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**RADIOLOGICAL FEATURES
OF
PSORIATIC ARTHRITIS**

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DECLARATION

I, Razaan Davis, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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This study was approved by the ethics committee of the University of Cape Town.

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TABLE OF CONTENTS

DECLARATION	1
TABLE OF CONTENTS	2
ACKNOWLEDGEMENTS	5
ABBREVIATIONS	6
LIST OF TABLES AND FIGURES	8
LITERATURE REVIEW	11
Introduction	11
Clinical findings	12
Radiography	14
Radiographic scoring methods	19
PATIENTS AND METHODS	23
Study design	23
Aims	23
Study population and sampling	23
Algorithm: Selection of the patient film sets included in this study	24
Radiographic assessment	24
Instruments	26
Data capture and statistical analysis	26
Ethical and legal considerations	27
RESULTS	28
Demographics	28
Duration of psoriasis and psoriatic arthritis	29
Disease modifying anti-rheumatic drugs (DMARDs)	30
Total radiographic score distribution	31

Total destruction and total proliferation scores	32
Correlation between the TDS and TPS	32
Radiographic distribution	32
Destruction score distribution	32
The right hand/wrist	35
The right foot	37
The left hand/wrist	37
The left foot	39
Proliferation score distribution	39
The right hand/wrist	42
The right foot	43
The left hand/wrist	44
The left foot	45
Comparison of destructive and proliferative change in individual joints	47
Sacroiliac disease	48
Correlation between the TRS and CRP, duration of PsA, the number of DMARDs and the severity of SIJ disease	50
DISCUSSION	52
Age	53
Total radiographic score and duration of disease	54
Race predilection	54
Inflammatory marker, C-reactive protein (CRP)	54
Disease modifying anti-rheumatic drugs (DMARDs)	55
Distribution of the involved joints	56
Hands	56

Wrists	58
Forefoot	58
Sacroiliac joint involvement	59
Strengths and limitations	60
FUTURE DEVELOPMENTS	62
RECOMMENDATIONS	64
CONCLUSION	65
IMAGES OF REPRESENTATIVE CASES	66
Hands and feet	66
Case 1	66
Case 2	68
Case 3	70
Case 4	72
Sacroiliac joint disease	74
Case 5	74
Case 6	75
Case 7	76
REFERENCES	77
APPENDICES	82
Appendix 1: Data capture sheet	82

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ABBREVIATIONS

ADEPT	Adalimumab Effectiveness in PsA Trial
Anti-CCP	Antibodies to Cyclic Citrullinated Peptides
CASPAR	Classification criteria for Psoriatic Arthritis
CRP	C Reactive Protein
DIP	Distal interphalangeal
DMARDS	Disease Modifying Anti-Rheumatic Drugs
DS	Destruction Score
EOPsA	Elderly Onset Psoriatic Arthritis
ESR	Erythrocyte Sedimentation Rate
IL	Interleukin
IPJ	Interphalangeal Joint
MCP	Metacarpophalangeal
MRI	Magnetic Resonance Imaging
MTP	Metatarsophalangeal
OMERACT	Outcome Measures in Rheumatoid Arthritis Clinical Trials
PARS	Psoriatic Arthritis Ratingen Score
PIP	Proximal interphalangeal
PS	Proliferation Score
PsA	Psoriatic arthritis
PsAMRIS	PsA MRI scoring system
RA	Rheumatoid Arthritis
RF	Rheumatoid Factor
SD	Standard Deviation
SIJ	Sacroiliac Joint

TDS	Total Destruction Score
TNF	Tumour Necrosis Factor
TPS	Total Proliferation Score
TRS	Total Radiographic Score

LIST OF TABLES AND FIGURES

Table 1: Mean and standard deviation (SD) for TDS

Table 2: Mean and standard deviation (SD) for TPS

Table 3: Destruction score (DS) distribution for the right hand and foot

Table 4: The number of patients with bilateral or unilateral destructive change

Table 5: Correlation between the TRS and the destruction score of the individual joints of the right hand/wrist

Table 6: Correlation between the TDS on the right and the destruction score of the individual joints of the right hand/wrist

Table 7: Correlation between the TRS and the destruction score of the individual joints of the right foot

Table 8: Correlation between the TDS on the right and the destruction score of the individual joints of the right foot

Table 9: Correlation between the TRS and the destruction score of the individual joints of the left hand/wrist

Table 10: Correlation between the TDS on the left and the destruction score of the individual joints of the left hand/wrist

Table 11: Correlation between the TRS and the destruction score of the individual joints of the left foot

Table 12: Correlation between the TDS on the left and the destruction score of the individual joints of the left foot

Table 13: Proliferation score (PS) distribution for the right hand and foot

Table 14: Proliferation score (DS) distribution for the left hand and foot

Table 15: Correlation between the TRS and the proliferation score of the individual joints of the right hand/wrist

Table 16: Correlation between the TPS on the right and the proliferation score of the individual joints of the right hand/wrist

Table 17: Correlation between the TRS and the proliferation score of the individual joints of the right foot

Table 18: Correlation between the TPS on the right and the proliferation score of the individual joints of the right foot

Table 19: Correlation between the TRS and the proliferation score of the individual joints of the left hand/wrist

Table 20: Correlation between the TPS and the proliferation score of the individual joints of the left hand/wrist

Table 21: Correlation between the TRS and the proliferation score of the individual joints of the left foot

Table 22: Correlation between the TPS on the left and the proliferation score of the left foot

Table 23: Comparison of destructive and proliferative change in individual joints in both right and left hands and feet

Table 24: Comparison of sacroiliac joint (SIJ) disease in the right sacroiliac joints in both males and females

Table 25: Comparison of sacroiliac joint (SIJ) disease in the left sacroiliac joints in both males and females

Figure 1: Sex distribution

Figure 2: Age distribution

Figure 3: Race distribution

Figure 4: Duration of psoriasis (years)

Figure 5: Duration of psoriatic arthritis (years)

Figure 6: Number of DMARDs taken by patients

Figure 7: Total radiographic score distribution

Figure 8: Mean DS distribution

Figure 9: Number of patients with positive destruction score (DS)

Figure 10: Number of patients with bilateral or unilateral destructive change

Figure 11: Mean PS distribution

Figure 12: Number of patients with positive proliferation score (PS)

Figure 13: Number of patients with bilateral or unilateral proliferative change

Figure 14: The distribution of radiographic grading of right-sided sacroiliac joint disease, for 31 patients

Figure 15: The distribution of radiographic grading of left-sided sacroiliac joint disease, for 31 patients

Figure 16: Correlation between CRP and the TRS ($r^2 = 16\%$; p value <0.035)

Figures 17 – 27: Images of representative cases

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LITERATURE REVIEW

Introduction

Psoriatic arthritis (PsA) is an inflammatory arthritis associated with psoriasis. Psoriasis is a dermatological condition that affects 1-2% of the population. Approximately 10-15% of patients with skin manifestations of psoriasis develop PsA [1] and 0.3-1% of the general population [2]. Moll and Wright [3] defined PsA as psoriasis associated with inflammatory arthritis and usually a negative serological test for rheumatoid factor (RF).

Meaney and Hays [4] in 1957, in one of the earlier studies of this disease, grouped the radiographic findings of 15 patients with psoriasis and arthritis into two categories. The first group [n=11] consisted of changes typical of rheumatoid arthritis (RA), for which the term *psoriasis with rheumatoid arthritis* was used. The second group [n = 4] consisted of findings that were not typical of RA, including varying degrees of articular destruction involving the terminal interphalangeal joints that may progress to lysis of the joint and eventual fibrous or bony fusion. Generalised demineralisation of bone was not a feature of this second group. This second group represented a distinct type of arthritis referred to as *psoriatic arthritis*. Currently the concept of PsA is well established.

The aetiology of PsA is thought to be a combination of environmental and genetic factors, with as many as 60% of patients being HLA-B27 positive [5].

Clinical findings

The clinical nature of the articular disease is variable. A monoarticular, pauciarticular or polyarticular distribution can be encountered. Almost any joint can be affected, although the small joints of the hands and feet are most frequently involved. The near constant involvement of the fingernails in patients manifesting with arthritis of the hands is well recognized [4]. These nail changes include pitting, discoloration, ridging, splintering, thickening and detachment [3,6]. In some patients lower back pain predominates, related to the involvement of the spine and sacroiliac joints. The articular symptoms may be acute or insidious in nature.

Laboratory analysis confirms the absence of serologically detectable RF in the majority of patients. This articular disorder has a wide clinical and radiological spectrum.

Five broad clinical varieties of PsA have been described [1,3,6,7]:

Subgroup 1 (classic psoriasis) includes erosion of the terminal tufts known as acroosteolysis and involvement of the distal and occasionally the proximal interphalangeal (PIP) joints of the hand.

Subgroup 2 (arthritis mutilans) is known for the 'opera glass' deformity of the hands.

Subgroup 3 (symmetric polyarthritis) may result in ankylosis of the proximal & distal interphalangeal (DIP) joints and in this form is indistinguishable from RA.

Subgroup 4 is the most common and is characterized by oligoarthritis, which is asymmetric, involving the proximal and distal interphalangeal & metacarpophalangeal (MCP) joints accompanied by sausage shaped digits.

Subgroup 5 is a spondyloarthropathy with features similar to ankylosing spondylitis.

Although radiographic abnormalities accompany each of these five subgroups, features in certain groups are much more specific than those in other groups. In some patients, a single diagnosis of PsA cannot be accomplished on the basis of radiographic changes alone.

A large, multicentre international study (CASPAR: Classification criteria for psoriatic arthritis) published in 2006 [8], compared the accuracy of existing classification criteria for the diagnosis of PsA and constructed new criteria from the observed data. The researchers concluded that the CASPAR criteria were more specific (98.7% vs 96%), but less sensitive (91.4% vs 97.2%), than those of the Vasey and Espinoza classification [9].

The CASPAR criteria consist of established inflammatory articular disease (joint, spine or enthesal) with at least 3 points from the following five categories:

1. Current psoriasis (assigned a score of 2);

A history of psoriasis (in the absence of current psoriasis - assigned a score of 1);

A family history of psoriasis (in the absence of current psoriasis and history of psoriasis - assigned a score of 1)

2. Dactylitis (assigned a score of 1)
3. A negative test for RF (assigned a score of 1)
4. Nail dystrophy (assigned a score of 1)
5. Juxta articular new bone formation (assigned a score of 1)

Dactylitis is considered a hallmark of PsA occurring in 16-24% of reported cases [10], tender dactylitis being associated with more aggressive disease in affected digits.

Radiography

Radiography is the first imaging study in the evaluation of arthritis. The role of radiography in the assessment of patients with RA, where the baseline radiographic changes predict progression of structural damage, have led to similar observations of predictive validity of baseline structural damage in PsA. Radiographic changes were used as an outcome measure in several drug trials and demonstrated superiority of some drug regimens over others [11].

The role of radiography in the assessment of patients with PsA is twofold. Firstly, it assists in the assessment of the structural damage caused by PsA and secondly it is an important outcome measure to judge the efficacy of treatment [12].

In the initial phase of PsA, radiographs may be entirely normal. Early radiographic abnormalities, which may include soft tissue swelling and some degree of osteopaenia, can resolve without any permanent sequelae [1]. Osteopaenia is not a prominent feature of PsA [4,13]. This lack of osteopaenia is a reliable sign in the differentiation of PsA from RA, although the presence of osteopaenia does not eliminate the diagnosis of PsA [12,14]. The lack of both intense synovial inflammation and severe synovial hyperaemia in this disease may account for the absence of significant periarticular osteopaenia. More extensive radiographic abnormalities appear with clinical progression of articular problems. These may worsen at a variable rate and may be influenced by impairment of hand function.

The radiographic features of PsA can be grouped into destructive and proliferative changes [6,12]. These changes occur simultaneously and in this manner PsA differs from RA [12]. Findings may be bilateral or unilateral and symmetric or asymmetric. The asymmetric distribution is emphasised as a distinctive feature in PsA. The destructive arthritis of the DIP joints of the hands is the best recognised manifestation of PsA [15]. In PsA the DIP joints are frequently involved from the beginning, while in rheumatoid arthritis DIP involvement is more often a feature of late disease [15] and is relatively uncommon. Adjacent PIP joints are frequently affected and severe abnormalities may be encountered at the interphalangeal joint (IPJ) of the thumb. The MCP joints may be relatively spared.

Erosions are a typical feature of the destructive group. These include erosions of the terminal phalangeal tufts (acro-osteolysis) and whittling of phalanges, metacarpals and metatarsals. Advanced bone destruction may result in a 'pencil in cup' appearance with one end of the joint forming a 'cup' and the other a sharp 'pencil' which projects into this cup. This appearance is not specific for PsA or any of the seronegative spondyloarthritides, but it is most commonly seen in these conditions [5]. RA rarely causes similar radiological changes [16].

PsA resembles RA in that the erosions occur in the bare area of the bone [15], the region between the cartilage covered joint surface and the joint capsule, frequently starting at the joint margins and then progressing towards the centre. In PsA the erosions become irregular with disease progression, as a result of periosteal bone formation adjacent to the erosions [14,15] and involve the DIP joints in addition to the PIP, MCP and wrist joints. The bare area erosions on the distal surface of the DIP joints in PsA have a characteristic appearance that suggests 'mouse ears'. The erosions may become so extensive, resulting in the appearance of a widened joint, rather than a narrowed joint space [6,11]. It is this lack of apposition of adjacent bone margins that distinguishes the radiographic picture of PsA from that of osteoarthritis [6], in which closely applied undulating osseous surfaces are encountered.

In contrast, the erosions of the IPJs in erosive osteoarthritis are secondary to articular cartilage destruction. The resultant 'gull wing' deformity is due to the marked *peripheral* bone erosion involving the distal subchondral cortex and the marked *central* bone erosion involving the proximal side of the joint [15]. The predilection of erosive osteoarthritis for scattered DIP and PIP joints may make it impossible to distinguish from PsA. Clinically, osteoarthritis may pose a diagnostic dilemma when associated with Heberden's nodes, as early active nodes may be red and swollen, similar to PsA of the DIP joint [3]. It is only later that the single globular swelling of the DIP joint settles to reveal the hard double node typical of osteoarthritis.

Juxta articular bone proliferation, a striking feature of PsA [12], may create a spiculated, frayed or 'paintbrush' appearance. An irregular and indistinct appearance of the marginal bone, so called 'whiskering' (5), is also encountered. Although bone proliferation may accompany erosions in gouty arthritis, the resulting excrescences in gout are well defined. Intra articular osseous fusion is another manifestation of bone proliferation in PsA. It is particularly prominent in the hands and feet. Although intra articular osseous fusion is also observed in inflammatory erosive osteoarthritis, septic arthritis and RA (carpal and tarsal regions), Resnick and Niwayama [6] have stressed it as an important radiographic sign of the seronegative spondyloarthritides. Bone proliferation occurs at sites at which tendons and ligaments insert on bones ('entheses'). These include the posterior and inferior surfaces of the calcaneus, the femoral trochanters, ischial tuberosities, medial and lateral malleoli, the ulnar olecranon, the anterior surface of the patella and the condyles of the distal femur and proximal tibia. The simultaneous processes of osteolysis and total ankylosis may occur.

Periostitis in the metaphyses and diaphyses of bones is not uncommon, particularly in the hands and feet [12]. This change may appear early in the disease, associated with soft tissue swelling, before significant abnormalities occur in the adjacent articulations. A similar abnormality accompanies reactive arthritis, juvenile chronic arthritis and infection. The periostitis has several forms, appearing as a thin periosteal layer of new bone adjacent to the cortex, a thick irregular layer or an irregular thickening of the cortex. It may be difficult to define where periostitis ends and bone erosion begins, as both may produce marked irregularity of the osseous surface. The periostitis may occur in areas without bone erosions, such as the radial aspect of the wrist extending into the first metacarpal bone. In summary, severe marginal and central erosions, bone ankylosis, the absence of osteopaenia as well as fraying and irregularity of the periarticular surfaces, differentiate PsA from RA.

Condensation of bone on the periosteal and endosteal surfaces of the cortex and trabecular thickening in the spongiosa can cause an entire phalanx to appear radiodense. This is the so called 'ivory phalanx', a characteristic feature of psoriasis

in the foot classically involving the distal phalanges, particularly the first, with sclerosis, enthesitis and soft tissue swelling.

Reports in the literature reveal significant variability [17,18] regarding the prevalence of sacroiliitis in patients with PsA. This inconsistency is multifactorial, including a wide spectrum of disease intensity and difficulty in achieving consensus amongst clinicians regarding standardised classification patterns. Sacroiliac joint involvement in PsA is usually bilateral, either symmetric or asymmetric in distribution, but can also be unilateral [17]. Symmetrical abnormalities predominate. These changes occur predominantly in the ilium. The 5- point grading scale, according to the Atlas of Standard Radiographs in Arthritis [19], follows the recommendations of the New York Conference for Population Studies. The scores ranged from 0 to 4: grade 0 = normal; grade 1 = suspicious changes; grade 2 = minimal abnormalities (small localized areas of erosion or sclerosis without alteration in the joint width); grade 3 = unequivocal abnormalities (moderate or advanced sacroiliitis with erosions, sclerosis, widening, narrowing or partial ankylosis) and grade 4 = total ankylosis.

An analysis of a large group of patients with PsA was published by Gladman et al in 1987 [20]. In a cohort of 220 patients assembled over an 11 year period, the prevalence of sacroiliitis was reportedly 27%. In a study conducted by Battistone et al [17] published in 1999, 221 patients with PsA were enrolled in a study over a period of 32 months. 202 radiographs were available for interpretation by a single experienced musculoskeletal radiologist who interpreted large batches over week-long sessions. These radiographs included multiple films from peripheral joints. They concluded a 78% prevalence of sacroiliitis in a large, multicentre cohort study of patients with PsA, a figure much higher than the previously reported 27% by Gladman et al [20]. Sacroiliac joint abnormalities are a minor feature of RA.

PsA, reactive arthritis and ankylosing spondylitis are grouped in the category of seronegative spondyloarthritis. Differentiation between these disorders relies on the distribution of radiographic abnormalities and clinical information [5].

In PsA, as in reactive arthritis, large comma shaped paravertebral ossifications may be seen at the thoracolumbar junction. Initially, ossification is thick and fluffy or thin and curvilinear on one side of the spine, paralleling the lateral surface of the vertebral bodies. Eventually it may produce a large and bulky outgrowth that merges with the underlying osseous and discal tissue. The greater size, asymmetric distribution and location farther away from the vertebral column help to distinguish paravertebral ossification from syndesmophytes of ankylosing spondylitis and spondylitis in inflammatory arthritis. Spondylitis is uncommon in the absence of sacroiliitis. The facet joints are relatively spared and there is absence of vertebral body “squaring” [1, 4]. A study by Helliwell and Porter [21] showed that new bone formation and erosion at major enthesal sites was most commonly observed in ankylosing spondylitis. Plain radiographic features of major enthesopathy are poor discriminators between PsA and RA.

Cervical spine abnormalities include atlantoaxial subluxation, apophyseal joint space narrowing and sclerosis, osseous irregularity at the discovertebral joint and extensive proliferation along the anterior surface of the spine [14]. Anterior subluxation predominates, but lateral instability, as reported in RA, also occurs. Associated erosive and sclerotic abnormalities of the odontoid process are frequent in patients demonstrating atlantoaxial subluxation. Rarely, subaxial cervical instability with cord compression is evident in psoriatic spondylitis, resembling changes observed in RA [6].

Elsewhere in the axial skeleton, the manubriosternal, sternoclavicular, costovertebral joints, the symphysis pubis and the tendinous connections of the pelvis may demonstrate significant changes such as soft tissue swelling, subchondral erosions and synostosis. Abnormalities of the phalangeal tufts and calcaneus are characteristic. Retrocalcaneal bursitis creates a radiodense area adjacent to the posterosuperior aspect of the bone. The Achilles tendon may be thickened. Poorly defined spurs occur at the plantar ligament insertion at the calcaneus (calcaneal spur).

Significant joint destruction and deformity are more characteristic of PsA than of reactive arthritis. Furthermore, in PsA, both upper and lower extremities are involved, distinguishing it from reactive arthritis which predominantly involves the joints of the lower extremity. PsA can affect synovial and cartilaginous joints and sites of tendon and ligament attachment to bone in both the appendicular and the axial skeleton. In this respect it is similar to reactive arthritis and ankylosing spondylitis and differs from RA [6].

Ankylosing spondylitis affects mainly the axial skeleton. The spinal changes consist of thin, linear and symmetrically distributed outgrowths. Apophyseal joint involvement and osteitis with squaring of vertebral bodies are more frequent in ankylosing spondylitis than in reactive arthritis. Bilateral, symmetrical sacroiliac joint abnormalities are almost universal [6]. Spondylitis, a characteristic feature of PsA, may be difficult to distinguish radiologically from ankylosing spondylitis [11,14]. Syndesmophytes occur in both PsA and ankylosing spondylitis, but a distinguishing feature may be that in PsA the syndesmophytes are paramarginal and do not appear in consecutive vertebra [14].

Radiographic scoring methods

Several scoring methods for psoriatic arthritis have been adapted from existing RA scoring systems [11]. These have been proposed for the assessment of structural damage in peripheral joints. The scoring methods by Larsen *et al.* [22], Steinbrocker *et al.* [23] and Sharp *et al.* [24] are most commonly reported for evaluating radiographic changes and quantifying damage [25]. These have been validated for RA, but studies in PsA are lacking. Currently, no single method has achieved universal acceptance in the assessment of PsA.

Steinbrocker's method [23] was devised in 1949 and is still widely used. Global changes are assessed, giving an overall measure of joint damage from 0 to 4. The severity of radiological involvement is scored by the degree of soft tissue swelling, osteopaenia, joint space narrowing, malalignment and bony ankylosis. It is

performed rapidly and thus is useful in clinical practice. No radiographic standards are employed in using this method.

Larsen's method [22] was introduced in 1977. Rau in 1995 [26] modified Larsen's method by quantifying the extent of joint space destruction required to attain stages 2-5. Larsen, like Steinbrocker, assessed the joint globally. Scores range from 0 to 5 depending on the extent of osteoporosis, joint space narrowing, erosions and joint destruction. This method is based on an atlas of standard radiographs in an attempt to improve reproducibility. Theoretically, Larsen's method may be more responsive for detecting change than Steinbrocker's method for any given joint as this index has an additional stage to detect change.

Sharp's method [24] was developed in 1971 and modified in 1985 [27]. Erosions and joint space narrowing are scored separately in this method for a total of 35 observations in each hand. This detailed analysis provides a greater sensitivity and amplitude to change than Larsen's and Steinbrocker's methods in patients with RA, but may not be as sensitive in detecting changes in PsA as compared to RA, since the erosions and new bone formation in PsA are often paramarginal or involve the shaft of the phalanges. These lesions would not be accounted for by Sharp's method, as it detects discrete intra articular erosions and joint space narrowing, unlike Larsen's and Steinbrocker's methods that score the joint globally.

The Sharp-Van der Heijde modified scoring method for PsA [11] is a detailed scoring method evaluating erosions, joint space narrowing, subluxation, ankylosis, gross osteolysis and pencil in cup. In addition to the joints evaluated for RA, the DIP joints of the hands are assessed. This adapted method for PsA is being applied by two readers in two placebo controlled clinical trials evaluating efficacy of anti-TNF treatment in PsA. This data will give insight on intra reader and inter reader agreement, discrimination among patients with different disease status and sensitivity to change. From these trials it is hoped that one may deduce which joints yield the most information and how gross osteolysis and pencil in cup should be included in the total score.

At the University of Toronto's PsA clinic, radiological progression in the peripheral joints of patients is assessed by a modification of the Steinbrocker technique [11,25]. The original Steinbrocker classification scored a patient according to their worst joint. The modified technique scores each joint on a 0–4 scale where: N 0 is normal, N 1 reflects juxta articular osteopaenia or soft tissue swelling, N 2 is the presence of erosion, N 3 is the presence of erosion and joint space narrowing, N 4 is total joint destruction, either lysis or ankylosis. This method reflects the biological changes in the arthritic joint, from soft tissue swelling to total joint destruction.

In this method the Toronto group, led by Gladman, scored all the joints of the hands (with the wrist considered one joint), all metatarsophalangeal (MTP) joints and the IPJ of the big toe. This included a total of 28 joints in the hands and 12 joints in the feet, thus 40 joints altogether. The maximum score possible is 160, if all joints had a score of 4 [11].

Rahman and Gladman et al [25] conducted a study comparing the reliability and responsiveness of the original Steinbrocker's, the modified Steinbrocker's and Larsen's radiological scoring methods for detecting radiological change in PsA over time. Two sets of radiographs of the hands and feet, 2 years apart, were selected from 68 patients. Films were randomly presented and scored independently by a rheumatologist and a radiologist, in a blinded fashion using all methods. They concluded that Larsen's and Steinbrocker's radiological scoring methods were reliable and reproducible. Larsen's and the modified Steinbrocker's methods were both equally responsive and superior to the original Steinbrocker's to detect radiographic change in PsA. Larsen's and the modified Steinbrocker's methods can be used to monitor disease progression, examine clinical correlations or study the effects of anti-rheumatic drugs in the radiographic assessment of PsA.

The scoring method for PsA should consider both the destructive and proliferative changes. The Psoriatic Arthritis Ratingen Score (PARS) was developed in the early 1990s, specifically for the radiographic assessment of patients with PsA. The method consisted of two separate scores namely the destruction score (DS) and the proliferation score (PS) [12]. It included 40 joints of the hands and feet namely eight

DIP joints, two IPJs of the thumbs, eight PIP joints, ten MCP joints, both wrists, both IPJs of the great toes and second to fifth MTP joints. All joints were scored separately for destruction and proliferation.

The destruction score (DS) was based on the amount of joint surface destruction on a 0–5 scale. Joint surface destruction was defined by the length of interruption of the cortical plate in relation to the total joint surface. The proliferation score (PS) considered any kind of bony proliferation typical for PsA on a 0–4 scale. The DS (0–200) and the PS (0–160) were added to give the total score (TS) (0–360) for each patient.

In summary, PsA has a wide clinical and radiological spectrum. In some patients, a single diagnosis of PsA on the basis of radiographic changes cannot be accomplished. Differentiation between the seronegative spondyloarthritides relies on the distribution of radiographic abnormalities and clinical information. The radiographic features of PsA can be grouped into destructive and proliferative changes, which may occur simultaneously. In this manner it can be differentiated from RA. The role of radiology in the assessment of patients with PsA is recognised, where the baseline radiographic changes could predict progression of structural damage. In the initial phase of PsA, radiographs may be entirely normal. However, conventional radiography remains an easy, cheap and accessible investigation, which allows the assessment of structural damage and is able to measure treatment efficacy.

Against this background, this study describing the radiological features of PsA in 31 patients with clinical features of PsA attending a specialist rheumatic diseases unit at a tertiary hospital in Cape Town, South Africa, was performed.

PATIENTS AND METHODS

Study design

A retrospective descriptive study.

Aims

- To describe the severity and joint distribution of radiological change of PsA in a population, examined in a specialist clinic, using the Psoriatic Arthritis Ratingen Score (PARS) to compute radiological severity.
- To correlate the severity of the total radiographic score with the duration of disease, the number of disease modifying anti-rheumatic drugs (DMARDs) and the inflammatory marker, C- reactive protein (CRP).
- To determine the prevalence, and describe the distribution, of sacroiliitis using the 5-point scale according to the Atlas of Standard Radiographs in Arthritis [19].

Study population and sampling

48 sets of radiographs of the hands, feet, pelvis, lumbar and cervical spines were collected in 2003 as part of a study conducted for a large multicentre international study by the CASPAR (Classification criteria for Psoriatic Arthritis) study group.

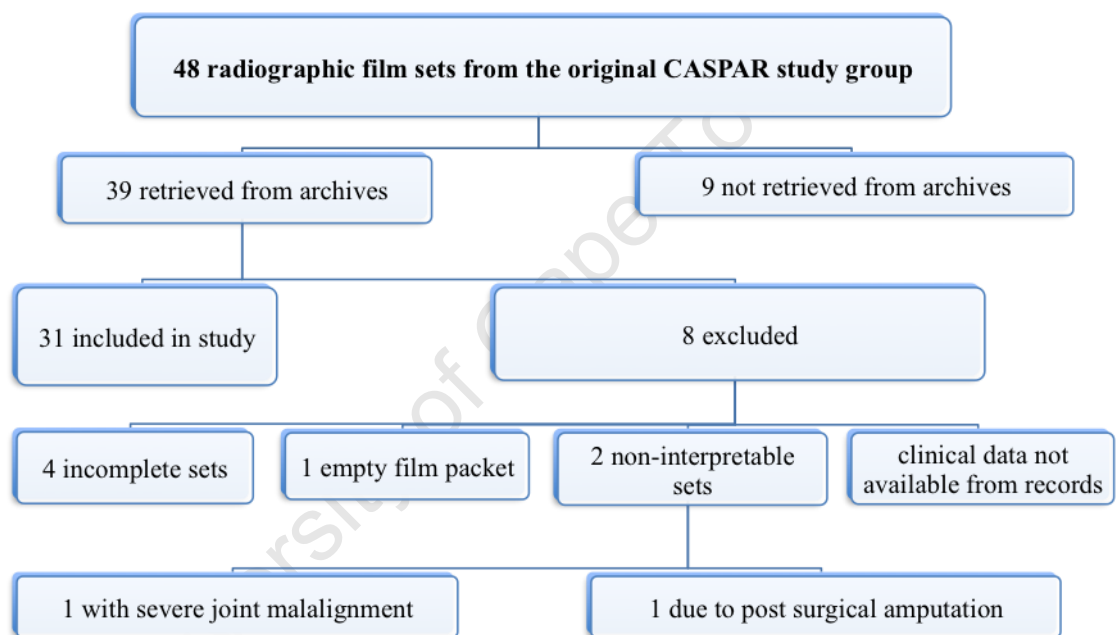
The study population consisted of 48 patients who attended the D6 Princess Alice Rheumatology Unit at Groote Schuur Hospital, Cape Town, with clinically confirmed PsA. The diagnosis was based upon the opinion of rheumatologists with expertise in PsA. The following history, clinical features and laboratory tests were considered:

- A personal and/or family history of psoriasis was elicited from the patient, general practitioner, dermatologist or rheumatologist. Physical evidence of psoriasis was recorded.
- 13 clinical features were evaluated, including the presence of dactylitis or any tender entheses, diffuse entheses pain, chest wall pain, inflammatory

heel pain, clinical sacroiliitis, inflammatory neck, thoracic or lower back pain, subcutaneous nodules, iritis, systemic features of RA and the presence of clinical small joint ankylosis.

- The distribution of the joints involved was recorded on a mannequin drawing.
- Laboratory tests included RF and CRP.

Algorithm: Selection of the patient film sets included in this study



Radiographic assessment

For the purposes of this study, the radiographs of the hands, feet and pelvis only were assessed. Antero-posterior projections were available for assessment of the hands and feet. The right and left sides were exposed on the same film. The sacroiliac joints were assessed on the available coned antero-posterior projections of the pelvis. The Psoriatic Arthritis Ratingen Score (PARS) was applied for the assessment of the bones and joints of the hands and feet. This method [12] only scores changes in or adjacent to the joints and abnormalities distant from the

joints are not included in the scoring system. For the purposes of this study, the total score will be referred to as the total radiographic score (TRS).

The TRS, for each patient, includes the 40 joints of the hands and feet namely eight DIP joints, eight PIP joints, the two IPJs of the thumbs, ten MCP joints, both wrists, both IPJs of the great toes and the second to fifth MTP joints. All joints were scored separately for destruction and proliferation.

The TRS (0-360) is the sum of the total destruction score (TDS) (0-200) and the total proliferation score (TPS) (0-160).



The destruction score of an individual joint was restricted to erosive damage and bone destruction. Grading was based on the amount of joint surface destruction. Joint surface destruction was defined by the length of the interruption of the cortical plate in relation to the total joint surface. The total joint surface was defined by the margins of the joint capsules attaching to the bones in the diarthrodical joints and as the complete circumference of the bones in the wrist.

Every individual joint was graded on a 0-5 scale as follows:

0 = normal

1 = one or more definite erosions with interruption of the cortical plate of >1mm with destruction of the total joint surface <10%

2= one or more erosions with destruction of the joint surface of 11-25%

3= 26-50% destruction of the joint surface

4= 51-75% destruction of the joint surface

5= total destruction of the joint surface (>75%) or bony ankylosis

The total proliferation score sums up bony proliferation typical for PsA, including paraarticular spikes, supracortical bone formation, diaphyseal thickening and enlargement of the bone compared to the opposite side.

Every individual joint was graded on a 0-4 scale as follows:

0= normal

1= bony proliferation of 1-2mm or bone growth up to 25% of the original size (diameter)

2= bony proliferation of 2-3mm or bone growth of 26-50% of the original size

3= bony proliferation of >3mm or bone growth of >50% of the original size

4= bony ankylosis

The 5-point grading scale, according to the Atlas of Standard Radiographs in Arthritis [17], was applied for the assessment of sacroiliitis. The score ranged from 0-4: Grade 0 = normal; grade 1 = suspicious changes; grade 2 = minimal abnormalities; grade 3 = unequivocal abnormalities and grade 4 = total ankylosis.

Instruments

The author, a qualified radiologist, visually scored the 31 radiographic film sets. A standard light box was used to evaluate the radiographs.

Data capture and statistical analysis

A scoring sheet, developed from original publications [12,17], was used to score the radiographs. For the purposes of this study, the total destruction score is the sum of the total destruction scores on the right and the left and the total proliferation score is the sum of the total proliferation scores on the right and the left. See Appendix 1 (Data capture sheet). The score at each joint level i.e. DIP, PIP, MCP, IPJ of the thumb, wrist, IPJ of the great toe and MTP joints, was summed, for both the destructive and proliferative processes.

The data was entered into a Microsoft Excel spreadsheet. The statistical software programme *Statistica version 10* was used to analyse the data. Descriptive statistics (mean, median and standard deviations) and non-parametric Spearman rank correlation co-efficients were applied to interpret data. Variance was calculated as the square of rho (r^2). P value < 0.05 was considered significant. The 95% confidence interval was calculated as 95% CI = estimate +/- 1.96 * SE (estimate). Multivariate analysis, which requires a larger sample size, was not possible.

ETHICAL AND LEGAL CONSIDERATIONS

This is a non-invasive retrospective study in patients receiving standard of care medication for PsA. The radiation exposure was delivered as part of the previous trial and is not considered to have detrimental effects. The original study received approval by the University of Cape Town's Health Sciences Research Ethics Committee (UCT HREC) in 2003. Our study received approval from the UCT HREC in 2010.

RESULTS

Demographics

There were 14 (45%) males and 17 (55%) females, with an age range from 25 to 78 years and a mean of 53 with a standard deviation (SD) = 13.4. There was a weak correlation between the TRS and age ($r^2 = 14\%$; $p < 0.05$). There were 29 (94%) coloured (mixed race), 2 (6%) white and 0 black patients.

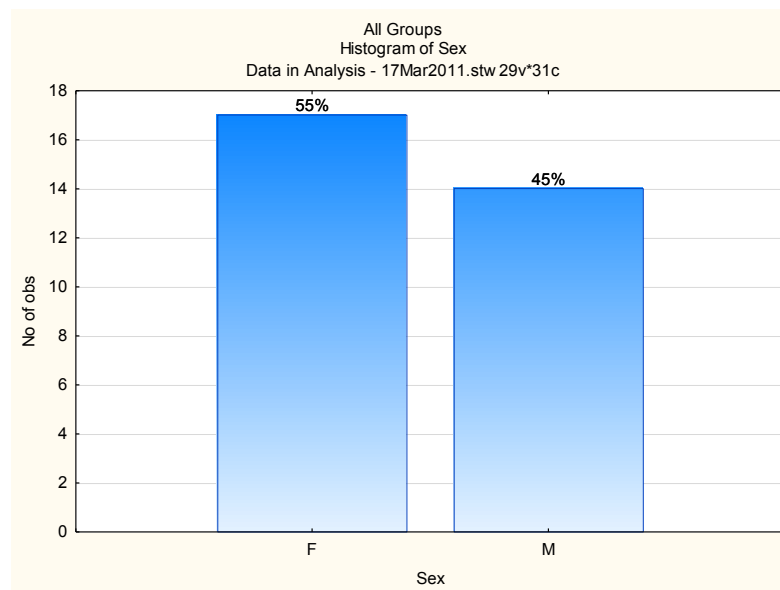


Figure 1: Sex distribution

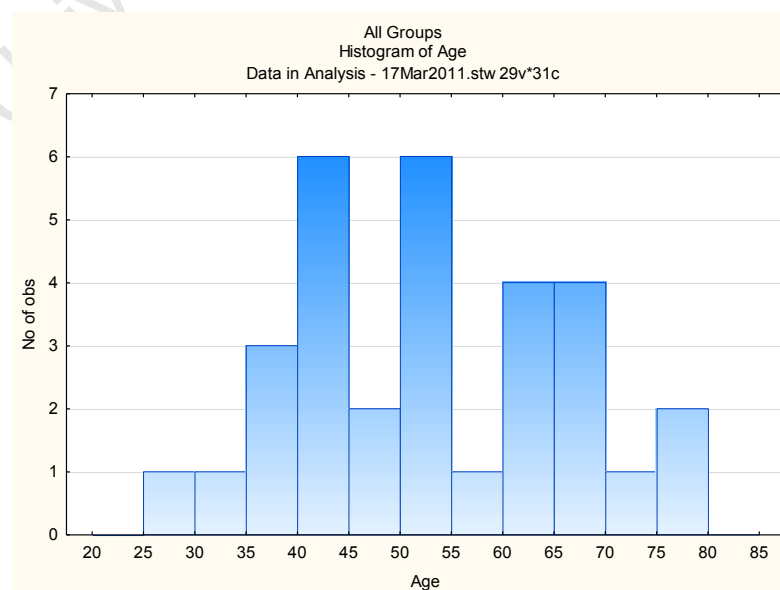


Figure 2: Age distribution

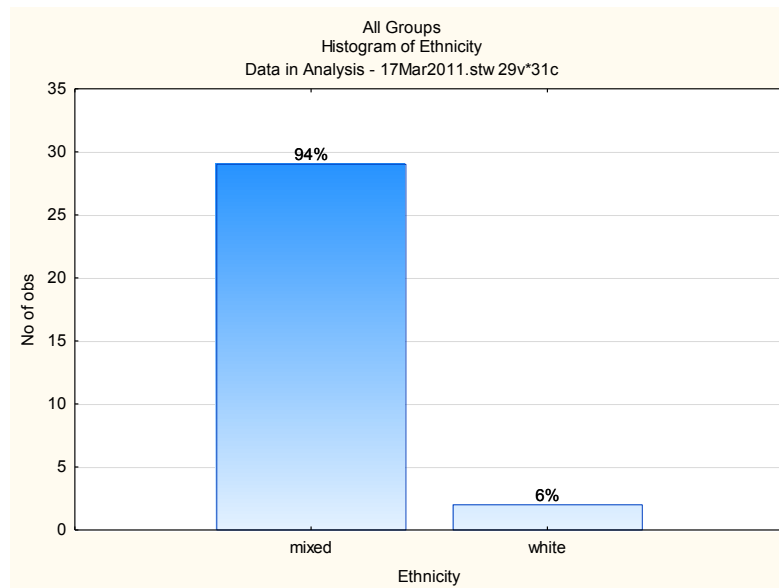


Figure 3: Race distribution

Duration of psoriasis and psoriatic arthritis

The duration of psoriasis ranged from 1 to 62 years with a mean duration of 14.5 years and a SD = 13.2 This was as a result of one patient, aged 78 years, who developed psoriasis at age 16. The duration of PsA ranged from 3 months to 37 years with a mean duration of 8.9 years and a SD = 9.3.

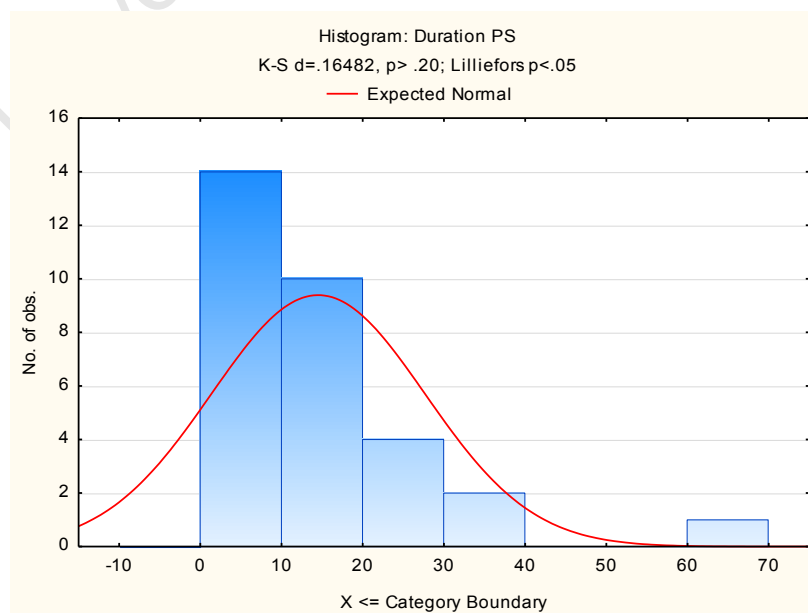


Figure 4: Duration of psoriasis (years)

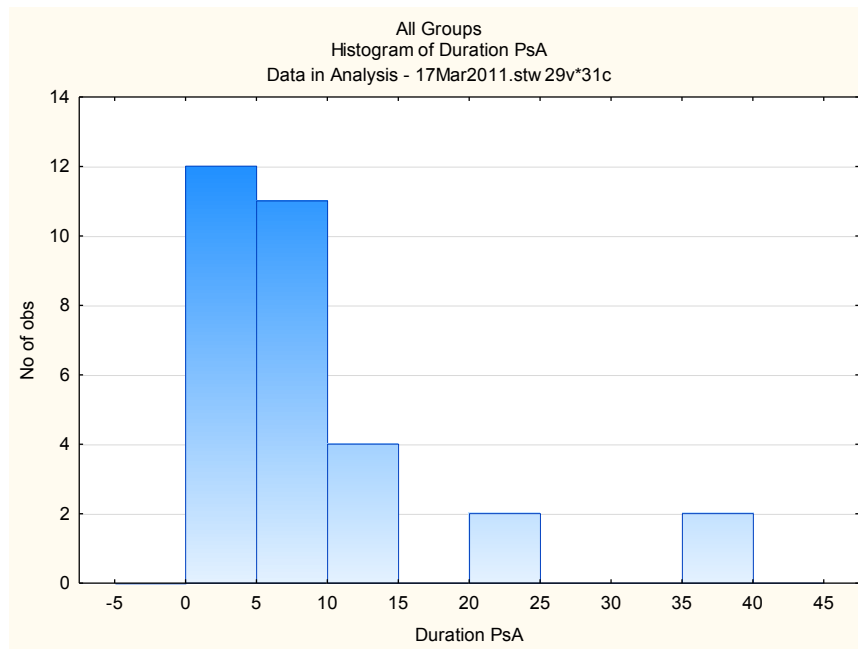


Figure 5: Duration of psoriatic arthritis (years)

Disease modifying anti-rheumatic drugs (DMARDs)

Seven (22.58%) patients were not receiving any DMARD treatment, 19 (61.29%) patients were treated with 1 DMARD, 4 (12.90%) with 2 DMARDs and 1 (3.23%) with 3 DMARDs. The mean number of drugs was 0.97 with a SD = 0.71.

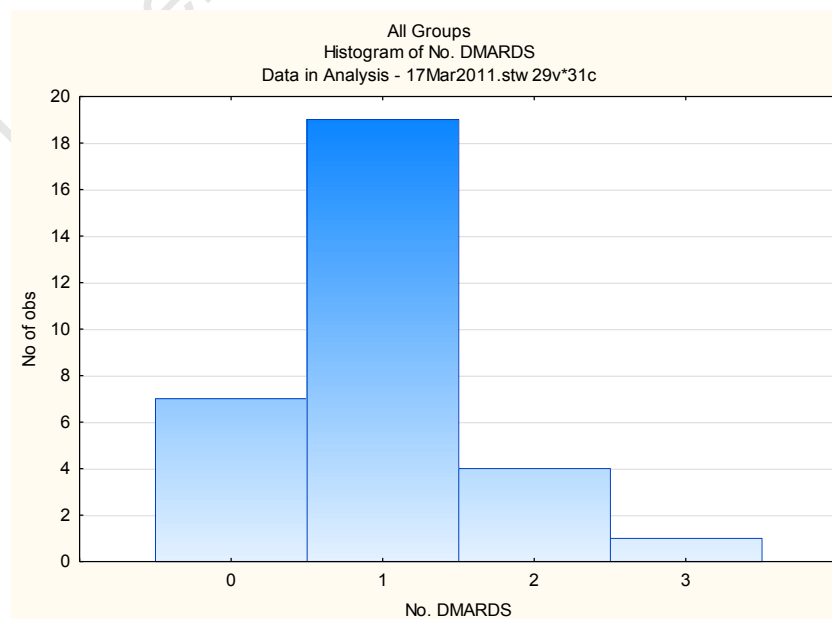


Figure 6: Number of DMARDs taken by patients

Total radiographic score distribution

The TRS ranged between 7 and 123 with a mean of 30.7 and a SD = 23.9. There were no patients with a score of 0. Therefore, all patients assessed had radiographic change. 8 (25.81%) patients had a score between 7 and 20 with 3 (9.67%) patients scoring 7, the lowest score. Nineteen patients (61.29%) had a score between 20 and 40, the highest score range. 1 (3.23%) patient scored between 20 and 40 and 2 (6.45%) patients scored between 60 and 80. No patients scored between 80 and 120. Only 1 patient had a TRS between 120 and 130.

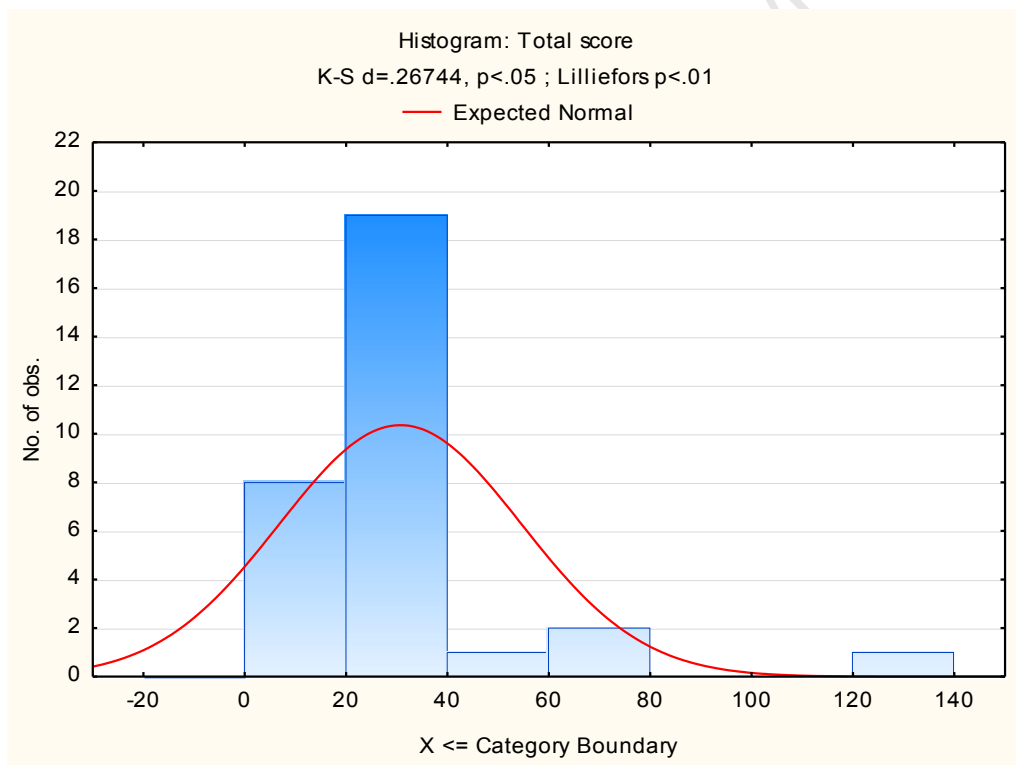


Figure 7: Total radiographic score distribution

Total destruction and total proliferation scores

Table 1. Mean and standard deviation (SD) for TDS

	TDS	Right TDS	LEFT TDS
Mean	26.5	13.6	13
SD	19.2	10.4	9.5

Table 2: Mean and standard deviation (SD) for TPS

	TPS	Right TPS	Left TPS
Mean	4.2	2.3	1.9
SD	5.9	3.4	3.1

12 (38.71%) of the 31 patients had a positive TDS only with no proliferative change and 19 (61.29%) of the 31 patients had both a positive destruction and proliferation score. There were no patients who had a positive proliferation score only, without coexistent destructive change.

Correlation between the TDS and TPS

There was no significant correlation between the total destruction and total proliferation scores on either the right or the left side ($r^2 = 12\%$ and 4% respectively; $P > 0.05$).

Radiographic distribution

Destruction Score Distribution

31(100%) patients had a positive destruction score on the right, while 30 (96.77%) had a positive destruction score on the left. The TRS correlated significantly with the TDS on the right ($r^2 = 74\%$) and left ($r^2 = 83\%$).

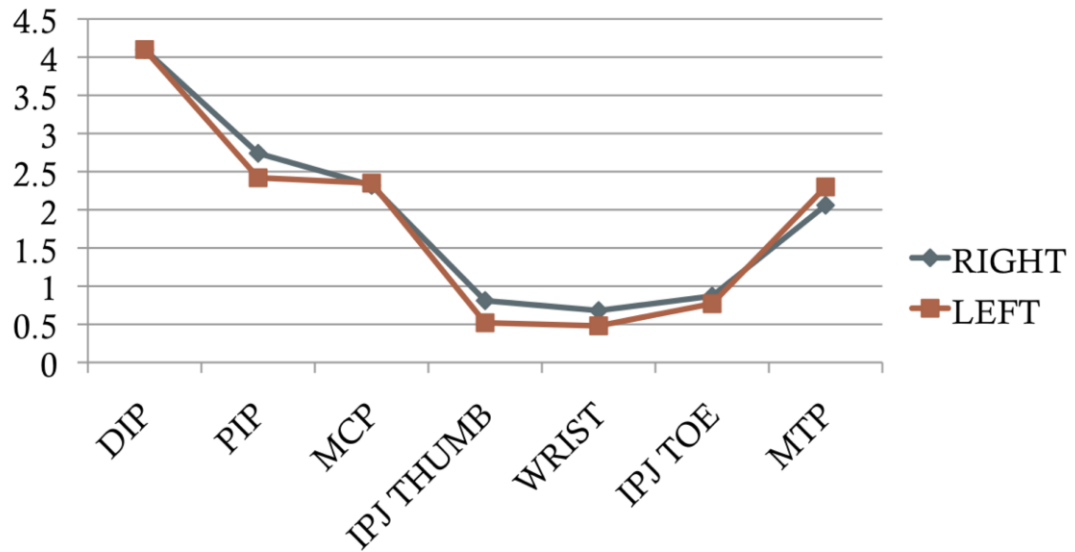


Figure 8: Mean DS distribution

In the hand, the mean destruction score decreased from the most distal joint to the more proximal joint.

Table 3: Destruction score (DS) distribution for the right hand and foot

Variable	N	Mean	SD	Range	CI -95%	CI 95%
Right DIP	31	4.10	3.51	0-17	2.81	5.38
Right PIP	31	2.74	2.46	0-11	1.84	3.65
Right MCP	31	2.32	3.16	0-13	1.17	3.48
IPJ right thumb	31	0.81	1.11	0-5	0.40	1.21
Right wrist	31	0.68	1.05	0-5	0.29	1.06
IPJ right great toe	31	0.87	1.45	0-5	0.34	1.40
Right MTP	31	2.06	3.52	0-16	0.77	3.36

Table 4: Destruction score (DS) distribution for the left hand and foot

Variable	N	Mean	SD	Range	CI -95%	CI 95%
Left DIP	31	4.10	3.80	0-16	2.70	5.49
Left PIP	31	2.42	1.88	0-7	1.73	3.11
Left MCP	31	2.35	3.04	0-15	1.24	3.47
IPJ left thumb	31	0.52	0.85	0-3	0.20	0.83
Left wrist	31	0.48	1.00	0-5	0.12	0.85
IPJ left great toe	31	0.77	1.09	0-4	0.38	1.17
Left MTP	31	2.30	3.73	0-16	0.92	3.66

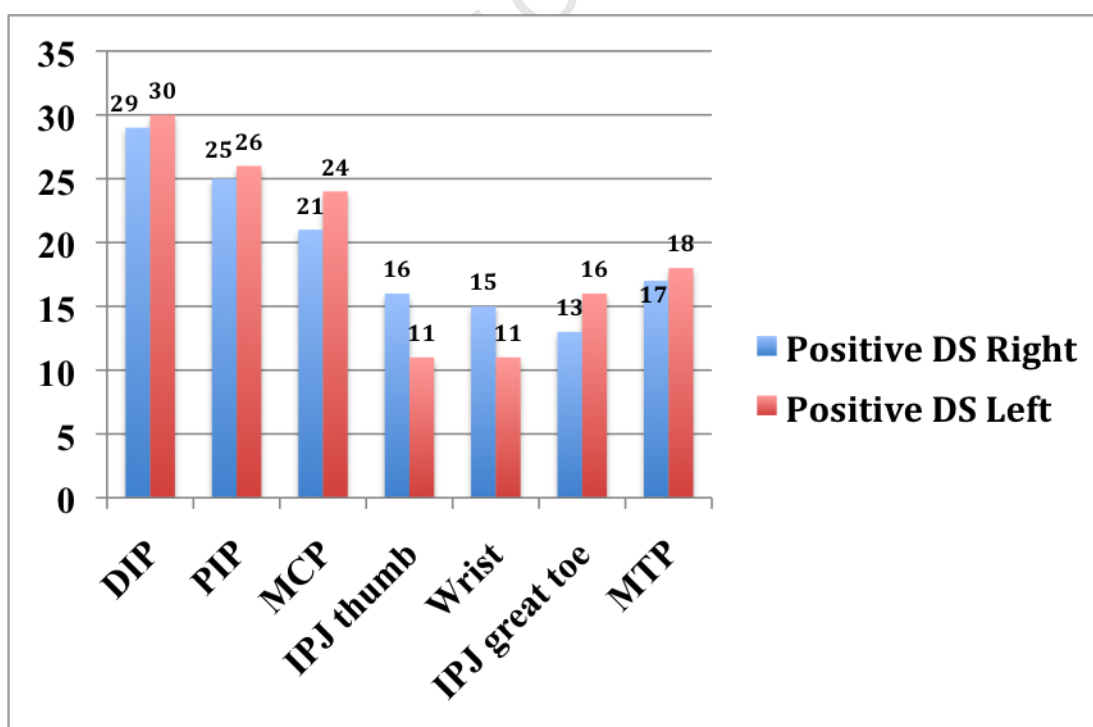


Figure 9: Number of patients with positive destruction score (DS)

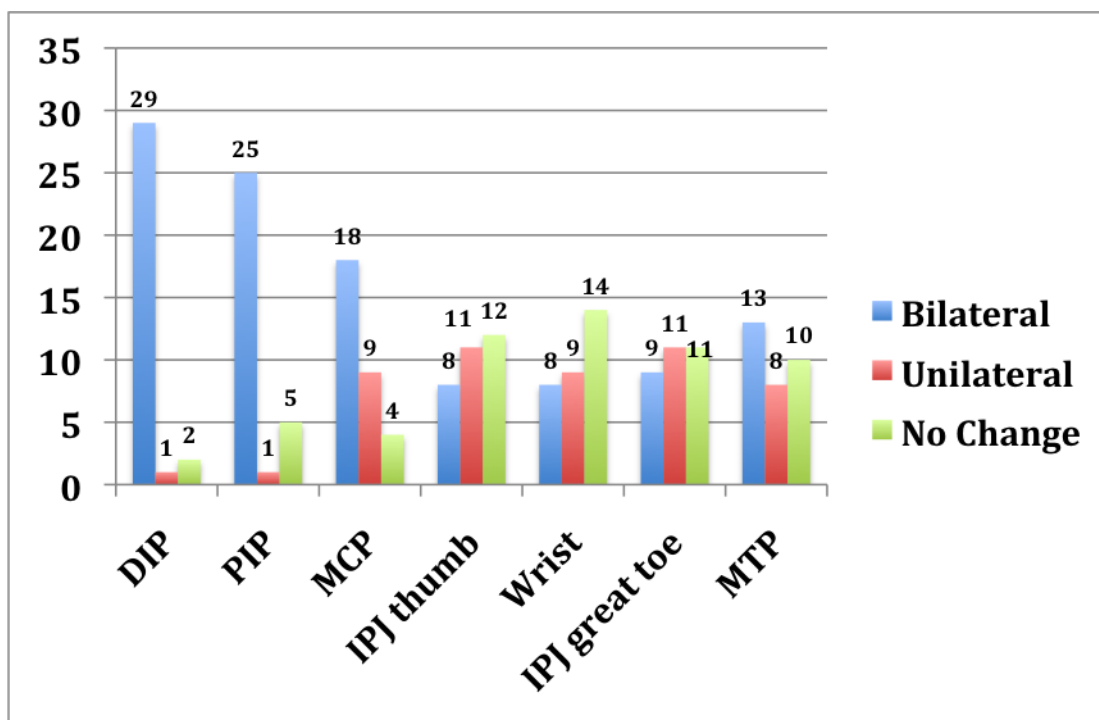


Figure 10: Number of patients with bilateral or unilateral destructive change

All patients had a positive destruction score on the right. On the left, all female patients had a positive destruction score and almost all male patients, with the exception of one.

The correlation between the various joints in the right and left hand and foot was determined as follows (Correlations are significant at $p < 0.05$):

The right hand/wrist

Table 5: Correlation between the TRS and the destruction score of the individual joints of the right hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & DS Right DIP	31	0.663697	4.77823	0.000047
Total score & DS Right PIP	31	0.622093	4.27881	0.000187
Total score & DS Right MCP	31	0.481091	2.95522	0.006147
Total score & IP thumb DS RT	31	0.491999	3.04332	0.004934
Total score & right wrist DS	31	0.079528	0.42963	0.670639

The variance in the TRS was explained to a greater extent by the variance in the right DIP joint destruction score ($r^2 = 43\%$), than by the variance in the destruction scores in the right PIP ($r^2 = 38\%$), the IPJ of the right thumb ($r^2 = 24\%$) or the right MCP joint ($r^2 = 23\%$), suggesting that the right DIP joint was most severely affected. There was no significant correlation between the TRS and the destruction score of the right wrist joint.

Table 6: Correlation between the TDS on the right and the destruction score of the individual joints of the right hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
DS Right & DS Right DIP	31	0.598076	4.01870	0.000380
DS Right & DS Right PIP	31	0.683388	5.04093	0.000023
DS Right & DS Right MCP	31	0.588631	3.92117	0.000495
DS Right & IP thumb DS RT	31	0.405504	2.38893	0.023624
DS Right & right wrist DS	31	0.166654	0.91019	0.370226

However, the variance in the TDS on the right was explained to a greater extent by a variance in the right PIP joint destruction score ($r^2 = 46\%$), than by the variance in the destruction scores of the right DIP ($r^2 = 36\%$), right MCP ($r^2 = 34\%$) or the IPJ of the right thumb ($r^2 = 16\%$). This confirms a predilection for the DIP joint, but shows that the PIP joint is also commonly affected. There was no significant correlation between the TDS on the right and the destruction score of the right wrist joint.

The destruction score of the right PIP is explained to a greater extent by a variance in age of the patient ($r^2 = 14\%$) and that of the right MCP by a variance in duration of psoriasis ($r^2 = 14\%$); these were considered significant at a p value < 0.05 . The destruction score of the right DIP joints was not significantly explained by a variance in the age of the patient, the duration of PsA or the duration of psoriasis.

The right foot

Table 7: Correlation between the TRS and the destruction score of the individual joints of the right foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & IP great toe DS RT	31	0.433299	2.58906	0.014893
Total score & right MTP DS	31	0.298792	1.68607	0.102514

There was a significant correlation between the TRS and the destruction score of the IPJ of the right great toe ($r^2= 18\%$), but no significant correlation with the destruction score of the right MTP joints.

Table 8: Correlation between the TDS on the right and the destruction score of the individual joints of the right foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
DS Right & RT MTP DS	31	0.481913	2.96179	0.006048
DS Right & IP great toe DS RT	31	0.474754	2.90487	0.006962

The variance in the TDS on the right was explained to a similar extent by the variance in the destruction scores of the right MTP joint ($r^2= 23\%$) and the IPJ of the right great toe ($r^2= 22\%$).

The left hand/wrist

Table 9: Correlation between the TRS and the destruction score of the individual joints of the left hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & DS left DIP	31	0.516065	3.24452	0.002961
Total score & DS left PIP	31	0.686632	5.08610	0.000020
Total score & DS left MCP	31	0.588576	3.92060	0.000496
Total score & IP thumb DS LT	31	0.211353	1.16448	0.253722
Total score & left wrist DS	31	0.295667	1.66673	0.106334

The variance in the TRS was explained to a greater extent by the variance in the destruction score of the left PIP joint ($r^2 = 48\%$), than the variance in the destruction scores of the left MCP ($r^2 = 35\%$) or the left DIP joints ($r^2 = 26\%$). There was no significant correlation between the destruction scores of the IPJ of the left thumb, or the wrist joint, and the TRS.

Table 10: Correlation between the TDS on the left and the destruction score of the individual joints of the left hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
DS Left & DS left DIP	31	0.575104	3.78572	0.000714
DS Left & DS left PIP	31	0.623127	4.29044	0.000181
DS Left & DS left MCP	31	0.643209	4.52374	0.000095
DS Left & IP thumb DS LT	31	0.229197	1.26802	0.214877
DS Left & left wrist DS	31	0.373906	2.17101	0.038256

The variance in the TDS on the left was explained to a greater extent by the variance in the destruction score of the left MCP joint ($r^2 = 41\%$), than the variance in the destruction scores of the left PIP ($r^2 = 38\%$), the left DIP ($r^2 = 33\%$) or the left wrist joints ($r^2 = 14\%$). There was no significant correlation with the IPJ of the left thumb.

The destruction score of the left MCP joint is explained by a variance in both the age of the patient ($r^2 = 19\%$) and the duration of psoriasis ($r^2 = 24\%$), but not by a variance in the duration of PsA. The destruction score of the left PIP and DIP joints was not explained by the age of the patient, the duration of PsA or the duration of psoriasis.

The left foot

Table 11: Correlation between the TRS and the destruction score of the individual joints of the left foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & IP great toe DS LT	31	0.332525	1.89875	0.067588
Total score & left MTP DS	31	0.292501	1.64720	0.110311

There was no significant correlation between the TRS and the destruction scores of the IPJ of the left great toe ($r^2 = 18\%$) or left MTP joints.

Table 12: Correlation between the TDS on the left and the destruction score of the individual joints of the left foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
DS Left & IP great toe DS LT	31	0.386111	2.25407	0.031920
DS Left & left MTP DS	31	0.384807	2.24513	0.032553

There was, however, a significant correlation between the destruction scores of both the IPJ of the left great toe ($r^2 = 15\%$) and the left MTP joints ($r^2 = 14\%$) with the TDS on the left.

Proliferation Score Distribution

Of the 31 patients included in this study, 16 (51.61%) patients had a positive proliferation score on the right, while 17 (54.84%) patients had a positive proliferation score on the left, with a variation in the number of joints involved as well as the joint distribution. There was a slight female predominance (F = 52.9%; M = 50%) on the right and a slight male predominance (M = 64.29%; F = 47.06%) on the left.

The correlation between the TPS, on the right and left, with the TRS ($r^2 = 30\%$ and $r^2 = 22\%$ respectively at $p < 0.05$) was significant.

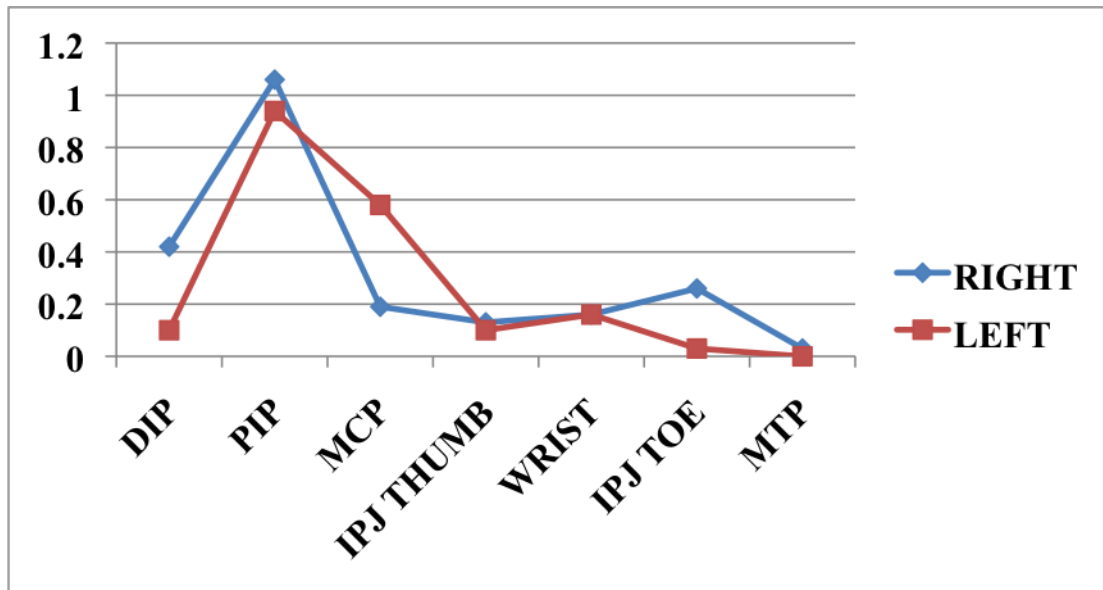


Figure 11: Mean PS distribution

Table 13: Proliferation score (PS) distribution for the right hand and foot

Variable	N	Mean	SD	Range	CI -95%	CI 95%
Right DIP	31	0.42	1.26	0-5	-0.04	0.88
Right PIP	31	1.06	1.48	0-5	0.52	1.61
Right MCP	31	0.19	0.40	0-1	0.05	0.34
IPJ right thumb	31	0.13	0.43	0-2	-0.03	0.29
Right wrist	31	0.16	0.90	0-5	-0.17	0.49
IPJ right great toe	31	0.26	0.96	0-5	-0.10	0.61
Right MTP	31	0.03	0.18	0-1	-0.03	0.10

Table 14: Proliferation score (PS) distribution for the left hand and foot

Variable	N	Mean	SD	Range	CI -95%	CI 95%
Left DIP	31	0.10	0.40	0-2	-0.05	0.24
Left PIP	31	0.94	1.18	0-3	0.50	1.37
Left MCP	31	0.58	2.22	0-11	-0.23	1.39
IPJ left thumb	31	0.10	0.30	0-1	-0.01	0.21
Left wrist	31	0.16	0.90	0-5	-0.17	0.49
IPJ left great toe	31	0.03	0.18	0-1	-0.03	0.10
Left MTP	31	0.00	0.00	0.00	-	-

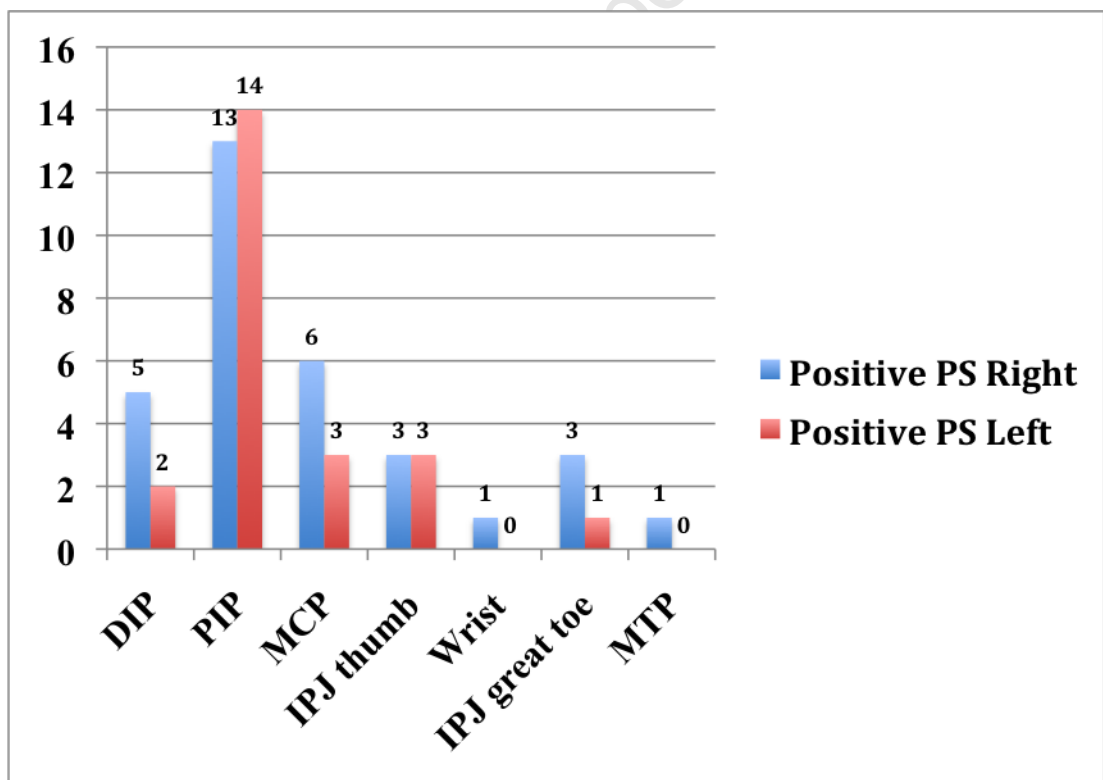


Figure 12: Number of patients with positive proliferation score (PS)

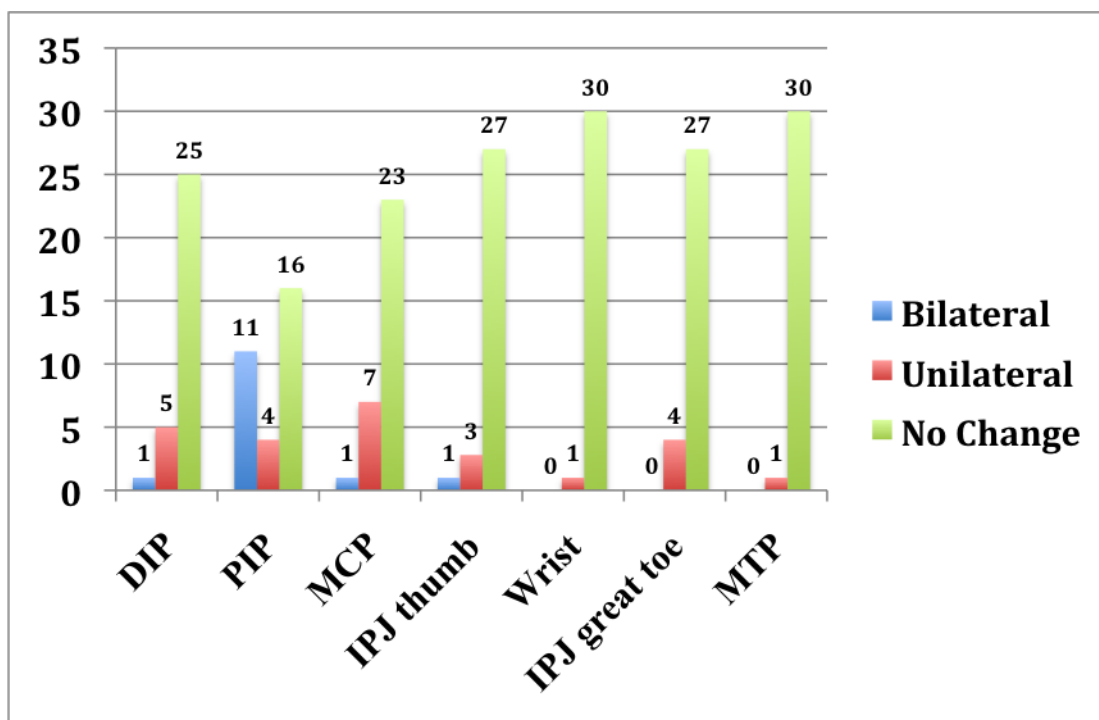


Figure 13: Number of patients with bilateral or unilateral proliferative change

The PIP joints demonstrated most bilateral proliferative change (35.48%) compared with only 3.23% bilateral DIP joint change. The MCP joints demonstrated most unilateral joint proliferative change, compared with only 16% unilateral DIP joint change. Figure 13 highlights the lack of proliferative changes in the different hand joints.

The right hand/wrist

Table 15: Correlation between the TRS and the proliferation score of the individual joints of the right hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & PS right DIP	31	0.440723	2.64400	0.013083
Total score & PS right PIP	31	0.331772	1.89392	0.068250
Total score & PS right MCP	31	0.150837	0.82168	0.417962
Total score & IP thumb PS right	31	0.375505	2.18182	0.037372
Total score & right wrist PS	31	0.306619	1.73475	0.093403

The variance in the TRS was explained to a greater extent by the variance in the proliferation score of the right DIP joint ($r^2 = 19\%$), than the variance in the proliferation score of the IPJ of the right thumb ($r^2 = 14\%$). There was no significant correlation between the TRS and the proliferation score in the right PIP, MCP or wrist joints.

Table 16: Correlation between the TPS on the right and the proliferation score of the individual joints of the right hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
PS Right & PS right DIP	31	0.509752	3.19078	0.003398
PS Right & PS right PIP	31	0.816265	7.60930	0.000000
PS Right & PS right MCP	31	0.500288	3.11152	0.004155
PS Right & IP thumb PS right	31	0.493769	3.05778	0.004758
PS Right & right wrist PS	31	0.293246	1.65180	0.109365

The variance in the TPS on the right was explained to a greater extent by the variance in the proliferation score of the right PIP joint ($r^2 = 67\%$), than the variance in the proliferation score of the right DIP ($r^2 = 26\%$), the right MCP ($r^2 = 25\%$) or the IPJ of the right thumb ($r^2 = 24\%$). The TPS on the right had a weak correlation with age ($r^2 = 13\%$), but not with the duration of PsA or duration of psoriasis (These were considered significant at a p value < 0.05).

The right foot

Table 17: Correlation between the TRS and the proliferation score of the individual joints of the right foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & IP great toe PS RT	31	0.357459	2.06116	0.048355
Total score & right MTP PS	31	0.071544	0.38627	0.702117

The variance in the TRS was explained to a greater extent by a variance in the proliferation score of the IPJ of the right great toe ($r^2 = 13\%$), but there was no significant correlation with the right MTP joint ($r^2 = 0.5\%$; $P > 0.05$).

Table 18: Correlation between the TPS on the right and the proliferation score of the individual joints of the right foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
PS Right & IP great toe PS RT	31	0.527447	3.34325	0.002295
PS Right & right MTP PS	31	0.206358	1.13572	0.265374

The variance in the TPS on the right was explained by a variance in the proliferation score of the IPJ of the right great toe ($r^2 = 28\%$), but there was no significant correlation with the right MTP joint ($r^2 = 4\%$; $P > 0.05$).

The left hand/wrist

Table 19: Correlation between the TRS and the proliferation score of the individual joints of the left hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & PS left DIP	31	0.150249	0.81840	0.419800
Total score & PS left PIP	31	0.124114	0.67358	0.505909
Total score & PS left MCP	31	0.216403	1.19365	0.242287
Total score & IP thumb PS left	31	0.427560	2.54703	0.016431
Total score & left wrist PS	31	0.306619	1.73475	0.093403

The variance in the TRS was explained by a variance in the IPJ of the left thumb ($r^2 = 18.5\%$). There was no significant correlation with the proliferation score of the left DIP, PIP, MCP or wrist joints.

Table 20: Correlation between TPS on the left and the proliferation score of the individual joints of the left hand/wrist

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
PS left & PS left DIP	31	0.318692	1.81062	0.080572
PS left & PS left PIP	31	0.730281	5.75672	0.000003
PS left & PS left MCP	31	0.528702	3.35430	0.002230
PS left & IP thumb PS left	31	0.205669	1.13175	0.267010
PS left & left wrist PS	31	0.322640	1.83564	0.076686

The variance in the TPS on the left was explained to a greater extent by the variance in the proliferation score of the left PIP joint ($r^2 = 53\%$) than the left MCP joint ($r^2 = 28\%$). There was no significant correlation with the proliferation score of the left DIP joint, IPJ of the thumb or wrist joint. These findings suggest that proliferative changes are more prominent in the PIP and MCP joints of the hand, rather than the DIP joints, as might be expected.

The left foot

Table 21: Correlation between the TRS and the proliferation score of the individual joints of the left foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
Total score & IP great toe PS LT	31	0.102206	0.55330	0.584302

There was no significant correlation between the TRS and the proliferation score of the IPJ of the left great toe. The correlation between the TRS and the proliferation score of the left MTP joint was not possible as the proliferation score for the left MTP joints was 0.

Table 22: Correlation between TPS on the left and the proliferation score of the individual joints of the left foot

Pair of Variables	Valid - N	Spearman - R	t(N-2)	p-value
PS left & IP great toe PS LT	31	0.086037	0.46505	0.645369

There was no significant correlation between the TPS on the left and the proliferation score of the IPJ of the left great toe. The correlation between the TPS on the left and the proliferation score of the left MTP joint was not possible as the proliferation score for the left MTP joints was 0.

The TPS on the left had a significant correlation with the duration of psoriasis ($r^2 = 29\%$) and age of patient ($r^2 = 21\%$).

University of Cape Town

Comparison of destructive and proliferative change in individual joints

Table 23: Comparison of destructive and proliferative change in individual joints in both right and left hands and feet

	Destructive change only	Proliferative change only	No change	Both destructive and proliferative change
Right DIP	24(77.42%)	0	2 (6.45%)	5 (16.13%)
Left DIP	29 (93.54%)	0	1 (3.23%)	1 (3.23%)
Right PIP	13 (41.94%)	1 (3.23%)	5 (16.13%)	12 (38.71%)
Left PIP	14 (45.16%)	2 (6.45%)	3 (9.68%)	12 (38.71%)
Right MCP	17 (54.84%)	2 (6.45%)	8 (25.81%)	4 (12.90%)
Left MCP	24 (77.42%)	2 (6.45%)	4 (12.90%)	1 (3.23%)
IPJ right thumb	14 (45.16%)	1 (3.23%)	14 (45.16%)	2 (6.45%)
IPJ left thumb	8 (25.81%)	0	20 (64.52%)	3 (9.68%)
Right wrist	14 (45.16%)	0	16 (51.61%)	1(3.23%)
Left wrist	11 (35.48%)	0	20 (64.52%)	0
IPJ right great toe	10 (32.26%)	0	18 (58.06%)	3 (9.68%)
IPJ left great toe	15 (48.39%)	0	15 (48.39%)	1 (3.23%)
Right MTP	16 (51.61%)	0	14 (45.16%)	1 (3.23%)
Left MTP	18 (58.06%)	0	13 (41.94%)	0

Of the 31 patients with PsA reviewed in this study, a comparison of the presence of destructive and proliferative change in individual joints (Table 23) demonstrates that the majority of patients had destructive change occurring either as the only feature or in conjunction with proliferative change. The former group predominated. The left

DIP joint was most involved (93.54%), followed by the right DIP (77.4%) and left MCP joints (77.42%), demonstrating a predilection for the distal joints. The right PIP and left PIP joints demonstrated both destructive and proliferative change, each in 38.71% of the patient population, compared to the right and left DIP and MCP joints. This demonstrates a predilection for proliferation at the proximal joints. Few patients had proliferative change as the only feature.

Sacroiliac disease

The prevalence of sacroiliac joint disease was 80.65%.

In this study population, 5 patients (16.13%) had unilateral disease, 13 patients (41.94%) bilateral symmetrical disease, 7 patients (22.58%) bilateral asymmetrical disease and 6 patients (19.35%) had no sacroiliac involvement. The dominant pattern was a bilateral symmetrical disease. The mean grade of severity on the right was 1.39 with a SD = 1.12 and on the left it was 1.32 with a SD = 1.14.

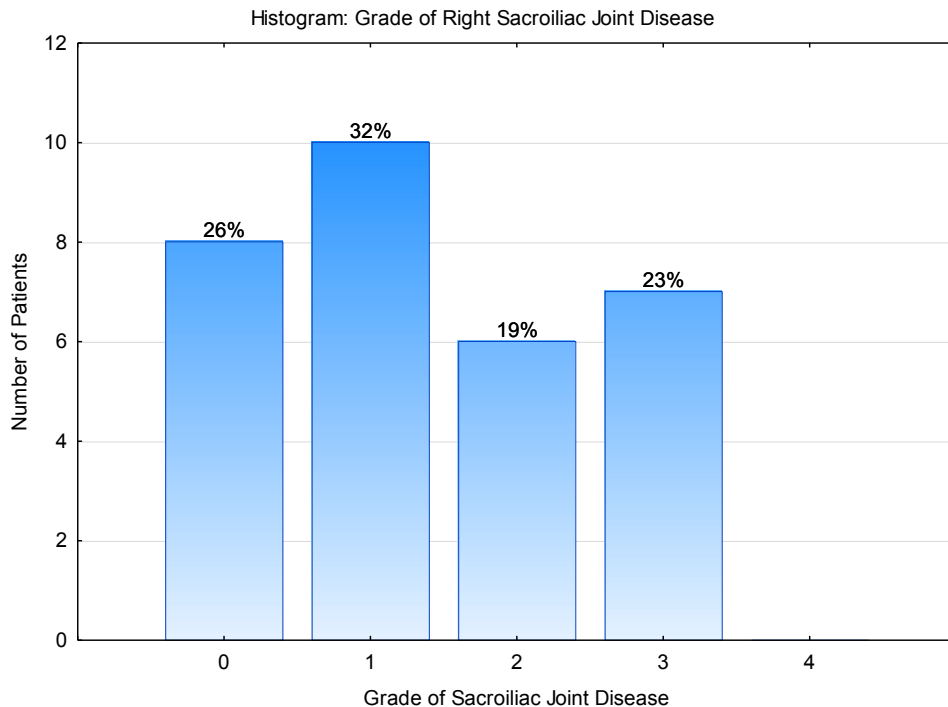


Figure 14: The distribution of radiographic grading of right-sided sacroiliac joint disease, for 31 patients, is reflected in the histogram above.

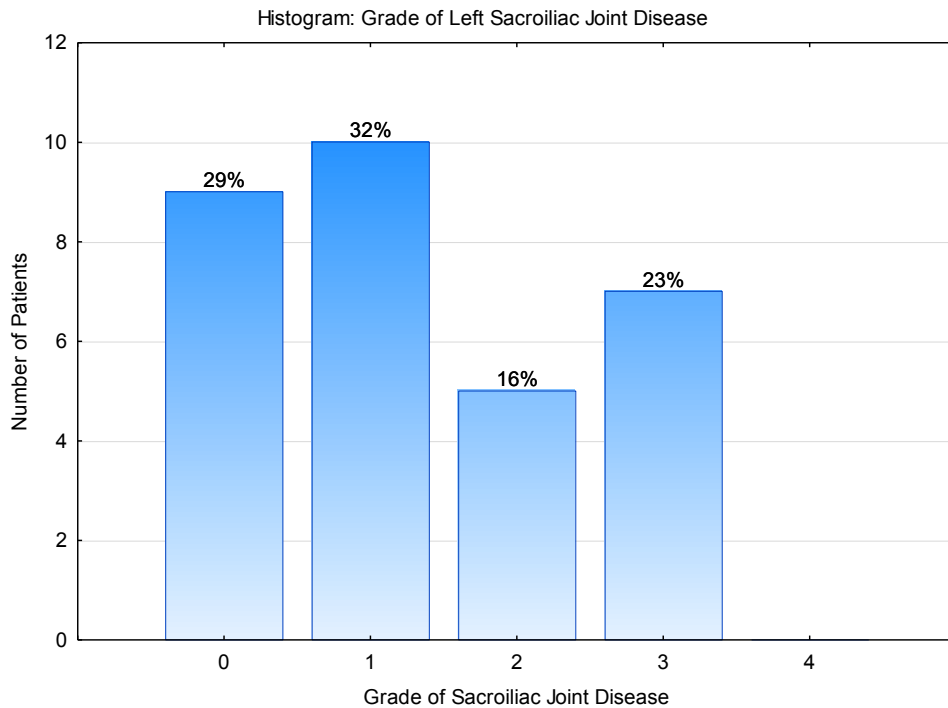


Figure 15: The distribution of radiographic grading of left-sided sacroiliac joint disease, for 31 patients, is reflected in the histogram above.

On the right side, 10 patients (32%) had grade 1 disease, 7 male (50%) and 3 female patients (18%). On the left side, 10 patients (32%) were also found to have grade 1 disease; however the female subgroup predominated with 7 female (41%) and only 3 male patients (21%).

Table 24: Comparison of sacroiliac joint (SIJ) disease in the right sacroiliac joints in both males and females

Right SIJ	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Male	3(21%)	7(50%)	3(21%)	1(7%)	0
Female	5(29%)	3(18%)	3(18%)	6(35%)	0

Table 25: Comparison of sacroiliac joint (SIJ) disease in the left sacroiliac joints in both males and females

Left SIJ	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Male	4(29%)	3(21%)	4(29%)	3(21%)	0
Female	5(29%)	7 (41%)	1(6%)	4 (24%)	0

On the right, grade 1 disease predominated in the male group (50%) and grade 3 disease in the female group (35%), whereas on the left, grade 2 disease predominated in the male group (29%) and grade 1 disease (41%) in the female group. Grade 1 disease, therefore was the most predominant bilaterally. There were no patients with grade 4 sacroiliac joint disease. The percentage of patients with Grade 2+ disease on the right = 42% and on the left = 39%. Prevalence of grade 2+ disease = 51.61%. 19.35% of patients had grade 2 disease and 32.26% grade 3. There was no correlation between sacroiliac disease and the TRS, TDS or TPS.

Correlation between the TRS and CRP, duration of PsA, the number of DMARDs and the severity of SIJ disease

There was a weak correlation between the TRS and CRP ($r^2 = 16\%$; p value <0.035), but no significant correlation between the TRS and duration of PsA, the number of DMARDs or the severity of SIJ disease. In addition, there was no correlation between the severity of SIJ disease and the total destruction or the total proliferation scores.

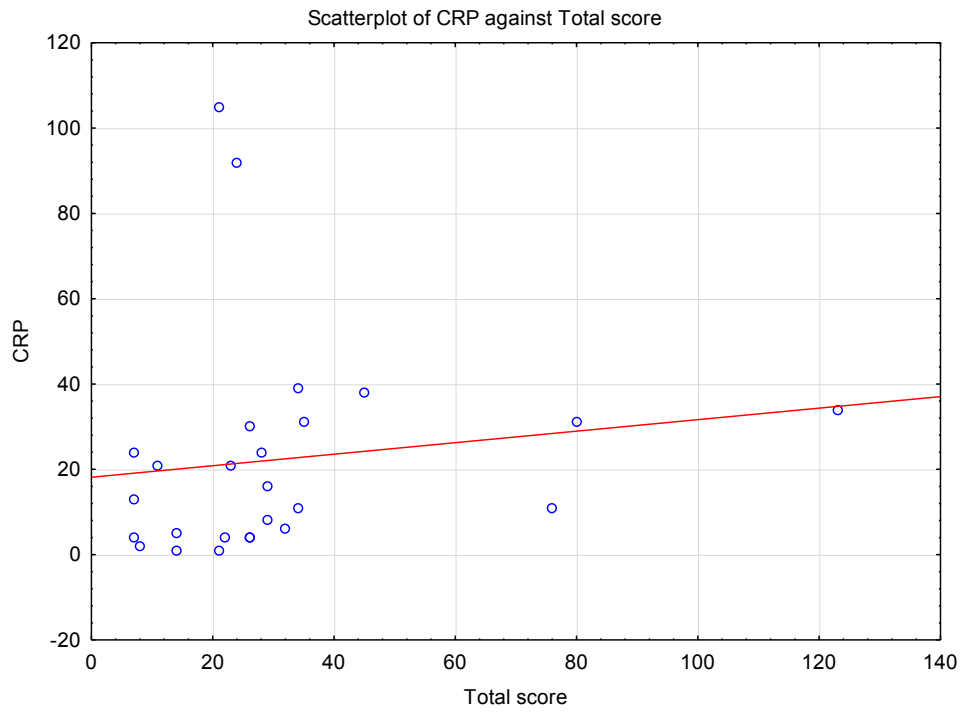


Figure 16: Correlation between CRP and the TRS ($r^2 = 16\%$; p value <0.035)

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DISCUSSION

Psoriatic arthritis (PsA) is a chronic, progressive disease [28,29,30]. The radiographic features of PsA have been grouped into destructive and proliferative changes. It is a diagnostic challenge to differentiate PsA from RA and the literature reports [6,10] indicate that the joint distribution and the simultaneous occurrence of destructive and proliferative change is a radiological distinguishing factor.

Bone proliferation is a striking feature of PsA [12]. Juxta articular new bone formation was reported by the CASPAR Study Group [8] as the only radiographic feature significantly and independently associated with PsA. There was no description of the joint distribution.

Radiographs reflect the progression or regression of the disease-related destructive or proliferative processes, but to be applied in clinical practice, it is necessary to quantify the radiographic change. The Psoriatic Arthritis Ratingen Score (PARS) was specifically developed as a method for scoring radiographic change in PsA. This method reliably quantifies the progression of the disease observed on radiographs and assesses both the destructive and proliferative processes of the disease. It is the only method to include both processes recognised in PsA [11,12,31].

Wassenberg et al [12] showed that there was good inter-observer variability regarding both the destruction score and the TRS. The reproducibility of the total proliferation score was less impressive for the two observers evaluating the radiographs in their study.

The results of our study demonstrate that destructive change was detected by the radiologist in all patients, with all patients having destructive change on the right and 96.77% on the left. There was a significant correlation between the TRS and the TDS on the right and left ($p < 0.05$).

Although there was a significant correlation between the TRS and the TPS on the right and left, fewer patients were found to demonstrate proliferative change, with less involvement of the individual joints when compared to those demonstrating destructive change (Figures 9 and 12). The variance in the TRS was explained to a greater extent by a variance in the TDS on the right and left. However, as stated by Wassenberg et al [12], intra and inter observer variability does exist and may be a confounding factor.

Wassenberg [12] reported that when both the change in destruction and the change in proliferation were plotted against each other, there was no convincing correlation. This indicated that proliferation develops independently from destruction and vice versa [11,12]. Significant information is derived from measuring both processes separately. Although there was no correlation, both changes nearly always displayed a similar trend.

The results of our study confirmed the above observation, as there was no correlation between the total destruction and the total proliferation scores on either the right or left side.

Age

PsA develops in persons aged 35 to 55 years old. Punzi et al [32] noted that the 2-year radiological outcome was worse in patients who were older than 60 years at disease onset. This outcome may be influenced by immune changes associated with aging, as suggested by the higher concentrations of IL1 beta and IL6 found in the synovial fluid of elderly onset psoriatic arthritis (EOPsA) patients. [28,32]. McHugh et al [33], did not support these findings in their study. They found the rate of progression to be similar across age groups, but admitted that the number of patients in their older age of onset group was small.

The results of our study showed an age range from 27 to 78 years and a mean of 53 with a SD = 13.4. There was a weak correlation between the TRS and the age of the

patient, suggesting that there was a trend towards more severe disease in the older patient.

Total radiographic score and duration of disease

A prospective study by Kane et al [28] showed that PsA is a chronic disease with significant functional impairment and radiological damage at an early stage in the course of the disease. The results of our study demonstrated no correlation between TRS and duration of disease. There was however a significant, albeit weak, correlation between the destruction scores of the right and left MCP joints with duration of psoriasis ($r^2 = 14\%$ and 24% respectively). This may suggest that subclinical joint damage occurs with the onset of the psoriasis and precedes clinical symptoms of joint inflammation.

Race predilection

Kerr et al [34] reported that PsA in African Americans was one third less prevalent than in Caucasians. In a recent study by Tey et al [35] it was reported that Indian psoriatic patients were more likely to have PsA compared to the other races. Mody et al [36] examined the clinical pattern of PSA in the Indian population attending the arthritis clinic, in Durban South Africa, over a period of 5 years and compared it with other western communities. They concluded that oligo-arthritis was the most common pattern, but was noted less often in Indians than in other race groups. The absence of black persons with PsA in the Groote Schuur hospital patient population compares with the literature reports [37] that PsA is rare amongst the indigenous black people of sub-Saharan Africa. There were, however, predominantly mixed race patients, consistent with the demographics in the Western Cape, South Africa.

Inflammatory marker, C- reactive protein (CRP)

Laboratory diagnostic markers are lacking in PsA and as a result, markers such as RF and the more specific anti-CCP (antibodies to cyclic citrullinated peptides) are used to differentiate RA from PsA [38]. Punzi and colleagues [38] also reported that the determination of ESR and/or CRP is frequently disappointing, being elevated in only

half of the patients with PsA. Gladman et al [2] analysed the data from the Adalimumab Effectiveness in PsA Trial (ADEPT). Their study demonstrated that baseline CRP was the dominant independent predictor of radiographic progression.

The results of our study indicate that the inflammatory marker, CRP, weakly influences the severity of the disease.

Disease modifying anti-rheumatic drugs (DMARDs)

The modified Steinbrocker scoring method has been used in case studies of several drugs in PsA, demonstrating that traditional DMARDs have not been able to prevent progression of joint damage in PsA [11].

Treatment options for peripheral disease, enthesitis and dactylitis, include non-steroidal anti-inflammatory drugs (NSAIDs), disease modifying anti-rheumatic drugs (DMARDs), local steroids and tumour necrosis factor (TNF) blocking agents. NSAIDs can control mild disease. Patients with progressive articular disease, not responsive to NSAIDs, should be treated with DMARDs to prevent joint damage and disability.

In 2003 Pipitone et al [29] reviewed the literature to determine current concepts and new developments in PsA. Methotrexate and sulphasalazine were considered the DMARDs of choice, but the evidence for the use of methotrexate in PsA was largely empirical, while the clinical benefit induced by sulphasalazine appeared to be modest. Other DMARDs proposed for the treatment of PsA included cyclosporin, gold salts and leflunomide. However, none of the DMARDs available to date are effective in the treatment of psoriatic spondylitis. In addition, a number of patients with severe peripheral arthritis fail to respond to standard DMARDs. Despite clinical improvement with current DMARD treatment, PsA results in radiological damage in up to 47% of patients at a median interval of 2 years. [29]

Recently De Vlam et al [30] in 2009 reported a major clinical response in approximately 30% of patients with methotrexate or leflunomide, but with no documented structural effect. Anti-TNF treatment has the best number needed to

treat/number needed to harm ratio of all DMARDs in PsA and is able to induce clinical remission in at least 30% of patients [30]. TNF-blocking agents have also been demonstrated to slow down or halt radiographic progression.

This study population, despite having been selected from a specialist clinic, is shown to have apparently mild disease as reflected by the total score, which ranged between 7 and 123. However, the severity of PsA was not influenced by the number of DMARDs, as there was no correlation between the TRS and the number of DMARDs. This discrepancy may be due to the fact that some patients presented at relatively advanced stages of the disease (i.e. damage more than clinical activity). Most patients (61.29%) were treated with only 1 drug and there was no information regarding the time into the disease that the DMARD therapy was initiated. It is expected that the likelihood of the DMARD impacting on progression would be less in those patients with longer disease duration at the time of initiating DMARD therapy.

Distribution of the involved joints

McHugh et al [33] stated that more precise information was required on the rate and pattern of joint damage in view of the advent of biological therapies that offer potential for preventing disease progression. They measured clinical and radiological joint involvement rather than joint damage. Joint involvement was defined as the presence of either synovial swelling or joint deformity or radiological abnormality not solely attributable to osteoarthritis. The peripheral joint score ranged from 0-70, with one point for each involved joint. The rate of progression of joint score was calculated. The rate of progression was 0.4 peripheral joints per year and was similar across age groups at onset. They concluded that although a disproportionately high number of peripheral joints are involved in the first 12 months following disease onset, there continues to be a steady progression of peripheral joint involvement in patients with PsA. They did not assess destructive and proliferative change separately, whereas our study consideration both processes.

Hands

An early study by Meaney and Hayes in 1957 [4], assessing the radiographs of 4 patients with PsA, reported destructive change in the DIP joints without associated involvement of the proximal joints or, at most, minimal involvement.

Recent studies [6,12] describe the most typical sites as the IPJs of the hand and foot, the MCP and MTP joints, the calcaneus, the sacroiliac joint and the spine. Resnick [6] reported that the destructive arthritis of the DIP joints of the hands is the most known manifestation of the disease and that adjacent PIP joints frequently are affected with severe abnormalities encountered at the thumb, with relative sparing of the MCP joints.

Our study clearly demonstrates involvement of the DIP, PIP and MCP joints by destructive change with the DIP being more involved than the PIP or MCP joints (Figure 9), although it also demonstrates that the PIP joints on the right and the MCP joints on the left contributed significantly to the destruction score ($r^2 = 46\%$ and $r^2 = 41\%$ respectively). This implies that although the DIP joints are most involved by the destructive process, they are not the only joints involved.

Our study also demonstrates that the joint most commonly involved by proliferative change is the PIP joint (Figure 12). The PIP joints on the right and left contributed significantly to the TPS on the right and left ($r^2 = 67\%$ and $r^2 = 53\%$ respectively). This implies that proliferative changes occurred predominantly in the PIP joints.

In the right thumb, variance in the TRS was explained to a greater extent by a variance in the destruction score than the proliferation score ($r^2 = 24\%$ vs $r^2 = 14\%$) i.e. destructive change contributed more to total structural abnormalities than proliferative change and was the dominant process. Further assessment between the TDS on the right and the destruction score of the IPJ of the right thumb revealed a weak correlation ($r^2 = 16\%$). This implies, that although destructive change was the more dominant process, the changes were mild. This is contrary to the results from Resnick and colleagues [6], who did not differentiate between destructive and proliferative change.

In the left thumb, the variance in the TRS was explained by a variance in the proliferation score ($r^2 = 19\%$). However, there was no significant correlation with the destructive change at this joint i.e. proliferative change contributed more significantly to total structural abnormalities than the destructive change. This is the opposite of the findings in the contralateral IPJ of the thumb. Further assessment between the TPS on the left and the proliferation score of the IPJ of the left thumb revealed no significant correlation. Rather, a variance in the TPS on the left was explained to a greater extent by a variance in the proliferation score of the left PIP and left MCP joints ($r^2 = 53\%$ and $r^2 = 28\%$ respectively). This implies that proliferative changes are more common at the PIP and MCP joints than at the IPJ of the left thumb and DIP joints.

Van der Heijde et al [12] reported that several patterns of distribution had been described, which included involvement of the distal and proximal IPJs which may occur in a ray pattern, involving all the joints of one digit as opposed to all the joints at the same level in both hands, as tends to occur in RA.

Wright [13] reviewed 157 patients with psoriasis and various rheumatic complaints. In only one patient with PsA was arthritis limited to the distal joints, as was the finding in our study. Therefore, the separation of a subgroup of pure DIP joint disease is superfluous.

Wrists

Ory et al [14] reported that asymmetrical erosions might be visible radiographically in the carpus. In our study, the wrists demonstrated slightly asymmetrical destructive change, with bilateral destructive change in 8 (25.81%) patients and 9 (29.03%) patients with unilateral change. There was no proliferative change except in one patient. There was no significant correlation with the total radiographic, total destruction or total proliferation scores on the right or left. This highlights that the wrist joint has minimal structural change in PsA and is a differentiating feature from RA.

Forefoot

Resnick [6] reported that the forefoot is commonly affected with bilateral, asymmetrical destructive and proliferative changes predominating in the IP and MTP joints. The researchers do not quantify these changes. Reportedly, extensive destruction of the IPJ of the great toe is more characteristic of this disorder than any other disease [6]. Furthermore, Ory et al [14] also reported that erosive change and bone proliferation usually involve the IP and MTP joints; the IPJ of the great toe is most often affected.

In our study, 20 (64.52%) patients had destructive change of the IPJ of the great toe, 9 (29.03%) with bilateral change and 11 (35.48%) patients with unilateral change. There was a weak correlation between the destruction score of the IPJ of the right great toe with both the TRS ($r^2 = 18\%$) and the TDS ($r^2 = 22\%$) on the right and a weak correlation of the left great toe with the TDS ($r^2 = 15\%$) on the left, indicating that although these findings were significant, the changes did not contribute greatly to the overall structural abnormalities. 4 (12.9%) patients had unilateral proliferative change at this joint, 3 on the right side and 1 on the left, occurring in combination with destructive change. Once again, these changes were significant, but did not contribute greatly to the overall structural abnormalities.

The changes in the MTP joints observed in our study were as follows: 13 (41.9%) patients had bilateral destructive change and 8 (25.81%) had unilateral destructive change. There was a significant correlation between the total destruction score on the right ($r^2 = 23\%$) and the left ($r^2 = 14\%$), but no significant correlation with the TRS on either side. Therefore, although the MTP joints are involved, the change contributes little to the TRS.

There was only one patient with proliferative change involving the MTP joint. The changes affected the right MTP and occurred in combination with destructive change. The finding was not significant.

Sacroiliac joint involvement

There has been great controversy in the literature regarding the prevalence of sacroiliitis in patients with PsA. Two large studies conducted in 1987, by Gladman et al (20), and 1999 by Battisone et al (17) reported a prevalence of 27% and 78% respectively.

Resnick et al [6], in 1989, reported that approximately 30-50% of individuals with PsA will develop sacroiliac disease and that bilateral abnormalities are more frequent with symmetrical abnormalities predominating. They also reported that although significant joint space narrowing and ankylosis can occur, the frequency of these findings, particularly ankylosis, is less than that observed in ankylosing spondylitis or the spondylitis associated with inflammatory bowel disease.

In our study, the prevalence of sacroiliac joint disease was 80.65% with grade 1 disease predominating. In 41.94% of patients it was observed to be bilateral and symmetrical. Only 16.13% of the patients in our study had unilateral disease. This high prevalence is as a result of including grade 1 disease, however when only grade 2+ disease is considered, the prevalence decreases to 51.61%. This is lower than the 78% obtained by Battisone et al [17] in 1999.

We found 19.35% of patients with grade 2 disease and 32.26% with grade 3. When comparing these results with those of Battisone et al [17] (grade 2 = 22.2% and grade 3+ = 55%), it is clear that our population had less advanced disease.

Strengths and limitations

The strength of the sample population was that it was selected from a specialist rheumatic diseases unit and each patient was assessed to have PsA based on the assessment of a qualified rheumatologist, which included a clinical and laboratory evaluation. The author of this study, a qualified radiologist trained to detect minor radiographic abnormalities, assessed the radiographs.

This study was a retrospective review of a small population, which was selected 8 years previously, as part of a large international study. The hospital does not have a PACS (Picture Archiving and Communication System). The study was therefore limited by an incomplete archive in which only 31 of the original 48 film sets were obtained and included in this study. A larger population may reveal different results. The sacroiliac joints were assessed on antero-posterior projections of the pelvis rather than dedicated sacroiliac joint views. The ability of the radiologist, trained in the assessment of radiographs, to detect mild sacroiliac joint disease may be the reason for the high prevalence of sacroiliitis. When considering only Grade 2+ disease, the prevalence of sacroiliac disease decreases. A further limitation of this study was that one radiologist interpreted the radiographs and that there were no controls.

Furthermore, there was inadequate laboratory data such as the lack of CRP blood levels in 5 of the 31 patients. No comment on the pattern of use or “handedness” was possible as this was a retrospective study and the data was not available.

University of

FUTURE DEVELOPMENTS

The diagnosis of PsA is primarily based on clinical findings and laboratory tests. In certain cases it is difficult to differentiate between PsA, RA and other chronic inflammatory joint diseases. Conventional radiography may be normal in patients with early PsA.

Magnetic resonance imaging (MRI) has reportedly enabled detection of bone marrow oedema and active synovitis visually, long before changes are detectable on conventional radiographs [39,40]. MRI features of PsA include synovitis, tenosynovitis, dactylitis, erosions, bone oedema and enthesitis. In a study conducted by Schoellnast et al [39], patients with PsA (n=18) and RA (n=21) underwent gadolinium-enhanced MRI of the wrist and hand. Periosteal enhancement, as a sign of periostitis, was significantly more frequent in patients with PsA than in patients with RA.

A recent study [40] investigating the role of dynamic contrast-enhanced MRI in the differential diagnosis of PsA and RA, in the hand and wrist, showed that it was possible to differentiate between PsA and RA on the basis of synovial late enhancement after fifteen minutes.

Histopathological differences could account for the significant difference in late contrast enhancement. Gadopentetate dimeglumine, which is transported in the plasma as an unlinked molecule and diffuses freely to the extracellular space, accounts for the signal increase in T1-weighted images. It is possible that the volume of the extravascular–extracellular space is wider in RA because of the higher cellularity and the multiple synovial layers of the highly inflamed synovium, leading to a slower washout of contrast medium. In contrast, in PsA, the inflamed synovium shows less cellularity and hyperplasia, thereby exhibiting a faster washout of contrast medium.

MRI images demonstrate widespread abnormalities in digits of people with PsA. Healy et al [12] showed circumferential soft tissue oedema in the majority of the 17 patients included in their study. Although tender dactylitic digits had more abnormalities than other digits, a strong relationship between clinical and MRI scores was not demonstrated in their study.

A new OMERACT (Outcome Measures in Rheumatoid Arthritis Clinical Trials) PsA MRI scoring system (PsAMRIS) for scoring inflammation and damage in PsA fingers was developed and preliminary validation was conducted [41,42]. In a cross-sectional study, the interobserver reliability of the scores for synovitis, tenosynovitis, bone edema, bone erosions and bone proliferation revealed moderate to high reliability. However, reliability for periarticular inflammation was poor.

In the longitudinal exercise, similar results were obtained for the status scores. However, while the change scores were moderately reliable for synovitis, tenosynovitis, periarticular inflammation and bone erosion, they were low or unmeasurable for bone edema and bone proliferation. At the DIP joints, reliability for change scores was acceptable only for synovitis and tenosynovitis. Overall PsAMRIS is a reliable instrument to assess PsA fingers. However, characteristic features of PsA, such as DIP joint involvement, periarticular inflammation, bone proliferation and bone edema were not reliably scored. Further refinement and validation of PsAMRIS is required before it may be used widely as a PsA specific instrument.

Conventional radiography in the initial evaluation of sacroiliac joints disease is often insensitive for demonstrating the early changes of sacroiliitis [43]. MRI has been proposed as an imaging method to detect sacroiliitis earlier. Puhakka et al [44] published a MRI scoring system for the sacroiliac joints in early spondylarthropathy and in a separate study [45] compared it with clinical and laboratory parameters. The conclusion was that MRI is able to detect sacroiliitis defined as destructive or inflammatory changes in patients suspected of spondylarthropathy despite normal clinical findings.

RECOMMENDATIONS

Our advice to future researchers conducting future studies, involving the evaluation of analogue films, is to convert the films into a digital format. This will allow the researcher to adjust the contrast and magnify the images, thus allowing for improved visualisation of any abnormalities, particularly the more subtle changes. A future study comparing the various scoring methods with a control group would be of interest.

Further studies are needed to:

- Improve the capacity of MRI to detect and score lesions as there is not yet an established, widely accepted method for the evaluation and quantification of MRI abnormalities.
- To discriminate between early psoriatic arthritis and rheumatoid arthritis.

CONCLUSION

- We measured radiological joint involvement and severity of joint damage, considering both the destructive and proliferative change.
- This study population was shown to have mild disease as reflected by the TRS, which ranged between 7 and 123.
- The results clearly demonstrate that destructive and proliferative changes are not present simultaneously in all patients.
- The results also demonstrate that destructive change is the dominant process and that although the DIP joints are most involved by the destructive process, they are not the only joints involved. There is a degree of asymmetrical distribution in the hands.
- The small joints of the hand are more severely affected by the destructive process than the joints of the toes. However, the destructive changes in the toes have a greater degree of symmetry than the hand joints.
- There were minimal structural changes at the wrist joint.
- Proliferative change has been shown to predominantly involve the PIP joints, with the wrist, the IPJs of the thumb and great toe and the MTP joints least affected.
- There was a weak correlation between the TRS and CRP, suggesting that the TRS is weakly influenced by CRP.
- There was also a weak correlation between the TRS and age, suggesting a trend towards more severe disease in older patients.
- There was no significant correlation between the TRS and the duration of PsA, the number of DMARDs or the severity of sacroiliac disease.
- In addition, there was no correlation between the severity of sacroiliac disease and the total destruction or total proliferation scores.
- Sacroiliac joint disease in this population was predominantly bilateral and symmetrical with a high prevalence. Mild Grade 1 disease predominated bilaterally.

**IMAGES OF REPRESENTATIVE CASES
HANDS AND FEET**

CASE 1

R

L



Figure 17: The destruction score (DS) for the right DIP joints = 10 and left DIP joints = 11. The proliferation score (PS) for the right DIP joints = 5 and left DIP joints = 0. The DS for the right PIP joints = 12 and left PIP joints = 7; whereas the PS for the right and left PIP joints = 0

R

L



Figure 18: The greatest destructive change involves the interphalangeal joint of the right great toe (destruction score = 5) with moderate proliferative change (score = 2)

CASE 2

R

L



Figure 19: This patient had the highest total radiographic score. The PIP and MCP joints were more severely affected by destructive change than the DIP joints: Right DS DIP = 4; right DS PIP = 11; right MCP= 13. Left DS DIP =5; Left DS PIP = 5; left DS MCP = 15. Minimal proliferative change. Note the ankylosis of the wrists bilaterally (DS = 5; PS =5 bilaterally)

R

L



Figure 20: Severe destructive change involving the 2nd to 4th MTP joints bilaterally (RT DS = 16; LT DS = 12) with no proliferative change. Destructive change involving the interphalangeal joints of the great toe bilaterally, left more than right (RT DS = 1; LT DS = 4)

CASE 3

R

L



Figure 21: Minimal destructive change – right 4th DIP joint, right 2nd PIP joints, right wrist; left 2nd, 3rd and 5th DIP joints, 3rd PIP joint and right wrist (each score = 1). No proliferative change

R

L



Figure 22: Minimal destructive change (score =1) in left 5th MTP joint is the only finding

CASE 4

R

L

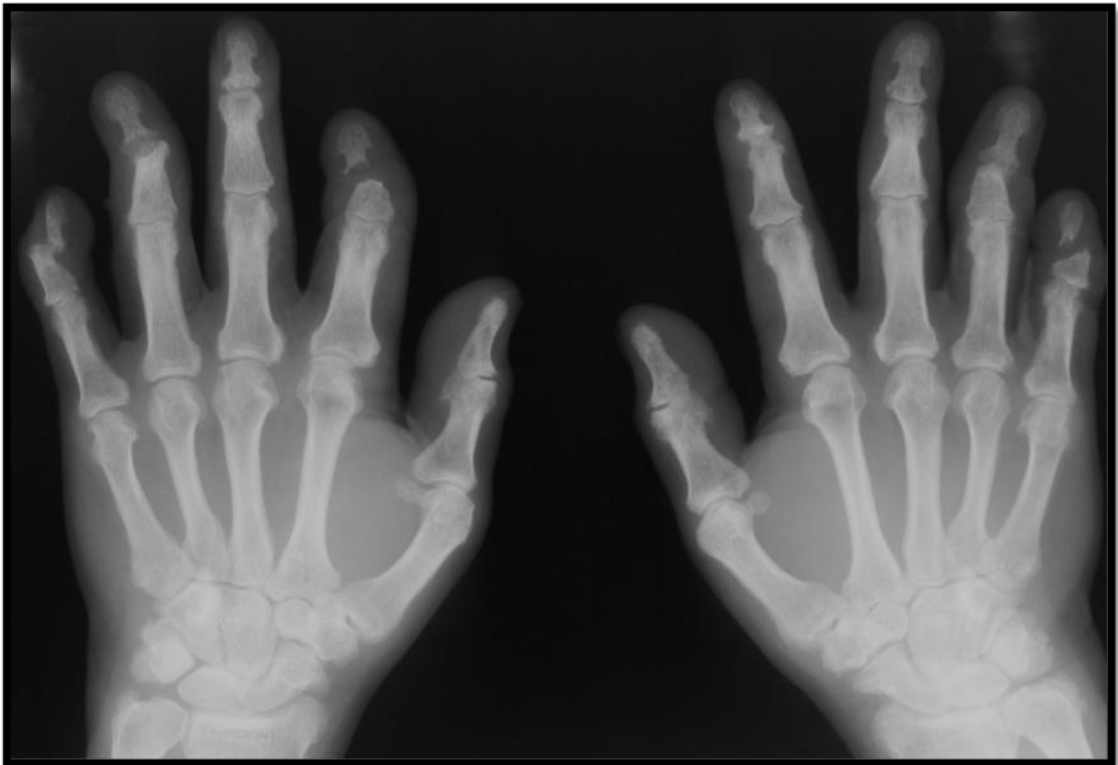


Figure 23: Destructive changes involving predominantly the distal interphalangeal joints. Note the proliferative change (score = 5) in the right 4th DIP

R

L



Figure 24: Ankylosis of the interphalangeal joint of the right great toe; destruction score = 5; proliferation score =5

SACROILIAC JOINT DISEASE

CASE 5



Figure 25: Right sacroiliac joint = grade 0; left sacroiliac joint = grade 1

CASE 6

R

L



Figure 26: Right sacroiliac joint = grade 2; left sacroiliac joint = grade 2

CASE 7

R

L



Figure 27: Right sacroiliac joint = grade 3; left sacroiliac joint = grade 3

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APPENDIX 1: DATA CAPTURE SHEET

Patient name:

Folder number:

Patient ID:

Date of Xrays:

Sex:

Age:

Duration of psoriatic skin disease: _____

Duration of PsA: _____

Number of DMARDS: _____

Inflammatory markers:

	RIGHT	LEFT	TOTAL
Total Destruction Score TDS (0-200)	TDS RIGHT	TDS LEFT	TDS RIGHT + TDS LEFT
Total Proliferation Score TPS (0-160)	TPS RIGHT	TPS LEFT	TPS RIGHT+ TPS LEFT
Total Radiographic Score (TDS +TPS)	na	na	TRS

GRADING SCALE FOR SACROILIAC DISEASE:

GRADE	RIGHT	LEFT

Joint (RIGHT)	Joint Number	Destruction Score	Proliferation Sc
DIP	2nd		
	3rd		
	4th		
	5th		
IP of thumb			
PIP	1st		
	2nd		
	3rd		
	4th		
MCP	1st		
	2nd		
	3rd		
	4th		
	5th		
Wrist			
IP of great toe			
MTP	2nd		
	3rd		
	4th		
	5th		
TOTAL			

Joint (LEFT)	Joint Number	Destruction Score	Proliferation Sc
DIP	2nd		
	3rd		
	4th		
	5th		
IP of thumb			
PIP	1st		
	2nd		
	3rd		
	4th		
MCP	1st		
	2nd		
	3rd		
	4th		
	5th		
Wrist			
IP of great toe			
MTP	2nd		
	3rd		
	4th		
	5th		
TOTAL			