SACRAH: a score for assessment and quantification of chronic rheumatic affections of the hands

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Objectives. To establish a questionnaire to quantify the extent of the function and activities of the hand in patients with degenerative or inflammatory disease of the hand and finger joints.

Methods. One hundred and seventy-two patients with osteoarthritis (OA, n = 69) or rheumatoid arthritis (RA, n = 103) completed a new questionnaire, the SACRAH, that included 23 visual analogue scales covering the extent of hand function, stiffness and level of pain. SACRAH scores may range from 0 to 100.

Results. Comparing all studied patients, there was no significant difference in SACRAH scores between OA and RA patients (34 vs 32, not significant). Scores for both patient groups differed significantly from those for 30 healthy controls. Among patients taking NSAIDs only, individuals suffering from OA (n = 50) scored significantly lower than RA patients (n = 42) (36 vs 48, P < 0.004). Sixty-one RA patients taking DMARDs scored lower than the RA patient group treated with NSAIDs only (20 vs 48, P < 0.0001). Thirty-two RA patients were evaluated longitudinally at their first visit and 3 months after the initiation of DMARDs. Following therapy, SACRAH scores were significantly reduced from 50 to 11 (P < 0.0001).

Conclusions. The questionnaire enables the quantification of compromised hand function, stiffness and pain in OA and RA patients, and is sensitive to therapy-related changes in RA patients.

Key words: Hand function, Disease activity, Scoring questionnaire.

Rheumatoid arthritis (RA) and osteoarthritis (OA) of the finger joints are the two most frequent diseases leading to pain and compromised hand function [1]. In recent years a variety of scoring systems and questionnaires have been developed to measure disease activity or progression, functional capacity, quality of life and/or therapeutic efficacy on the basis of clinical appearance, the patient’s subjective assessment or radiological findings.

The applicability of these established instruments in OA of large joints of the lower limb, such as the Western Ontario and McMaster Universities Arthritis Index (WOMAC) [2], and in chronic inflammatory joint diseases in general, such as the health assessment questionnaire (HAQ) [3] and the MOS (Medical Outcomes Study) 36-item short-form health survey (SF-36) [4], has been proven. However, generalized instruments such as the HAQ, and even the visual analogue scale (VAS) for pain rating, seem to be unable to provide enough information to determine the extent to which patients are able to use their hands [5].

One self-report instrument to assess the function of the upper extremity, the DASH (Disabilities of the Arm, Shoulder and Hand), has proved its validity and responsiveness in proximal and distal disorders [6, 7].

A few scoring systems that exclusively examine the consequences of rheumatic affections of the hands have been developed.
been developed [8, 9]. Most of these tests, however, are either confined almost exclusively to the measurement of deteriorated hand function or the assessment of algofunctional affection in OA patients, or have been validated only in OA or RA patients.

In contrast to RA, in OA of the finger joints there are only a few possibilities for treatment. There is a need for instruments to assess therapeutic interventions with respect to hand function in a disease exclusively affecting the finger joints. Although RA may attack almost every joint, hand function in particular plays an essential role in managing daily life. Our objective was therefore to develop a reporting system (questionnaire) that can be completed easily and can quantify functional status and subjective manual function in patients suffering from osteoarthritic or rheumatoid disease of the finger joints. Further goals were to test the score’s sensitivity to change after therapeutic interventions and its ability to distinguish between OA and RA patients.

Here we report the results of a pilot study to evaluate the applicability and usefulness of this questionnaire.

Patients and methods

Questionnaire

The original questionnaire was established in German. Using a Delphi approach at first, all authors were asked to propose 20 questions covering hand functions, based on the problems reported most frequently by patients. This resulted in a total of 42 questions.

Thereafter, the questions generated were ranked with respect to the author’s opinion of their relevance to hand functions. At a subsequent consensus meeting there was unanimous agreement that pain, function and stiffness should constitute the main domains of the questionnaire. It was also agreed that the maximum number of questions that could be answered easily by patients in daily practice was 25. Therefore, questions of minor relevance or redundancy, determined according to the difficulties reported most frequently by patients suffering either from OA or RA, were eliminated after discussions with occupational therapists.

The newly developed questionnaire SACRAH (score for assessment and quantification of chronic rheumatic affections of the hands) comprised 23 VASs [10] of 100 mm covering the three categories of symptoms that primarily determine the situation of patients with rheumatic diseases of the hand: function, joint stiffness and pain.

(i) Hand function (17 questions). The following daily activities were measured, using a range from ‘possible without any difficulty’ (0) to ‘impossible’ (100): locking/ unlocking a door, turning the handle of a door or window, fastening a bra/tying a tie, buttoning and unbuttoning a shirt/blouse, turning a water tap, fastening or unfastening a zips, tying shoe laces, unscrewing the cap of a tube of toothpaste, striking a match, holding a mug, buckling a belt, manicuring, turning the ignition key in a car, turning the pages of a newspaper, handling paper money, writing, and cutting with a kitchen-knife.

(ii) Stiffness (two questions): severity of morning stiffness and daily starting stiffness, using a range from ‘no stiffness’ (0) to ‘unbearable stiffness’ (100).

(iii) Pain (four questions): pain during regular daily work, during intensive work, at times of inactivity and during the night, using a range from ‘no pain’ (0) to ‘unbearable pain’ (100).

The average score for each category was calculated, and the overall average for the three category scores was then obtained. The overall score therefore ranged between 0 and 100, 0 representing the best and 100 the worst possible status.

Patients

Sixty-nine patients with OA according to the American College of Rheumatology criteria [11], presenting at the outpatient’s department between July 1999 and February 2000 (median age 58 yr, range 39–78 yr; 61 females eight males), and patients with RA according to the American Rheumatism Association criteria [12] (median age 61 yr, range 29–78 yr; 85 females, 18 males) gave their consent to be enrolled in the study, and completed the questionnaire once.

Nineteen of the OA patients had completed a 3-month treatment cycle of chondroitin sulphate (CS) within the last 4 weeks before completing the questionnaire.

Forty-two of the RA patients were treated with non-steroidal anti-inflammatory drugs (NSAIDs) only and 61 with disease-modifying anti-rheumatic drugs (DMARDs) and/or corticosteroids up to 12.5 mg/day in additional to NSAIDs.

In 32 RA patients, DMARDs and/or corticosteroids were administered after the first completion of the SACRAH. In order to assess the instrument’s sensitivity to change after therapy, these patients were asked to complete the questionnaire again, 3 months after first administration of DMARDs and/or corticosteroids.

The results of these second questionnaires were not included in the evaluation of RA patients on DMARDs, who completed the questionnaire only once (n = 61).

The patients were well matched with respect to age, gender and disease duration. The RA population, who had a disease duration of about 4 yr, can be considered relatively mildly affected, 54% of patients having erosions and 48% being positive for rheumatoid factor. Patients presenting with Steinbrocker stages III–IV were not included in the study.

In order to obtain SACRAH values for an apparently unaffected, fully employed population and to assess the practicability of the questionnaire, 30 healthy individuals (healthy controls, HCO) (median age 29.5 yr, range 18–65 yr; 19 females, 11 males) were recruited, mainly from the hospital staff, and were asked to complete the questionnaire (Table 1).

Table 1. Demographic data

<table>
<thead>
<tr>
<th></th>
<th>Controls (n = 30)</th>
<th>OA (n = 103)</th>
<th>RA (n = 69)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>29.5 (18–65)</td>
<td>58 (39–78)</td>
<td>61 (29–78)</td>
</tr>
<tr>
<td>Females, males</td>
<td>19, 11</td>
<td>61, 8</td>
<td>85, 18</td>
</tr>
<tr>
<td>Disease duration (yr)</td>
<td>1.5 (0.8–41)</td>
<td>1.5 (0–40)</td>
<td>13</td>
</tr>
<tr>
<td>Erosive disease (n)</td>
<td>0</td>
<td>7</td>
<td>49</td>
</tr>
<tr>
<td>RF-positive (n)</td>
<td>0</td>
<td>21.7 ± 42.5</td>
<td>42.7 ± 65.8</td>
</tr>
<tr>
<td>Morning stiffness (min)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are median (range).

RF, rheumatoid factor.
**Methods**

After initial instruction by a nurse as to how the questionnaire should be tackled, the participants completed the form without further assistance. Afterwards, difficulty in completing the questionnaire was assessed with a VAS (0 = without difficulty; 100 = too difficult to complete).

To quantify the actual state of the patient, the patients’ and physicians’ global assessments (PGA, PhGA) were also determined, using a VAS. Simultaneously, the erythrocyte sedimentation rate (ESR) in the 1st hour, C-reactive protein (CRP) concentration (mg/dl) and rheumatoid factor (U/ml) were determined and early morning stiffness (minutes) was recorded [13]. X-rays of the hands were taken for the evaluation of erosions in OA or RA patients. For ethical reasons no X-rays were taken from the HCO group.

**Statistics**

Continuous variables were compared between groups using the Mann–Whitney U-test. Correlations of continuous variables were measured using the Spearman rank correlation. ANOVA (analysis of variance) for repeated measures was used to assess changes in longitudinally observed patients.

To assess the reliability of the questionnaire, we first obtained correlations between single questions and the domain scores and the total score. To provide a numerical coefficient of reliability, Cronbach’s \( \alpha \) was calculated for domain scores and the total score.

Results are presented as median (range) for continuous variables where appropriate. \( P \) values < 0.05 were considered statistically significant.

**Results**

Patients considered the questionnaire easy to complete. The median VAS was 25.2 (0–75).

HCO subjects (n = 30) reported no functional problems [SACRAH score 0 (0–0.85)], whereas the total SACRAH score in OA (n = 69) and RA patients (n = 103) was 32.1 (0–84.1) and 28.7 (0–92.3) respectively (OA vs RA, not significant; OA, RA vs HCO, \( P < 0.0001 \)) (Table 2).

OA (n = 50) and RA (n = 42) patients receiving only NSAIDs showed scores of 15 (0–100) vs 33 (0–98) for function (\( P < 0.004 \)), 46.5 (0–100) vs 48.2 (9–100) for stiffness (not significant) and 39.5 (0–100) vs 54.7 (9–100) for pain (\( P = 0.029 \)), resulting in a total SACRAH of 36.3 (0.4–84.1) for OA vs 46.1 (8.2–92.3) for RA patients (\( P < 0.03 \)) (Fig. 1).

Although morning stiffness was reported to last 6.5 (0–180) min in OA patients and 30 (0–360) min in RA patients, which was a statistically significant difference, inconvenience indicated by the VAS results showed a trend to be smaller for the RA patients [45.7 (9–100)] than for the OA patients [46.5 (0–100)] (not significant). In both patient groups, however, VAS results and the values for morning stiffness in minutes correlated well (\( r_s = 0.63, P < 0.003 \) for OA; \( r_s = 0.66, P < 0.0001 \) for RA).

**RA patients**

When comparing RA patients with (n = 61) and without (n = 42) DMARD therapy of sufficient duration (more than 3 months), with or without corticosteroids, individuals reported significantly different values for the domain scores and for the total score (\( P < 0.0001 \)). PGA and PhGA (\( P < 0.0001 \) for both), CRP (\( P < 0.0016 \)) and ESR (\( P < 0.0022 \)) also differed significantly between these two groups (Table 3).

Moreover, the SACRAH score showed a statistically significant correlation with CRP values (\( r_s = 0.27, P < 0.0078 \)) and PGA (\( r_s = 0.77, P < 0.0001 \)).

Thirty-two RA patients could be evaluated longitudinally at their first visit and 3 months after the initiation of DMARD and/or corticosteroid treatment. The total SACRAH score decreased significantly from 43.1 (10–92.3) to 7.2 (0–46.1) (\( P < 0.0001 \)). This improvement was in line with a significant reduction in CRP values, morning stiffness, PGA and PhGA. For this group of patients, the disease activity scores (DAS28) obtained routinely were correlated with SACRAH. DAS28 scores totalled 5.5 (3.5–6.5) before and 3.4 (1.9–5.5) after therapy (\( P < 0.001 \) and were significantly correlated with SACRAH (\( r_s = 0.71, P < 0.0001 \)).

**Table 2. Total and domain scores in healthy controls and OA and RA patients**

<table>
<thead>
<tr>
<th></th>
<th>Controls (n = 30)</th>
<th>OA (n = 69)</th>
<th>RA (n = 103)</th>
<th>RA vs OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>SACRAH</td>
<td>0 (0–0.85)</td>
<td>32.1 (0–84.1)</td>
<td>28.7 (0–92.3)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Function</td>
<td>0 (0–2.5)</td>
<td>17.5 (0–100)</td>
<td>19 (0–98)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Stiffness</td>
<td>0 (0)</td>
<td>36.5 (0–100)</td>
<td>27.2 (0–100)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Pain</td>
<td>0 (0)</td>
<td>38.5 (0–100)</td>
<td>37 (0–100)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Values are median (range), n.s., not significant.

![Fig. 1. SACRAH scores for RA patients on NSAIDs only compared with OA patients on NSAIDs only. Values are median and interquartile range.](https://academic.oup.com/rheumatology/article-abstract/42/10/1173/1784625/fig1?download=true)
The SACRAH scores of the HCOs indicate that zero values represent the complete availability and complete freedom of movement of the hands. Nevertheless, direct comparison among controls and patients may not be possible because of the HCOs’ significantly lower age, as age itself may contribute significantly to worsening of hand function.

A strong correlation between the total score and PGA and CRP in RA patients and with PGA in OA patients indicates a reliable reflection of the patient’s subjective assessment and disease activity. The correlation with PGA also indicates construct validity.

Lower SACRAH scores, PGAs and CRP in RA patients receiving sufficient therapy demonstrated the questionnaire’s ability to distinguish between conditions of different severity [14].

The questionnaire produced consistent results irrespective of the status of the patients’ treatment phase. The SACRAH appeared to be significantly related to the acute-phase response in RA. This is in line with other observations that the acute-phase response can be seen as a strong indicator of grip strength, which determines the functional capacity of the hand [15]. Other self-report measures have been shown to correlate with grip strength in carpal tunnel syndrome patients [16] and other clinical findings, such as the number of active joints in psoriatic arthritis patients [17]. Grip strength, however, is considered to be only a semi-objective parameter of hand function.

Another advantage of a patient-oriented questionnaire is the exclusion of investigator-dependent variation [18]. Moreover, the relatively higher impact of patient-centred outcome measures, such as self-report questionnaires, has been emphasized recently [19].

The significant decrease of scores in repeatedly studied RA patients undergoing DMARD therapy indicates that the SACRAH is capable of measuring improvement in hand function and decreased disease activity. This sensitivity to change was confirmed by a parallel decrease in DAS28 after therapy [20].

No relationship of the SACRAH could be established with radiological findings, indicating the lack of a strong correlation between functional impairment and morphological change, especially in the early stages of disease [21].

To test the reliability of the score, we used Cronbach’s α, a numerical coefficient. The values obtained were within the range (0.7) considered to indicate high reliability. Thus, the score showed a very high inter-variable correlation, indicating that the chosen variables (i.e. the questions) measured the tested latent construct (the SACRAH score) very well.

The attempt to distinguish between OA and RA by means of this questionnaire failed. No difference was

OA patients

There were no significant differences between OA patients on NSAIDs only (n = 50) and patients who had received CS treatment for 3 months (n = 19) concerning function [15.5 (0–100) vs 22.7 (0–73.9)] and pain [39.5 (0–100) vs 31.7 (0–79.7)]. Stiffness, however, appeared to be lower in the CS-treated patients [29.5 (0–74.5) vs 46.5 (0–100), P < 0.019]. CS-treated OA patients showed a lower total score than patients treated only with NSAIDs [28.6 (0–76) vs 36.3 (0.4–84.1)]. This difference, however, did not reach statistical significance.

As in RA patients, PGA was also significantly correlated with SACRAH (r_s = 0.63, P < 0.0001) in OA patients, but for CRP levels, as expected, no such relationship was found.

For both RA and OA patients, no correlation between radiological findings and the SACRAH could be established.

Reliability of the score

Correlations between the single questions concerning function and the total score ranged from 0.63 (turning pages of a newspaper) to 0.79 (cutting with a knife) for all patients, from 0.60 (turning pages of a newspaper) to 0.80 (using a door handle) for RA patients and from 0.58 (tying shoelaces) to 0.83 (cutting with a knife) for OA patients. The two questions addressing stiffness correlated with the total score, with coefficients of 0.79–0.86 (all patients), 0.8–0.86 (RA patients) and 0.79–0.85 (OA patients). Questions of the pain domain had correlations with the total score of 0.77–0.86 (all patients), 0.76–0.82 (RA patients) and 0.67–0.89 (OA patients) (P < 0.0001 for all correlations).

Cronbach’s α was 0.98 for the total SACRAH score, 0.98 for the function domain, 0.79 for the stiffness domain and 0.90 for the pain domain.

Discussion

Disease activity and hand function scoring systems should be easily applicable, representative of the patient’s actual situation, sensitive to changes, and reproducible. Our questionnaire was designed to meet these demands.

Table 3. Total and domain scores and parameters of disease activity in RA patients receiving and not receiving DMARD therapy

<table>
<thead>
<tr>
<th></th>
<th>Receiving DMARDs (n = 42)</th>
<th>Not receiving DMARDs (n = 61)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SACRAH</td>
<td>46 (8.2–92.3)</td>
<td>18.3 (0–77)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Function</td>
<td>33.5 (0–97.7)</td>
<td>12.9 (0–79)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Stiffness</td>
<td>45.7 (0–100)</td>
<td>13 (0–77.5)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pain</td>
<td>54.7 (0–100)</td>
<td>21.1 (0–94.2)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CRP (mg/dl)</td>
<td>1.7 (0.1–7.6)</td>
<td>0.6 (0–9.2)</td>
<td>&lt;0.0016</td>
</tr>
<tr>
<td>ESR (1st h)</td>
<td>25 (4–90)</td>
<td>14 (3–60)</td>
<td>&lt;0.0022</td>
</tr>
<tr>
<td>PGA</td>
<td>64.5 (15–100)</td>
<td>31 (0–90)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>PhGA</td>
<td>60 (20–100)</td>
<td>30 (0–70)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Values are median (range).
observed in the total scores for OA and RA patients in general. RA patients on NSAIDs only, however, scored significantly higher than OA patients. The reason for this difference was the higher scores in the categories ‘function’ and ‘pain’ (no major difference was observed in the category ‘stiffness’). The difference, however, was no longer evident when evaluating RA patients after treatment with DMARDs and/or corticosteroids. Therefore, we conclude that the deterioration in hand function of OA patients in general is less than that in RA patients [22]. Efficacious therapy may improve the participation of RA patients to, or sometimes above, the level of OA patients.

The relatively low scores of RA compared with OA patients in the present study may have been due partly to the facts that the RA population can be considered generally moderately ill, as measured by acute-phase reactants, and an early arthritis subgroup was part of the RA group. This difference in functional capability should increase with the severity of RA.

The results of the subjective measurement (expressed in the results of PGA) of deteriorated hand function were similar for RA and OA patients. Interestingly, physicians considered RA patients more severely affected by this disease, which was expressed by a statistically significant difference in PhGA between RA and OA patients.

The results in the category ‘stiffness’ were somewhat confusing. Although morning stiffness (expressed in minutes) in RA patients lasted significantly longer, the VAS results did not differ significantly between RA and OA patients. The inconvenience caused by morning stiffness seemed to be equal in RA and OA patients, indicating that stiffness can only be seen as a relative activity parameter in rheumatic diseases.

Whether or not it will prove feasible to discriminate between RA and OA patients by the differences in the score’s ‘function’ domain in patients not receiving DMARD and/or corticosteroid therapy is a matter for future investigations. Sensitivity to change will have to be validated in larger cohorts of patients. Moreover, the application of the questionnaire in early RA patients and other rheumatic disorders affecting the hands, such as psoriatic arthritis, is a further objective.

An attempt to cut down the number of questions without losing the validity of the score merits consideration.

Interestingly, others have recently developed and published a similar method to assess pain and disability in hand OA [23], using a self-completed Likert scale as well as a VAS, which also promises to be an effective tool for future clinical trials in hand OA. The comparison of the AUSCAN (Australian/Canadian osteoarthritis hand index) and the SACRAH offers interesting possibilities.

The SACRAH score may be a useful tool in measuring the degree of rheumatic hand involvement, to compare patient cohorts and to monitor the effects of therapy reproducibly.

Acknowledgements
We wish to thank Mrs Judit Gruber for the English translation of the questionnaire and linguistic review of the manuscript, and Thomas Sautner MD, PhD for statistical support and thorough review of the manuscript. We appreciate the helpful comments of Mrs Bernadette Koller, occupational therapist, with respect to the patients’ perspective.

References


