physiotherapists in each country, for the purpose of internal reliability after 48hours the survey were sent again to these 10 physiotherapists to ensure consistency of the responses. The essence of conducting validity and reliability tests is to examine the feasibility of the questionnaire in collecting specific data aimed at addressing the questions in the study. There were no changes made to the original questionnaire in terms of questions and arrangement. However, the experts recommended the use of much easier and direct words to ease participant understanding of the survey questions and answering. PROCEDURE The Human Research Ethics Committee Faculty of Health Sciences at the University of Cape Town granted the project ethical permission (HREC REF:641/2018 - Attachment 7). Permission to distribute the questionnaire to their members were obtained from the SASP, PASA and EPS. A pilot study was conducted with 10 people from each country to confirm face validity. The electronic questionnaire link was sent to the head office of PASA, SASP and EPS for distribution to its members. A two-week reminder was sent to associations and societies to resend the questionnaire until the required sample size was achieved. The researcher relied only on the distribution of the questionnaire via the participating organizations. DATA MANAGEMENT AND STATISTICAL ANALYSIS Survey Monkey (Surveymonkey.inc, 1999) data was moved to an excel spreadsheet and then exported to SPSS Version 25 for analysis. After exporting the Excel spreadsheet to SPSS, coding was done for statistical analysis. Demographic data were analyzed using descriptive statistics. Descriptive data were presented through the use of tables and graphs and presented as frequencies for numerical data. Significant differences between country of registration and sex were detected using the Chi-square test, and mean age was determined using the T-test, with p set at >0.05. Graded questions were recoded into ordinal data. Generally, all the questions were intended to collect different types of categorical data; dichotomous, ordinal, and nominal data. Descriptive content analysis was used to extract meaning from additional comments made by participants. The comments were read through and specific units were identified, using terms from the narrative, categories were developed (Cresswell, 2003). These categories were merged into themes for presentation. ETHICAL CONSIDERATIONS The study protocol was submitted to the Human Research Ethical Committee of the University of Cape Town for approval (HREC REF: 641/2018). The data collection process did not commence until the proposal was accepted by the Ethical Committee of the University of Cape Town. As such, receiving approval from the committee qualifies the study as adhering to the appropriate ethical standards. Before completing the online survey, potential participants were asked to read a Participant Information Sheet outlining the objectives of the survey and the nature of the questions included. (Attachment 9). The online survey only started after consent was given. Participants have the option to leave the research at any time. The survey was anonymous, and no personal data allowing identification of participants were included, except for the demographic data needed for analysis: age, sex, country of professional practice, and country of study. The benefit of this study was that researchers could make recommendations concerning the use of acupuncture in physiotherapy practice. There were no personal risk or benefit associated with participation. In terms of Justice every participant that replied to our study, was included in the study. The information collected was used only for the intended purpose of the study. After data analysis, data were stored on memory sticks and deleted from a personal computer. Stored data are password protected and stored in a locked room, with access restricted to the researcher. Data will remain available for five years, after which data will be destroyed. This study protocol complies with the principles laid down in the Declaration of Helsinki 2013 (American Medical Association, 2013). Results of the Survey DEMOGRAPHIC DETAIL Based on the SurveyMonkey platform a total of 283 physiotherapists took part in the study but only 64% (181 participants) have completed the entire questionnaire. There was an estimated response time of 6 minutes for the completion of the entire survey by a participant. A greater proportion was from South Africa (60.2%) (Table 18). There were significantly more male participants in UAE (40.3%), that is, more male physiotherapists from the United Arab Emirates responded to the survey questionnaire than those from South Africa compared to South Africa (11%) (Table 18, p<0.001). The mean age of the participants was 41.2 years (SD=11.9). Table 18 - Cross Tabulation of Country of Registration and Sex (n-181) Sex: South Africa UAE Row Totals M 12 29 41 11.0% 40.3% F 97 43 140 89.0% 59.7% Total 109 72 181 60.2% 39.8% ChiSq=21.20, p<.001 Most of the Physiotherapists had a Bachelor's level qualification (n=110), followed by a Masters (n=54), seven having a certificate level qualification and four with a PhD. (Figure 4) Figure 4 - Qualification level of the sample (n=181) TRAINING IN ACUPUNCTURE Sixty-two respondents (34.25%) reported that they had specialized in acupuncture. A higher percentage of respondents working in South Africa reported specialization 39.4% compared to the UAE (26.4%), there was no association between country and specialization (table 19). Table 19 - Specialization in Acupuncture across country of registration Country of Work:

Specialized in Acupuncture Specialized in Acupuncture No Yes Row Totals South Africa 66 60.6% UAE 53 All Grps Chi-sq=3.28, p=0.07 73.6% 119 43 39.4% 19 26.4% 62 109 72 181 Among those who have indicated that they had specialized in acupuncture, 71% had gained a certificate, 9.5% a diploma, 19% a MSc and 1 person obtained a PhD. Even though 62 participants indicated to having a qualification, 93 participants said they were practicing acupuncture, with the most practicing for 0-2 years followed by more than 12 years (Fig 5). Figure 5 - Length of years Practicing Acupuncture (n=93) USE OF ACUPUNCTURE BY PHYSIOTHERAPISTS Most physiotherapists (69%) use acupuncture on a regular basis in their practice, with usage ranging from sometimes to always. As evidenced in the figure 6 below. 16% of physiotherapists always used acupuncture in their treatment practice compared to 21 % that did not use it at all. Figure 6 - Frequency of use of acupuncture (n=181) MOST COMMON CONDITIONS TREATED USING ACUPUNCTURE The most common conditions treated using acupuncture included. 90 80 70 60 Frequency 50 40 30 20 10 0 Condition Figure 7 - Frequency of Conditions treated with Acupuncture INCLUSION IN UNDERGRADUATE CURRICULUM AND PRACTICE The number of participants who agreed or disagreed with the inclusion of acupuncture in the curriculum did not change significantly (table 20). Table 20 - Responses to inclusion of Acupuncture in Curriculum (n=147 Missing=34) Country of Registration Acupuncture Acupuncture Y N Row Totals Count SA 47 40 87 Row Percent 54.02% Count UAE 41 45.98% 19 60 Row Percent 68.33% Count Total 88 31.67% 59 147 Chi-Sq =3.03, p=.082 The rank ordering of replies in the two countries on whether acupuncture should be offered as an option, whether every student should be exposed to acupuncture, and the value of acupuncture in the practice of physiotherapy differed significantly ($p<0.05$) (Table 21). Majority of the participants in South Africa neither supported nor were against the inclusion of Acupuncture in Physiotherapy curriculum as an elective course. However, in the UAE, majority of the participants were in favor of acupuncture being included as an elective course. In terms of the number of participants, 15.7% for SA and 19.4% were against the inclusion of acupuncture as an elective course. In terms of training, majority of participants agreed that to be a specialist in acupuncture, there is need for more and expansive training and experience. The participants further responded that not being able to practice acupuncture or being trained in acupuncture did not impact their physiotherapy qualification and practice. In SA perhaps, 33.3% did not believe that lack of acupuncture training derailed or negatively impacted their practice. They however agreed that acupuncture training and practice was and is important in physiotherapy practice (34.8% and 27.8% respectively). Table 21 - Responses related to acupuncture in Physiotherapy South Africa UAE Adjusted P Z-score Count Column N % Count Column N % Acupuncture should be included in the physiotherapy Strongly agree Agree 16 31 14.8% 28.7% 19 22 26.4% 30.6% -2.406 0.02 curriculum as an elective course. To what extent do you agree with this Neither agree nor disagree Disagree 21 17 19.4% 15.7% 12 14 16.7% 19.4% statement? Strongly 23 21.3% 5 6.9% disagree physiotherapy should be given thorough training in Strongly agree Neither agree nor disagree 20 23 18.5% 21.3% 19 11 26.4% 15.3% Every student Agree 14 13.0% 19 26.4% -2.659 0.01 pursuing acupuncture. To what extent do you agree with this statement? Disagree Strongly disagree 30 27.8% 21 19.4% 17 6 23.6% 8.3% How important is acupuncture to the overall field of Important Very important 37 11 34.3% 10.2% 14 20 19.4% 27.8% -0.517 0.61 physiotherapy? Neither important nor unimportant Not important 34 15 31.5% 13.9% 22 12 30.6% 16.7% Absolutely 11 10.2% 4 5.6% unimportant practice could be effective physiotherapy professional Absolutely false Neither true nor false 33 21 30.6% 19.4% 12 23 16.7% 31.9% Without False 36 33.3% 15 20.8% 3.274 0.00 acupuncture significantly compromised. To what extent do you agree with this statement? True Very true 13 5 12.0% 4.6% 16 6 22.2% 8.3% CONTENT ANALYSIS OF ADDITIONAL COMMENTS RELATED TO THE INCLUSION IN UNDERGRADUATE CURRICULUM Units Category Theme Dry needling versus acupuncture Anatomical knowledge, evidence, no place in physiotherapy, very different Fits better Treatment modality Double Advantage, treating patients physically and emotionally, passive treatment Toolbox Time Short courses, post-graduate Overloaded Curriculum The emerging themes included: Fits Better, Toolbox and Overloaded curriculum. Fits Better Most participants who provided comments felt that Dry needling was a better suited to physiotherapy than acupuncture. Reasons for this belief were linked to the philosophical bases for acupuncture and the anatomical approach to dry needling Participant 30: "It should rather be Dry needling than Acupuncture. It fits better with physio models of trigger points and massage techniques where one can put needles in the Trigger points. Acupuncture is totally different. I have done both." Participant 6: "Dry needling is just as effective, but an acupuncture (Chinese medicine) background opens a whole new way of thinking." Toolbox This theme refers to acupuncture seen as a modality that could be included as part of physiotherapy treatment. Some participants see adding acupuncture as promoting a holistic approach to patient care. 90 | P a g e Participant 80: "Acupuncture is a toll which should be available to the therapist as a treatment modality (amongst others) to compliment all other manual therapy techniques. It does not weight high up on the scale of treatment modalities available." Participant 128: "I think acupuncture will help in treating patients physically and psychologically" Participant 36: "The understanding of how acupuncture might have evolved is interesting and good to explore. Physios should understand the current scientific mechanisms behind the effects of acupuncture. Acupuncture/dry needling is an optional tool. I studied acupuncture before dry needling in a fair amount of depth and found that acupuncture was better knowledge for targeting a treatment at a zone without irritating an already irritable tissue" Overloaded Curriculum The perception is that Acupuncture required too intensive training and the undergraduate physiotherapy curriculum was already tough and overloaded. They were not convinced that acupuncture was appropriate for inclusion at undergraduate level and felt it should be a post graduate option. Participant 37: "Acupuncture is a useful addition to musculoskeletal treatment, but

effective treatment is possible without it. I find it useful for extremely sore patients or highly stressed patients. It is unnecessary to complicate an already full course by adding Dry needling and acupuncture" Participant 42: "For my opinion it shouldn't be given in the college, while you're a student. It's a course that physios should take after at least 1-2 years of clinical practice". Discussion SAMPLE The success rate of a study lay in the number of participants involved and the credibility of the survey answers given. The sample size of 160 was achieved to obtain a 95% confidence level in the results. The complete response rate of 64%, can be questionable based on the total estimated sample. A limitation of the study could be the dependence on the participating societies for distribution of the questionnaire. It is unknown what database or criteria was used for distribution. A response rate of 64% suggests that the questionnaire was only sent to 283 individuals. More females than males responded to the survey, with a larger proportion of males being from the UAE. However, traditionally, Physiotherapy is a predominantly female profession, and studies show a percentage of 70% to 80% of women in the profession (Louw, 2021). According to Moreira (1999), in the history of mankind, male labor relationships were related to physical strength and abstraction, while female relationships were linked to sensitivity and observation. Perhaps this justifies, in part, the great inclusion of women in physiotherapy (Moreira, 1999). There were significantly more physiotherapists females responding to the survey in South Africa than in the UAE. This parity in physiotherapy professionalism may be attributed to the impact of culture on female education; noteworthy, in the UAE compared to South Africa, the nature of the society and responsibilities associated with women limits their exposure and their interest in physiotherapy (Alkaabi, 2018). Moreover, in the UAE some career choices especially careers in medicine are gendered with the female population more likely to follow courses such obstetrics and gynecology (Abdulrahman, 2016). The minimal qualification for a Physiotherapy qualification is set at a bachelor's degree. Countries that offered an initial diploma level course have since upgraded their programme to Bachelor status (WCPT, 2003). The lack of recognition for post graduate qualification by professional boards, could suggest the lower rate of post graduate qualification. ACUPUNCTURE TRAINING AND SPECIALIZATION Acupuncture is a form of complementary medicine that has gained traction in contemporary medical practice in different countries in the world. While this research was limited to South Africa and 92 | P a g e the UAE, there were many other countries in which physiotherapists and other medical practitioners use acupuncture in treating their patients. Additionally, approximately 40% of general surgery and physiotherapists occasionally utilize acupuncture in their practice (Hay, 2004). In Denmark, acupuncture is practiced by many physiotherapists, although no formal research has documented the exact number of physiotherapists that use this treatment modality in the country (Rittig-Rasmussen, 2011). For one to be considered as a specialist in acupuncture, one has to show adequate and in-depth training. Scholars have pointed out that with a PhD, one cannot be considered a specialist ((Sahi, 2018) (Xue, 2015)). In addition to competence, training, and experience, there is no need for registration and accreditation. According to Foster et al. (2007), in the United Kingdom, one has to be accredited by the British Acupuncture Accreditation Board. In the United States, one has to be a credited by the Accreditation Commission for Acupuncture and Oriental medicine (Xue, 2015). In Australia, to be considered an acupuncture specialist an acupuncture specialist, one has to be accredited by the Australian Health Practitioner Regulation Agency (Zhen, 2014). In the current study, it was observed that country of practice is strongly and significantly associated with the level of acupuncture training. Physiotherapists from South Africa have a generally higher level of training in acupuncture as compared to physiotherapists in the UAE. From the survey results, there were many Acupuncture practicing in South Africa than in the United Arab Emirates. These findings are novel since no prior research has established the levels of acupuncture training in South Africa and the UAE. One of the most probable reasons for increased likelihood of physiotherapists in South Africa specializing in acupuncture is the availability of resources and infrastructure for acupuncture training and practice (WHO, 2013). South Africa is among the countries that are slowly accommodating acupuncture in adjunct therapy practice and physiotherapy training (Gqaleni, 2007). None of the respondents from the UAE had PhD level training in acupuncture, while there was one South African physiotherapist with PhD level training in acupuncture. Comparing the above findings to other nations practicing acupuncture treatment, Xue et al.(2015) found the number of PhD students in acupuncture treatment was negligible. In their data, Xue et al. (2015) showed, the maximum number of PhD students in acupuncture in a Chinese university were twenty. Examining the same for the United Kingdom, Xue et al. (2015) identified 21 universities accredited with training PhD acupuncture students with a graduation rate of 37%. Xue et al. (2015) however, argued, practical training in acupuncture were offered mostly for master qualification with individuals qualified for PhD programs based on their years of experience with acupuncture. For countries like Canada, US, Australia and Italy, there is a significant number of PhD acupuncture graduates who are all awarded based on their level of exposure and acupuncture experience (Xue, 2015). FREQUENCY OF ACUPUNCTURE USAGE When examining the frequency of use of acupuncture by physiotherapists, the researcher in figure 3 showed that 21% of the participants did not use acupuncture in their physiotherapy practice. Of the surveyed participants, 23% reported using acupuncture more often while 30% of the participants used acupuncture only when it deemed necessary. However, 16% of the participant physiotherapists reported that they always used acupuncture in their treatment process. Reiterating on the findings of the systematic review of literature, acupuncture has found application in the treatment of conditions such as knee-osteoarthritis, asthma, non-specific hip-pain (Duffin, 1982), and musculoskeletal conditions as shown in this study. The inconsistency observed in the application of acupuncture and its use in cases where conventional physiotherapy failed is an indication that the use of acupuncture in treatment has become more common and more frequent. The inconsistent use is supported by the

qualitative comments of the participants suggesting that they only use acupuncture if conventional physiotherapy does not provide a response. In particular, participant 128 stated: "I think acupuncture will help in treating patients physically and psychologically". The response by participant 128 is such that, acupuncture treatment is seemed to be more holistic than conventional treatment modality hence its application in psychological and physical treatment. These findings are consistent with Chen et al (2013) and Dascanio (2015), who said that the low success rate of traditional physiotherapy treatment necessitates a more sophisticated treatment system that includes acupuncture as a therapeutic method. Nevertheless, considering there were no clear differences in the types of responses selected, a definitive frequency of usage cannot be determined. To examine the responses among the participants further, the researcher measured the extent to which the physiotherapists use acupuncture as a treatment modality. COMMON CONDITIONS TREATED USING ACUPUNCTURE It was evident that the most common conditions treated using acupuncture included Musculoskeletal, Orthopedics, and Neurology. Additionally, on the lower periphery, the least common conditions that were treated using acupuncture – whose percentage values were less than 10% – included Peadiatrics, Geriatrics, Neuropediatric, Cardiorespiratory, Oncology, Obstetrics, and Gynecology. Acupuncture has and is being used in the treatment of a wide range of illnesses, including pain relief, according to research evaluated in the literature (Kerr, 2001). For instance, Duffin (1982) reported that physiotherapy with acupuncture was commonly used in treatment of asthma, eczema, knee osteoarthritis, non-specific hip pain, post-patellectomy pain, scar pain, and adhesive capsulitis in cases where conventional physiotherapy failed to yield desired results. In addition, orthopedic and musculoskeletal patients treated with acupuncture reported considerable improvements in health in addition to pain relief, according to Duffin et al. (1982). Furthermore, according to Lovesey et al. (2001), combining acupuncture with pharmaceuticals for musculoskeletal pain improved the outcomes and general health of individuals seeking rapid and long-term relief. Kerr et al. (2001) further observed, combining acupuncture with placebos in the treatment of asthma and eczema showed significant health improvements. ACUPUNCTURE INCLUSION IN PT CURRICULUM Although more participants agreed (60%) with the inclusion of acupuncture in the undergraduate curriculum, this was contradictory to the qualitative comments provided. Those who provided comments with regard to the potential inclusion, cited curriculum overload and its philosophical basis as issues. In most studies reviewed, researchers have reported increasing adoption of acupuncture in Western colleges and institutions ((Abdulrahman, 2016) (Barros, 2011) (Bodevan, 2004) (Brokaw, 2002) (CAHCIM, 2004) (Chen, 2019) (Costi, 2012)). However, the most colleges and universities in the Western world provide separate acupuncture courses to interested students rather than including it in standard physiotherapy curriculum (Mann, 2016). In general, there is a paucity of evidence on acupuncture's inclusion in regular physiotherapy education (Mann, 2016). However, the most colleges and universities in the Western world provide separate acupuncture courses to interested students rather than including it in standard physiotherapy curriculum (Mann, 2016). Similar to the suggestions made by participants that courses in acupuncture be offered at post graduate level or as short courses. Studies by Costi et al (2012) and Carnevale (2017) support the inclusion of acupuncture only at post graduate level. The participants included in the study conducted by Costi et al. (2013) reported that the load or the volume of academic work in undergraduate programs limited the amount of time and concentration that students would give in acupuncture training. However, Costi et al. (2013) developed that the research time allocated for post graduate students offered an opportune moment for schools to introduce acupuncture 95 | P a g e training. Costi and colleagues however noted, acupuncture training and practice in Brazil was still at its infancy. Agreeing with Costi et al.(2013), Carnevale et al. (2017) reported, large number of undergraduate students in Brazilian campuses were not conversant with acupuncture nor its use in physiotherapy. According to Carnevale et al.(2017), for the students that reported knowing about acupuncture was through personalized reading. The students further presented, the number of units to cover and the volumes of knowledge to amass made it difficult to fully concentrate on acupuncture and its benefits in physiotherapy. However, the students studied by Carnevale et al.(2017) preferred taking the course at post graduate level. In the United Kingdom, there were also some efforts by acupuncturists to lobby for legalization of acupuncture and subsequent development of standards of practice for acupuncturist (Balogun, 2018). However, the acupuncturists faced significant backlash from the science community as most skeptics tend to believe traditional or alternative medicine had no scientific basis. (Balogun, 2018). Part of the reason's participants disagreed with the inclusion of acupuncture in curriculum was that they felt it lacked scientific evidence: "I stopped using acupuncture for the last 5 years as I do not find it effective and cannot find scientific evidence on it as well". There seems to be more of an acceptance of Dry needling in Physiotherapy curriculum compared to acupuncture. The mechanical basis for its application, is more acceptable "there is a big difference between acupuncture which is Chinese medicine and dry needling which is anatomically and trigger point within a muscle based. I don't think that acupuncture should form part of the physio curriculum and I feel that DDN should be kept as a post-grad course/training as you should have thorough knowledge and understanding of anatomy to safely and effectively dry needle". It is evident that more physiotherapists are using acupuncture as a modality in physiotherapy practice-albeit the concern with its evidence base and finding it effective in treatment of mostly musculoskeletal conditions. Due to the already loaded undergraduate curriculum the general feeling is that it remains as an optional post graduate specialty. This can be seen by the responses given by participants' 37 and 42. For participant 37, "….It is unnecessary to complicate an already full course by adding Dry needling and acupuncture". Similarly, participant 42 asserted, "For my opinion it shouldn't be given in the college, while you're a student. It's a course that physios should take after at least 1-2 years of clinical practice". While the

participants were against acupuncture training in undergraduate studies, acupuncture training was an area of specialization for individuals who were interested and wanted to specialize in acupuncture as an additional skill to conventional medicine. Baloan (2018) argument that many acupuncturists and acupuncture training was being criticized for its lack of scientific basis hence the reason for most students taking it as an optional course or as additional skill. LIMITATIONS A major limitation of the current quantitative cross-sectional survey is the risk of bias in the answers provided by study participants considering that the participant pool seems to have been selected by the organizations. Second, given the size of the population in both fields of investigation, the small sample size hampered the generalization of the findings. The third limitation was that in as much as the researcher developed a questionnaire and validated the items therein via use of experts, it posed a limitation in terms of language and length of use. While the questionnaire can be tailed into responding to researchers' objectives, it might not be effective in the study of this magnitude. Individual limited understanding and mixing of dry needling and acupuncture impacted the kind of responses given by the participants. Most participants were in favor of dry needling to acupuncture, hence, there was a possibility that the results could be skewed positively. RECOMMENDATIONS Future research should examine extending the sample population size so that the findings may be applied to a larger population. Studies should include in-depth interviews with physiotherapists for better understanding of responses and to avert the confusion between dry needling and acupuncture. Physiotherapists using acupuncture as an adjunct to treatment should be encouraged to provide an evidence-base for its use and efficacy. This will serve to further promote the possible inclusion of acupuncture as an accepted modality in physiotherapy treatments. Future researchers should also consider an experimental research design to practically design to practically examine the effectiveness of acupuncture inclusion physiotherapy alleviation of pain. From the reviewed studies, I found that, while acupuncture in physiotherapy was effective against frozen shoulder and functional disability, there were no statically relevant findings on pain. Therefore, focusing future research on how effective combining acupuncture and physiotherapy in alleviating pain would be significant addition to literature. Conclusion of the survey The goal of performing a cross-sectional survey was to identify the characteristics of physiotherapists who use acupuncture in their relevant practice. The purpose was also to explore what views participants had regarding the inclusion of acupuncture in physiotherapy curriculum. Surveying and analyzing the data from 181 participants, the researcher showed that majority of the respondents were South Africans however, many male respondents were from the United Arab Emirates. Further, a self- developed online questionnaire was developed on the SurveyMonkey platform and validated using pilot studies and a panel of experts prior to collecting the data. Overall, the survey results presented mixed findings with the majority of surveyed participants agreeing on the significance of acupuncture in physiotherapy practice. Most of the participants however disagreed that physiotherapy was not effective on its own. Overall, survey results also showed a number of participants were not of the opinion of including acupuncture curriculum in undergraduate education but rather preferred acupuncture training in post-graduate levels. Noteworthy, the survey information showed, majority of physiotherapists had hands on experience with acupuncture despite majority of practicing physiotherapists having a bachelor's degree, certificate qualification followed by Masters' degree and PhD having a least number of qualified participants. CHAPTER 5: GENERAL DISCUSSION AND CONCLUSION Discussion A thorough assessment of the data found that acupuncture as an adjuvant to physiotherapy treatment is useful for some medical disorders. For instance, the findings showed acupuncture in physiotherapy treatment was effective against frozen shoulder and functional disability and not highly effective against pain. The implication of these findings serves to promote the inclusion and further exploration of the efficacy of acupuncture in physiotherapy. The evidence that a large number of physiotherapists are using acupuncture or dry needling in practice suggests that physiotherapists are exploring alternatives to what is currently being offered in the undergraduate curriculum. This would encourage curriculum advisors to revisit the evidence and efficacy of traditional physiotherapy modalities that are currently included. The objectives of the current quantitative cross-sectional survey were to examine the application, frequency and impacts of acupuncture in the treatment of various ailments. Moreover, in recent years, physiotherapists have become increasingly interested on the effects and general application of acupuncture in therapy. The increased interest is evident by the studies conducted by Bishop et al. (2016), Kizhakkeveettil et al. (2017), and Foster et al. (2007). Furthermore, the findings of the specific objectives above positively correlated with the physiotherapists increased interest in acupuncture and its overall positive treatment outcomes. As such, although more studies are still needed, the researchers recommends that physiotherapists should consider beginning early training and practice for acupuncture given the findings situating acupuncture as an important component of physiotherapy- based treatment ((Duffin, 1982) (Costi, 2012) (Kohut, 2011)). Eventhough majority of reviewed literature and participants in this study were against the inclusion of acupuncture curriculum in undergraduate studies, it is high time that colleges and universities consider incorporation. Despite the huge amount of work, assigned individuals in the education sector should consider distributing the curriculum throughout the undergraduate program. While this might be the case, existing literature argued that increased skepticism has hindered the progress and inclusion of acupuncture curriculum in undergraduate studies. Mann et al. (2016) and Balogun et al. (2018) argued, the inclusion of acupuncture curriculum when training undergraduate physiotherapists increased their load and what they needed to cover before graduation and hence would limit the quality of training and depth of skills acquired in the course of training. Therefore, the implications for this study lies in the need for broadened or enhanced debate around the inclusion of acupuncture physiotherapy curriculum in undergraduate education and its overall impact on the

quality of skills obtained by undergrads following the curriculum. Recommendations Future studies should consider increasing the size of the sample population such that the obtained results can be applicable to a wider population. Studies should include in-depth interviews with physiotherapists for better understanding of responses and to avert the confusion between dry needling and acupuncture. Physiotherapists using acupuncture as an adjunct to treatment should be encouraged to provide an evidence-base for its use and efficacy. This will serve to further promote the possible inclusion of acupuncture as an accepted modality in physiotherapy treatments. Future researchers should also consider an experimental research design to practically design to practically examine the effectiveness of acupuncture inclusion physiotherapy alleviation of pain. From the reviewed studies, I found that, while acupuncture in physiotherapy was effective against frozen shoulder and functional disability, there were no statically relevant findings on pain. Therefore, focusing future research on how effective combining acupuncture and physiotherapy in alleviating pain would be significant addition to literature. Conclusion of the Study The study sought to quantitatively and cross-sectionally investigate the impacts of acupuncture in physiotherapy. A thorough examination of the cross-sectional survey's primary goals reveals that acupuncture has been widely used to treat illnesses such as asthma, eczema, and pain (Kerr, 2001). Similarly, the systematic review found that the use of acupuncture in physiotherapy treatment has acquired substantial momentum, with many professionals currently using it or planning to use it while caring for their patients. As discussed, acupuncture had been employed in the easing pain and in the treatment of musculoskeletal conditions an indication of its positive use in addressing medical conditions. When looking at the results of the survey that was used for this, it was clear that, similar to the findings of the systematic review, the frequency of use has grown as a result of its good rating in pain relief and its use in the event that conventional therapies fail. Following the increased application of acupuncture in treatment, existing literature supported the development and inclusion of undergraduate PT curriculum to begin early training and specialization of acupuncture. This recommendation is reiterated by the scholar in the sense that 79% of interviewed participants reported having used acupuncture at one point in their treatment process. Even though this is the case, the researcher could locate definite support from existing literature for the inclusion of acupuncture undergraduate PT curriculum. Despite the majority of participants responding positively to the survey and a growing trend of obtaining a qualification in acupuncture practice, there are still uncertainties for its inclusion in undergraduate curriculum. Therefore, more studies are still needed to measure the effectiveness of combining physiotherapy and acupuncture in therapy and their overall outcome on patient health.

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