The assessment of disease activity and outcomes in psoriatic arthritis

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ABSTRACT

Psoriatic Arthritis (PsA) is a common condition that significantly impacts affected patients. The introduction of novel therapeutic agents for PsA has generated considerable interest in both clinical trials and in clinical care. Thus, there is a great need for standardized outcome measures to assess the activity of disease and the response to therapy. Because psoriasis is a heterogeneous and multi-faceted condition, defining outcome measures has been a challenge. To date, such measures have largely been adapted from related diseases, as described in this essay. Further research is needed to further develop outcome measures for PsA to facilitate optimal treatment of patients with PsA.

Introduction

Psoriatic Arthritis (PsA) is a chronic systemic inflammatory disorder characterized by joint inflammation associated with cutaneous psoriasis. This seemingly straightforward description belies a complexity relevant to the clinical assessment and treatment of PsA. The core areas of involvement, skin and joints, are heterogeneous among patients, and multiple patterns of involvement are seen within these groupings (Table I). Any given patient may have various levels of activity of skin psoriasis, peripheral arthritis, axial arthritis, and associated features. While each of these areas of involvement may be considered separately, considerable overlap is seen in effects on patients, certainly in regard to quality of life and functional status. Moreover, treatment decisions generally are based on the level of activity, taking into account all the disparate clinical features.

PsA is relatively common, affecting approximately 1% of the population (1). While previously considered to be a relatively mild form of arthritis, there has been a growing recognition that PsAcan be progressive, destructive and deforming, with profound deleterious effects. The impact of the disease can be comparable to that of other pernicious chronic conditions, such as rheumatoid arthritis (RA) (2,3). For many years, the level of attention directed to PsA had been less than that for various other autoimmune conditions. However, the availability of potent new therapeutic agents for psoriasis and PsA has stimulated interest in research and clinical care for these conditions. Probably the most significant therapeutic advance in PsAhas been the development of novel biologic agents, particularly inhibitors of the pro-inflammatory cytokine TNF-α (4-6). The introduction of biologic agents for PsAand psoriasis has been largely facilitated by 4 factors: 1) a greater understanding of the immunopathogenesis of PsAand psoriasis, thereby defining potential therapeutic targets, 2) progress in biotechnology, allowing the synthesis of specific targeted therapies, 3) appreciation of the unmet clinical need among affected patients, and 4) the substantial and growing clinical experience with biologic agents in other autoimmune sys-

Table I. Psoriatic arthritis: Areas of involvement.

- Articular
  - Peripheral arthritis
    - oligoarticular
    - polyarticular
    - arthritis mutilans
  - Associated features
    - enthesitis
    - dactylitis
  - Axial arthritis
- Dermatologic
  - Plaque psoriasis
  - Guttate psoriasis
  - Other types of psoriasis (pustular, etc)
  - Associated features
    - nail changes

temic inflammatory disorders, particularly RA.

The focus on PsA has led to greater interest in identifying relevant clinical outcomes, not only in clinical trials, but also for clinical care. The multi-faceted nature of PsA makes this a challenging task. Some PsApatients may have a peripheral arthritis nearly indistinguishable from RA, while other patients have spinal involvement very similar to that in ankylosing spondylitis (AS). Skin psoriasis, an important component of PsA, precedes the development of joint disease in 70% of PsA patients and occurs concomitantly in 15%.

The easiest method of assessing disease activity in PsA is to 'borrow' outcome measures from these other conditions that have close resemblance to features of PsA. However, this extrapolation may be suboptimal, as PsA is distinct from these other disorders. For example, peripheral arthritis in PsAhas a greater tendency towards asymmetry and oligoarticular involvement compared to RA. Certain joints such as the DIP joints are more frequently involved in PsA, and associated features such as enthesitis and dactylitis are more common in PsA. Similarly, spinal involvement in PsA has a greater tendency towards asymmetry and discontinuous involvement compared to AS. In regard to the skin, the overall level of severity may be lesser among PsA patients as compared to psoriasis patients who do not have arthritis.

Thus, outcome measures originally developed in other diseases must be specifically validated in patients with PsA. In addition, there may be unpredictable interactions among disease involvement in different areas. For example, does the severity of skin disease impact functional status in patients with peripheral arthritis? Similarly, might the presence of enthesitis or axial arthritis affect a patient's quality of life (QOL) as measured by an instrument focusing on skin involvement ? In this manuscript, we will describe currently used outcome measures for PsA, focusing on the distinct areas of involvement.

Peripheral arthritis

The assessment of activity of peripheral arthritis in PsA utilizes several types of measures (Table II). Central among these is the assessment of joint tenderness and swelling, reflecting articular inflammation. Most assessments are derived from those initially developed and used in patients with RA. Although the pattern of joint involvement in PsA may differ from that characteristically seen in RA, the various instruments nonetheless appear to perform acceptably.

The American College of Rheumatology (ACR) joint count, initially developed nearly half a century ago for RA patients, assesses the presence of joint pain (i.e. joint line tenderness and/or stress pain) and swelling in 68 and 66 peripheral joints, respectively. This count includes the vast majority of all peripheral diarthrodial joints, reflecting the protean possibilities of RAinvolvement. Although developed for RA, it has been shown to have good inter-observer and intra-observer reliability in PsA (7). The ACR joint count has become a standard measure, both in RAas well as in PsA, in part because of its inclusion in key composite criteria (*vide infra*) (8, 9).

Several modifications of the ACR joint count have been reported. The use of scoring (e.g. rating pain and tenderness on a 0-3 scale), rather than counting, has the potential to increase sensitivity, particularly for detection of change over time, but scores (as opposed to counts) also increase variability, both inter-observer and even intra-observer, and counts provide similar information (Fuchs). Hence, joint counts are most widely used. Because PsA can be relatively oligoarticular in comparison to RA, and because it can involve the DIP joints of the toes as well as those of the fingers, a 78/76 tender/swollen joint count that includes both proximal and distal toe joints has been suggested. However, it has not been shown to perform better than the 68/66 joint count.

In RA, there has been a growing trend towards reduced joint counts, with the idea that they are easier to perform and could conceivably reduce variability. A 28 tender/swollen joint count, which includes the shoulders, elbows, wrists, MCPs 1-5, PIPs 1-5 and the knees, bilaterally, has become popular. Importantly, it has been shown to perform comparably to more extended joint counts (10). Although the 28 joint count excludes some joints characteristically involved in PsA, such as the DIP joints, it has been shown to perform acceptably in PsA. The Ritchie Articular Index, also originally developed for RA, is another method of assessment, although it performs less well in PsA than other instruments (8).

Other measures beyond joint counts are useful to assess active inflammation in peripheral joints in PsA (Table II). Increased concentrations of acute phase reactants (e.g. erythrocyte sedimentation rate [ESR], C-reactive protein [CRP]) are less commonly observed in patients with PsA than in RA (6, 11). However, elevations in acute phase reactants are associated with a poorer outcome in PsA(3).

Functional status, which in RA has been shown to predict most key outcomes such as cost of disease and mortality, is arguably the most important measure in patients with peripheral arthritis. It is measured most commonly using the Health Assessment Questionnaire (HAQ) (12). Although it was originally developed for RA, and although modifications of the HAQ specific for patients with spondyloarthropathies and psoriasis have been developed, the standard HAQ has been validated and is widely used in PsA(9,11). A study has shown that PsA patients consider a change in HAQ score of 0.3 on a 0-3 scale as being the minimal important difference, slightly higher than the 0.22 difference rated minimally important by RApatients (13). Another functional instrument originally developed for RA, the arthritis impact measurement scales (AIMS) has been validated in patients with PsA(14), but it is not widely used in RA or PsA, in part due to its relative length and complexity.

The greatest utility from these individual measures of peripheral joint arthritis is seen when they are included in composite indices of response. Three widely used composite measures are used in PsA(Table II).

A measure that has come to be called

Table II. Outcome measures in psoriatic arthritis.

Area of involvement	Domain	Manifestations	Instruments	Composite indices
Articular				
Peripheral arthritis	Arthritis activity	Signs and symptoms	Tender joint count (68, 28, other)	ACR20/50/70
			Swollen joint count (66, 28, other)	DAS/EULAR
			Patient assessment of joint pain (VAS)	PsARC
			A.M. stiffness	
			MD global assessment of arthritis (VAS)	
			Patient global assessment of arthritis (VAS)	
		Acute phase reactants	ESR	
			CRP	
		Functional status	HAQ	
			AIMS	
		QOL	SF-36	
			PsAQOL	
		Radiographic damage	Sharp (modified)	
			Rau/Wassenberg	
			Modified Steinbrocker	
Associated features	Enthesitis activity	Signs and symptoms	Mander	
			MASES	
	Dactylitis activity	Signs and symptoms		
Axial arthritis	Arthritis activity	Signs and symptoms	Pain VAS	BASDAI
			A.M. stiffness	ASAS
		Functional status	BASFI	
		Radiographic damage		
Dermatologic				
	Skin activity	Signs and symptoms	Erythema	PASI
			Induration/thickness	NPF-Ps
			Scale	
			Extent (BSA)	
		Quality of life	SF-36	
			DLQI	
Associated features	Nail activity	Signs and symptoms		NAPSI

ACR: American College of Rheumatology; EULAR: European League Against Rheumatism; DAS: Disease Activity Score; PsARC: Psoriatic Arthritis Response Criteria; ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; VAS: visual analog scale; QOL: quality of life; MASES: Maastricht Ankylosing Spondylitis Enthesitis Score; SF-36: Short Form 36; BASFI: Bath Ankylosing Spondylitis Functional Index; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; ASAS: Assessment in Ankylosing Spondylitis; PASI: Psoriasis Area Severity Index; NPF-Ps: National Psoriasis Foundation Psoriasis score; BSA: body surface area; DLQI: Dermatology Life Quality Index; NAPSI: Nail Assessment in Psoriasis.

the Psoriatic Arthritis Response Criteria (PsARC) was specifically developed for a study to evaluate the efficacy of sulfasalazine in PsA (15). The PsARC is composed of four measures, including: 1) patient global assessment of disease activity (improvement of 1 on a 5 point Likert scale is required for a response), 2) physician global assessment of disease activity (improvement of 1 on a 5 point Likert scale is required for a response), 3) joint pain (reduction of 30% or more in total score, assessing either 68 or 78 joints, using a 4 point scale is required for a response), and 4) joint swelling (reduction of 30% or more in total score, assessing either 66 or 76 joints using a 4 point scoring scale, is required for a response). In order to be a 'PsARC responder', patients must achieve improvement in 2 of 4 measures, one of which must be joint pain or swelling, without worsening in any measure. In several trials of various therapeutic agents where it was included as a primary or secondary outcome measure, the PsARC has been shown to be able to distinguish active treatment from placebo responses (5, 6, 8, 9). However, the PsARC in general results in higher placebo responses compared to other composite measures. The ACR response criteria, initially developed for RAclinical trials, require improvement in tender joint count, swollen joint count, and 3 of 5 additional measures, which include patient global assessment of disease activity, physician global assessment of disease activity, patient assessment of pain, functional status (e.g. using the HAQ) and an acute phase reactant. The original criteria, commonly called the ACR 20, require 20% improvement in these measures (16); more extensive improvement may be documented according to ACR50 and ACR70, which require 50% and 70% improvement, respectively. ACR20 criteria are reported to be as effective as higher levels to distinguish active treatment from placebo responses (17), and have been widely used as a primary outcome measure in clinical trials in PsA with good performance (8, 9).

The European League Against Rheumatism (EULAR) response criteria for rheumatoid arthritis utilize one of the iterations of the disease activity score (DAS) (18). The original DAS included an assessment of joint pain (the Ritchie Articular Index [RAI]), a swollen joint count (44 joints examined), a patient

global assessment of disease activity, and ESR. It was derived from actual RA patients, and changes in the various assessments were weighted according to how they impacted changes in disease activity that were considered relevant by treating physicians. While the formula is complex, the DAS generates a numerical value that identifies a level of disease activity, and that can be used to assess the magnitude of responses to treatment. A more recent modification of the DAS replaces the 44 joint RAI with a 28 joint count for pain and swelling. Further modifications include CRP instead of ESR. The EULAR criteria perform comparably to the ACR criteria in RA to define significant treatment responses (19). The DAS has become more widely used as a primary or secondary outcome measure in clinical trials in PsA, and has been shown to perform well.

Recently, the Group for Research and Assessment in Psoriasis and Psoriatic Arthritis (GRAPPA) has assembled together international investigators with an interest in PsAand psoriasis in order to optimize the approach to clinical research and care in this area (20). As part of the GRAPPA participation in OMERACT 7 (Outcome Measures in Rheumatoid Arthritis Clinical Trials), an assessment of the utility of these indices in recent clinical trials in PsA was performed. Interestingly, the ACR20/50/70, the PsARC and the EULAR/DAS-28 all functioned very well in distinguishing active treatment from placebo in PsA trials; overall, the DAS appeared best (21).

Other aspects of peripheral arthritis include joint damage, which is most readily identified through radiographic changes. Characteristic radiographic changes in patients with PsA include: 1) periarticular soft tissue swelling, 2) joint space narrowing, 3) peri-articular erosions, 4) osteolysis (e.g. yielding the 'pencil in cup' change), 5) bone proliferation (periarticular and shaft osteiitis), and 6) ankylosis (22). Several methods have been developed to assess radiographic changes in PsA. Although PsA has radiographic characteristics distinct from RA(less peri-articular osteopenia, a tendency for asymmetric involvement, the presence of osteiitis, etc), most methods used in PsA to date derive in part from radiographic assessments developed for RA.

The original Steinbrocker method assessed the progression of changes in characteristic joints, including joint space narrowing and erosions, with grading from 0 to 4. Amodification of these criteria has been validated in PsA (23). In RA, the Sharp score and its modifications grade erosions and joint space narrowing in the small joints of the hands and feet; it has become a *de fac - to* standard measure of joint damage in RA insofar as it has been used as the basis for regulatory approval for claims in that regard. A modification that includes the DIPjoints has been similarly used for PsA(24). Another method that measures destruction and proliferation has been specifically developed for and validated among patients with PsA (25). Further study will help define the optimal means of assessing radiographs in PsA. Also, as has been seen in other arthritides, newer imaging modalities such as magnetic resonance imaging (MRI), ultrasound, and others may prove to be of utility in PsA.

Assessment of quality of life (QOL) through self-report questionnaires provides another method to assess damage in PsA. The most commonly used generic measure of QOL, the short form 36 (SF-36), has been found to be reliable, valid and responsive to change in PsA (11, 26). The advantage of a generic QOL measure is that it allows direct comparisons to QOL in other medical conditions. However, disease specific measures of QOL may allow more accurate assessment, particularly in such a complex and multi-faceted disease as PsA. Recently, the PsAQol, a quality of life instrument specific to PsAhas been developed and validated (27). QOL measures provide important information regarding disease status, as well as response to therapeutic agents.

Associated features: Dactylitis and enthesitis

Dactylitis, swelling of an entire digit related to articular and periarticular inflammation, is characteristic of spondyloarthropathies, including PsA. Although most clinicians consider it an important manifestation of disease, there are no validated measures to assess it. Nevertheless, using simple grading systems (e.g. 0-3 scale for severity), assessment of dactylitis has been incorporated into PsA clinical trials (28,29). Similarly, enthesitis, inflammation at the bony insertion of tendon, ligament, or joint capsule, is common in PsAand considered important by affected patients. Two methods of assessing enthesitis have been developed to assess patients with AS (30). These indices, the Mander and the MASES, are somewhat lengthy, and they have not been specifically validated in PsA nor utilized in PsA clinical trials. Simpler measures of enthesitis have been incorporated into 2 clinical trials (28, 29). In these 2 trials, pain at the insertion into the calcaneus of the achilles tendon and also the plantar fascia was assessed by direct palpation and was considered evidence of enthesitis. In the future, validation of straightforward, easily performed, and reliable assessments of dactylitis and enthesitis in PsA will be very important, and such measures are eagerly awaited.

Axial arthritis

Spinal involvement is seen in approximately 40% of patients with PsA, although it tends to be less severe, less symmetric and less contiguous in PsA than in AS. Most outcome measures in spinal PsAhave been derived from and validated in patients with AS, although the utility of extrapolating these measures to patients with PsAremains to be defined. As with peripheral arthritis, assessment of the activity of axial inflammation includes assessment of pain, and patient and physician global assessment of disease activity. Unlike peripheral arthritis, spondylitis does not readily lend itself to direct assessment of inflammatory activity by physical examination. A number of metrology assessments of spinal mobility have been described, but these measures may reflect damage or irreversible change as much as inflammatory activity, and they have not been validated in PsA. Early morning stiffness, a characteristic symptom of inflammatory arthri-

tides, is not typically included in the assessment of peripheral arthritis due to lack of specificity, but is considered an important measure of spinal arthritis.

The assessment in ankylosing spondylitis study group (ASAS) has defined core outcome measures that should be included in clinical trials in AS: 1) pain, 2) function (e.g. using the Bath Ankylosing Spondylitis Functional Index; BASFI), 3) patient global assessment, 4) spine mobility, 5) duration of morning stiffness, 6) peripheral joint assessment, 7) entheses count, 8) a measure of the acute phase response, 9) fatigue, and 10) radiographic progression (31). A composite of these measures has been developed for AS clinical trials, but has not yet been tested in PsA. The Bath ankylosing spondylitis disease activity index (BASDAI) is a composite index that includes a number of the measures noted above, but it has not yet been tested in PsA.

Skin involvement

Skin psoriasis is a major aspect of PsA, although the extent of activity in the skin does not necessarily correlate with joint activity. A number of instruments to assess skin psoriasis have been developed, although there is controversy concerning their utility (32). A widely used instrument is the psoriasis area and severity index (PASI). The PASI assesses individual psoriatic lesions for erythema, thickness/induration, and scale, and then uses a formula to account for the overall extent of the body surface area of skin involved, with scores ranging from 0-72. Several objections to the PASI have been raised, including a lack of sensitivity, particularly at lower ranges of involvement, equal weighting to the various facets (whereas induration may be of greater pathophysiologic relevance), and poor correlation with QOL measures (8, 32). Nevertheless, because the PASI has often been used by regulatory agencies in the process of granting approval by the Food and Drug Administration to be available to the public by prescription, it has been widely used in clinical trials. Typically, improvement in studies is reported according to the percent improvement in PASI (e.g. those achieving 75% improvement in the PASI = PASI75). Alternative measures include assessments of target lesions, overall physician global assessment of disease activity, composite assessments such as the National Psoriasis Foundation psoriasis score (NPF-Ps), and others.

Several QOL assessments for patients with psoriasis have been developed and tested. As noted above, an advantage of generic QOL measurements, such as the SF-36, is that they allow comparison with other medical conditions (33). The dermatology quality of life index (DLQI) was developed for and validated among patients with psoriasis, and has been shown to detect meaningful changes in clinical status over time (34), although limited as a disease specific QOL measure.

Nail involvement

Psoriasis can affect the nails in up to 50% of patients with psoriasis, and can be quite severe and disfiguring in some cases. There is at present no widely used, standardized tool to assess the severity of psoriatic nail involvement. Recently, the Nail Psoriasis Severity Index (NAPSI) was developed to quantify nail involvement (35). It assesses eight characteristic features of psoriatic nail involvement, including: pitting, leukonychia, nail plate crumbling, red spots in the lunula, onycholysis, nail bed hyperkeratosis, splinter hemorrhages, and oil drop discoloration. This instrument has begun to be incorporated into clinical trials, although it still needs to be tested for validity and inter- and intra-observer reproducibility.

Conclusion

Currently available outcome measures in PsA, which mainly consist of those 'borrowed' from other conditions, certainly have flaws. However, they also have some utility. As Winston Churchill remarked concerning democracy, "…it is the worst form of government…with the exception of all of the others". With renewed interest in clinical research on PsA, there will be greater experience accrued using a variety of instruments. This will allow refinement and hence optimize their use, and hopefully aid in the treatment of patients affected by this important condition.

References

1. GLADMAN D, ESPINOZA L: International symposium on psoriatic arthritis. *J Rheumatol* 1992; 19: 290-1.
2. McHUGH N, BALACHRISHNAN C, JONES S: Progression of peripheral joint disease in PsA; a 5 year prospective study. *Rheumatology* 2003; 42: 778-83.
3. GLADMAN D, FAREWELL V, WONG K *et al*.: Mortality studies in psoriatic arthritis; results from a single outpatient center. II. Prognostic indicators for death. *Arthritis Rheum* 1998; 41: 1103-10.
4. MEASE P: Tumor necrosis factor (TNF) in psoriatic arthritis: pathophysiology and treatment with TNF inhibitors. *Ann Rheum Dis* 2002; 61: 298-304.
5. GOTTLIEB A, ANTONI C: Treating psoriatic arthritis: how effective are TNF antagonists. *Arthritis Res Ther* 2004; 6 (Suppl. 2): S31-35.
6. VAZ A, BARTON J, RITCHLIN C: Psoriatic arthritis: an update for clinicians. *Int J Adv Rheumatol* 2004; 2: 126-34.
7. GLADMAN D, FAREWELL V, BUSKILA D *et al*.: Reliability of measurements of active and damaged joints in psoriatic arthritis. *J Rheumatol* 1990; 17: 62-4.
8. TAYLOR WJ: Assessment of outcome in psoriatic arthritis. *Curr Opin Rheumatol* 2004; 16: 350-6.
9. GLADMAN D, HELLIWELL P, MEASE P, NASH P, RITCHLIN C, TAYLOR W: Assessment of patients with psoriatic arthritis: a review of currently available measures. *Arthritis Rheum* 2004; 50: 24-35.
10. FUCHS H, PINCUS T: Reduced joint counts in controlled clinical trials in rheumatoid arthritis. *Arthritis Rheum* 1994; 37: 470-5.
11. HUSTED J, GLADMAN D, FAREWELL V, COOK R: Health-related quality of life of patients with psoriatic arthritis: a comparison with patients with rheumatoid arthritis. *Arthritis Rheum (Arthritis Care Res)* 2001; 45: 151-8.
12. FRIES J, SPITZ P, KRAINES R *et al*.: Measurement of patient outcomes in arthritis. *Arthritis Rheum* 1980; 23: 137-45.
13. MEASE P, GANGULY L, WANKE E, YU E, SINGH A: How much improvement in functional status is considered important by patients with active psoriatic arthritis: applying the outcome measures in rheumatoid arthritis clinical trials (OMERACT) group guidelines. *Ann Rheum Dis* 2004; 63 (Suppl. 1): 391.
14. HUSTED J, GLADMAN D, FAREWELL V *et al.*: Validation of the revised and expanded version of the arthritis impact measurement scales for patients with psoriatic arthritis. *J Rheumatol* 1996; 23: 1015-9.
15. CLEGG D, REDA D, MEJIAS E *et al*.: Comparison of sulfasalazine and placebo in the treatment of psoriatic arthritis: a department of Veterans Affairs cooperative study. Arthritis Rheum 1996;39:2013-20.
16. FELSON D, ANDERSON J, BOERS M *et al*.: American College of Rheumatology prelimi-

nary definition of improvement in rheumatoid arthritis. *Arthritis Rheum* 1995; 38: 727-35.
17. FELSON D, ANDERSON J, LANGE M, WELLS G, LAVALLEY M: Should improvement in rheumatoid arthritis clinical trials be defined as fifty percent or seventy percent improvement in core set measures, rather then twenty percent ? *Arthritis Rheum* 1998; 41: 1564-70.
18. VAN GESTELA, PREVOO M, CAN'T HOF M, VAN RIJSWIJK M, VAN DE PUTTE L, VAN RIEL P: Development and validation of the European League Against Rheumatism response criteria for rheumatoid arthritis; comparison with the preliminary American College of Rheumatology and the World Health Organization/ International League Against Rheumatism criteria. *Arthritis Rheum* 1996; 39: 34-40.
19. VAN GESTEL A, ANDERSON J, VAN RIEL P *et al*.: ACR and EULAR improvement criteria have comparable validity in rheumatoid arthritis trials. *J Rheumatol* 1999; 26: 705-11.
20. MEASE P, GLADMAN D, KRUEGER G, ANTONI C: Psoriatic arthritis and Psoriasis: State of the art review and research advances. *Ann Rheum Dis* 2005; 64 (Suppl. II): (ii) 1-117.
21. GLADMAN D, STRAND V, MEASE P, ANTONI C, NASH P, KAVANAUGH A: OMERACTpsoriatic arthritis workshop: Synopsis. *J Rheumatol* (in press).
22. TAYLOR W, PORTER G, HELLIWELL P: Operational definitions and observer reliability of the plain radiographic features of psoriatic arthritis. *J Rheumatol* 2003; 30: 2645-58.
23. RAHMAN P, GLADMAN D, COOK R, ZHOU Y, YOUNG G, SALONEN D: Radiological assessment in psoriatic arthritis. *Br J Rheumatol* 1998; 37: 760-5.
24. MEASE P, KIVITZ A, BURCH F *et al*.: Etanercept treatment of psoriatic arthritis: safety, efficacy, and effect on disease progression. *Arthritis Rheum* 2004; 50: 2264-72.
25. WASSENBERG S, FISCHER O, KAHLE V *et al*.: A method to score radiographic changes in psoriatic arthritis. *Z Rheumatol* 2001; 60: 156-66.
26. HUSTED J, GLADMAN D, FAREWELL V *et al*.: Validating the SF-36 health survey questionnaire in patients with psoriatic arthritis. *J Rheumatol* 1997; 24: 511-7.
27. MCKENNA A, DOWARD L, WHALLEY D, TENNANT A, EMERY P, VEALE D: Development of the PsAQol: a quality of life instrument specific to psoriatic arthritis. *Ann Rheum Dis* 2004; 63: 162-9.
28. ANTONI C, KAVANAUGH A, KIRKHAM B *et al*.: Sustained benefit of infliximab therapy for dermatologic and articular manifestations of psoriatic arthritis: Results from the infliximab multinational psoriatic arthritis controlled trial (IMPACT). *Arthritis Rheum* 2005; 52: 1227-36.
29. ANTONI C, KRUEGER G, DE VLAM K *et al*.: Infliximab improves signs and symptoms of psoriatic arthritis: results of the IMPACT 2 trial. *Ann Rheum Dis* 2005 Feb 24 [Epub ahead of print].
30. HEUFT-DORENBOSCH L, SPOORENBERG A, VAN TUBERGEN A *et al*.: Assessment of enthesitis in ankylosing spondylitis. *Ann Rheum Dis* 2003; 62: 127-32.
31. VAN DER HEIJDE D, VAN DER LINDEN S, DOUGADAS M, BALLAMY N, RUSSELL A, EDMONDS J: Ankylosing spondylitis: plenary discussion and results of voting on selection of domains and some specific instruments. *J Rheumatol* 1999; 26: 1003-5.
32. ASHCROFT D, PO A, WILLIAMS H, GRIFFITHSC: Clinical measures of disease severity and outcome in psoriasis: a critical appraisal of quality. *Br J Dermatol* 1999; 141: 185-91.
33. DE KORTE J, MOMBERS F, SPRANGERS M, BOSJ: The suitability of quality-of-life measures for psoriasis research. *Arch Dermatol* 2002; 138: 1221-7.
34. MAZZOTTI E, PICARDI A, SAMPOGNA F *et al.*: Sensitivity of the Dermatology life quality index to clinical change in patients with psoriasis. *Br J Dermatol* 2003; 149: 318-22.
35. RICH P, SCHER R: Nail psoriasis severity index: a useful tool for evaluation of nail psoriasis. *J Am Acad Dermatol* 2003; 49: 206-12.