

Arthroscopic subacromial decompression results in normal shoulder function after two years in less than 50% of patients

Lars Aage Glud Konradsen¹ & Claus Hjorth Jensen²

ABSTRACT

INTRODUCTION: The aim of this study was to evaluate the outcome two years after arthroscopic subacromial decompression using the Western Ontario Rotator-Cuff (WORC) index and a diagram-based questionnaire to self-assess active shoulder range of motion (ROM).

METHODS: Outcomes in 80 patients with impingement of the shoulder undergoing arthroscopic subacromial decompression were prospectively assessed preoperatively, at three months and at two years post-operatively using the WORC index. All patients had received non-operative treatment for at least six months before undergoing surgery. Active range of motion was measured pre-operatively by the examining physician and at two years by the patient him-/herself using a diagram-based questionnaire to self-assess active shoulder ROM. A total of 75 patients (94%), of whom 31 were women, completed the study. The median age was 56 years. In all, 31 patients had additional resection of the acromioclavicular joint.

RESULTS: WORC scores improved significantly from pre-operatively (median: 1,392) to three months (median: 204) and two years post-operatively (median: 243) ($p < 0.001$). A clinically significant decrease in the WORC index was observed in 83% of patients, but only 45% reported near normal or normal WORC scores, and 56% presented with a reduced active range of motion at two years.

CONCLUSION: Arthroscopic subacromial decompression appears effective in alleviating symptoms in patients with subacromial impingement who are resistant to conservative treatment, but can only be expected to restore normal shoulder function as measured by the WORC in less than 50% of the cases.

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The subacromial impingement syndrome (SIS) includes a number of pathological entities such as rotator cuff syndrome, tendonitis and bursitis in the shoulder [1]. Typical patient complaints include anterolateral shoulder pain worsened by active lifting of the arm into the impingement arc (60-120 degrees of abduction) [2]. Nocturnal pain is frequently reported [3]. A number of physical tests for SIS have been described. A positive Hawkins

test combined with a positive painful arch sign and weakness in external rotation have been proposed as the best diagnostic combination [4], but probably the diagnosis should be supported by ultrasound and/or magnetic resonance imaging (MRI) [5] and supplemented by a subacromial diagnostic blockade [2].

The accepted primary approach to treating SIS is conservative [6]. If clinical symptoms persist despite relevant conservative management for 6-12 months, surgical treatment is considered.

Long-term results of arthroscopic subacromial decompression (ASD) have primarily been reported using combined subjective and objective assessment scores (UCLA or Insalata scores [7]). More recently, region-specific patient assessment scores (Constant-Murley or DASH score [7]) have been applied. The Western Ontario Rotator Cuff (WORC) index was designed as a disease-specific self-reported health assessment questionnaire. It has been proven responsive to changes in rotator cuff disease [8-10] and has been considered a more precise tool than the region-specific questionnaires when measuring the treatment effect on rotator cuff disease [9].

We evaluated the effect of ASD and combined ASD and acromio-clavicular (AC) joint resection (ASD+ACJR) as measured by the WORC index in a series of patients pre-operatively and at three months and two years after the operative procedure. Furthermore, we recorded self-reported restriction in ROM two years post-operatively.

METHODS

Between April 2006 and July 2008, 80 patients undergoing ASD at Aleris Hamlet Private Hospital, Denmark, and who were eligible were enrolled in the follow-up study.

Patients were eligible if they 1) presented with a positive impingement test [2], 2) experienced relief with a diagnostic sub-acromial blockade, and 3) had no full thickness rotator cuff tears on clinical examination or by MRI and/or sonography. Furthermore, at arthroscopy they should present with 4) a near full range of passive motion (max. 20 degrees of range of motion (ROM) deficit), 5) have no instability, and 6) no full thickness rotator cuff tears.

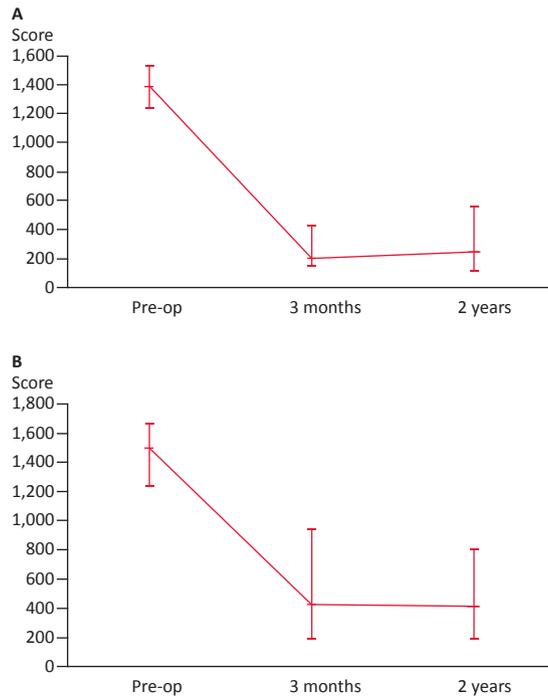
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1) Department of Orthopedics, Bispebjerg and Frederiksberg Hospitals
2) Department of Orthopedics, Gentofte Hospital

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 **FIGURE 1**

The total Western Ontario Rotator-Cuff index score for patients operated with arthroscopic subacromial decompression (A) and with arthroscopic subacromial decompression combined with acromio-clavicular joint resection (B). Median and 95% confidence limits are shown. The difference from pre-operative to three months and two years post-operatively was statistically significant ($p < 0.001$).



Conservative treatment (relevant physiotherapy and steroid injections) of at least six months' duration should have failed to relieve symptoms.

Concomitant acromio-clavicular joint resection (ACJR) was performed if 1) there was tenderness at the AC joint and/or pain from this joint on compression, and 2) radiological/MRI or sonographic evidence of degenerative AC joint disease.

The same experienced shoulder arthroscopist operated all patients. At surgery, a subacromial bursectomy, an acromioplasty and a transection of the coracoacromial ligament was performed through a posterior and a lateral approach. If an ACJR was included, this was done through an antero-medial portal.

All patients underwent a 3-6-month course of post-operative physiotherapy.

All patients completed the Danish version of the WORC score pre-operatively and three months post-operatively. After two years, they received the WORC score and a diagram-based questionnaire to assess active shoulder ROM [11].

The diagram-based questionnaire to self-assess active shoulder ROM was created and evaluated by

Carter et al [11]. For both shoulders, flexion ROM is registered in five categories, external rotation ROM in four categories, and the ability to reach up the spine in four categories.

If patients did not respond to the letter, they were contacted by phone; and if they still did not wish to participate, they were excluded.

All follow-up was performed by an orthopaedic surgeon not otherwise involved in the treatment.

The primary outcome measures were considered to be change in total WORC over time and change in the WORC questions SP1 and SP2 (sharp pain, and constant nagging pain, respectively) over time. The secondary outcome measure was patient-recorded ROM deficits two years post-operatively. The following comparisons were planned: two-year post-operative total WORC results related to pre-operative total WORC score, age, workman's compensation, emotional WORC sub-score, and ROM restrictions.

Statistics

Non-parametrical statistics was applied. WORC scores were compared using Friedman's test. Wilcoxon-Pratt rank sum test was used post-hoc to compare the results of two dependent groups. The level of significance was set at 0.05.

Correlations were performed using Spearman's test. The level of significance was set at 0.05.

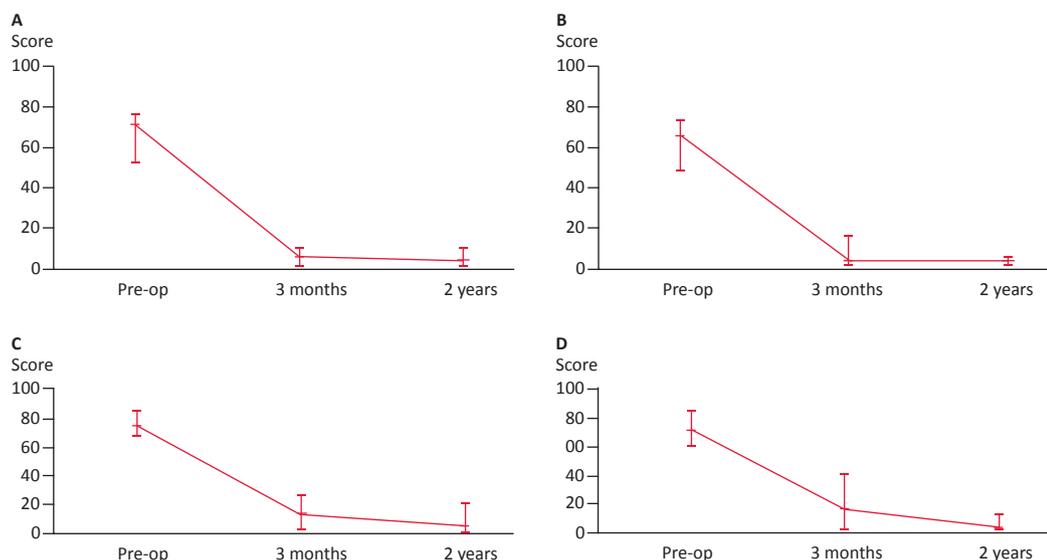
Trial registration: not relevant.

RESULTS

A total of 80 consecutive patients were included. Five subjects did not complete the follow-up (94% follow-up). A total of 44 ASDs and 31 ASD+ACJRs were performed. The median age was 56 years (range: 40-81 years). In all, 31 patients were women, and 36 operations were performed on the non-dominant side.

The total WORC scores for ASD and ASD+ACJR groups improved significantly from pre-operatively to three months and two years after surgery ($p < 0.001$). No significant change was seen when comparing results at three months and two years post-operatively (Figure 1).

The WORC scores for the questions SP1 ("How much sharp pain do you experience in your shoulder?"), and SP2 ("How much constant, nagging pain do you experience in your shoulder?") for both ASD and ASD+ACJR groups improved significantly from pre-operatively to three months and two years after surgery ($p < 0.001$). No significant change was seen when comparing results at three months and two years post-operatively (Figure 2).

 FIGURE 2


The Western Ontario Rotator-Cuff index VAS-scores for the questions SP1 ("How much sharp pain do you experience in your shoulder?") (A), and SP2 ("How much constant, nagging pain do you experience in your shoulder?") (B) for patients operated with arthroscopic subacromial decompression and with arthroscopic subacromial decompression combined with acromio-clavicular joint resection (C and D, respectively). Median and 95% confidence limits are shown. The difference from pre-operative to three months and two years post-operatively was statistically significant ($p < 0.001$).

We found no correlation between pre-operative and two-year post-operative total WORC scores (Figure 3). Note that five patients in both the ASD and the ASD+ACJR group had the same or worse total WORC scores when compared with pre-operative values.

We found no significant results when correlating the two-year post-operative WORC scores with patient age, pre-operative emotional WORC sub-score, the existence or absence of a worker's compensation issue, or the deficit in the ability to reach up the spine divided into four categories.

Pre-operatively, the primary examiner reported a loss of active shoulder flexion when compared with the contralateral side in 61 patients (75%) (a median active ROM of 135 degrees (range: 30-180 degrees)). A total of 63 patients (79%) had an active abduction deficit (a median ROM of 135 degrees (range: 35-180)). In 57 patients (71%), a reduced active external rotation was present (a median ROM of 60 degrees (range: 10-70 degrees)). In all, 36 patients (45%) presented with a reduced ability to reach with their hand up along their spine to the same level as with the contralateral hand.

Overall, pre-operatively, 67 patients (84%) presented with a reduction in active ROM.

At the two-year follow-up, 15 patients (20%) reported a reduction in shoulder flexion compared with the contralateral side. A total of 29 patients (39%) reported a reduction in external shoulder rotation. In all, 29 patients (39%) had a decreased ability to reach as high up their back as when using the contralateral extremity.

Overall, two years post-operatively, 42 patients (56%) presented with a reduction in active ROM when compared with the opposite side. Nine patients (12%) had a reduction of more than one level.

DISCUSSION

We found a significant improvement in the WORC index 3 months after ASD and ASD+ACJR, and this improvement was maintained at follow-up two years post-operatively.

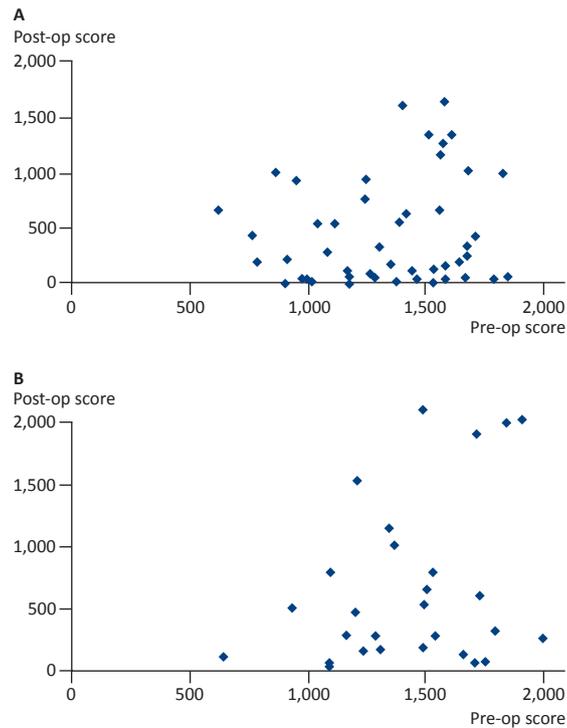
We chose the WORC index to monitor the effect of the surgical intervention as it is a disease-specific self-reported assessment questionnaire designed for rotator cuff pathology [8], and we expected it to be more responsive to treatment targeted at that entity than re-



Acromioplasty of the right shoulder. The arthroscope is introduced posteriorly into the subacromial space. At the point marked with an X instruments will be introduced to resect the subacromial bursa and remove bone from the inferior side of the acromion.

 **FIGURE 3**

Correlation between total Western Ontario Rotator-Cuff index (WORC) score for arthroscopic subacromial decompression (A) and arthroscopic subacromial decompression combined with acromio-clavicular joint resection (B) pre-operatively (pre-op) and two years post-operatively (post-op). There was no statistically significant correlation.



gion-specific scores. There are diverging opinion as to whether this holds true [8-10], but recent results suggest that the WORC index is at least as responsive to changes in impingement symptoms as the Shoulder Pain and Disability Index (SPADI) and the Oxford Shoulder Score (OSS) [12].

The WORC index does not have categories for the improvement in scores (i.e. excellent, good); but if we applied the definitions of Kirkley et al [13] on our population, we had 29% excellent results (91-100% improvement), 16% very good (81-90%), 11% good (71-80%), 7% fair (61-70%), and 39% poor ($\leq 60\%$). Those results correspond very well to those presented by Kirkley et al [13] and to those of Gleyze et al [14] as measured 6 months post-operatively, but they are not as high as those reported in previous studies [15]. This may be because we used a patient-derived, disease-specific quality-of-life questionnaire, whereas a number of other studies used mixed scoring systems or a satisfactory/un-satisfactory categorisation. On the other hand, this study included a low percentage of women (41%). There is a trend towards inferior results after subacromial decompression in women [16]; and if our material had in-

cluded the common two thirds of women participation, this might have reduced our success rate even more.

Based on subacromial injections in impingement patients, Ekeberg et al [12] found the minimal clinically important change in WORC score to be approximately 22%. If this threshold is applied, 83% of the patients in this study experienced a clinically important improvement. It should, however, be noted that 10 patients (13%) had no better or even a worse WORC index scores at the two-year follow-up. As many different scoring systems have been applied to this group of patients, comparisons are, as mentioned above, difficult to perform. However, if we concentrate solely on changes in pain parameters, long-term visual analogue score (VAS) results can be compared. For the questions "How much sharp pain do you experience in your shoulder?" and "How much constant, nagging pain do you experience in your shoulder?" VAS scores dropped from 7 to 1 at two years after the operation. This corresponds to the results of Lunsjö et al [17] six years after subacromial decompression (VAS for pain from 6 to 1), to those of Ketola et al [18] (VAS from 6 to 2) two years after operation, and to those of Hoe-Hansen et al [16] (VAS 2) six years post-operatively.

We found no statistically significant connection between the two-year post-operative total WORC scores and patient age or workman's compensation issues. The reason may be that the patients included were health insured through the company they worked for. Therefore, the majority were in the age group 55 to 65 years, and a significant correlation with WORC results would thus be hard to find given the number of patients enrolled. Moreover, only four patients in the present group were involved in a workman's compensation case. Results from a public hospital could very well differ in this respect.

Using the ROM self-assessment questionnaire developed by Carter et al [11], we found a reduction in active ROM in 56% of our patients two years post-operatively when compared with the contralateral side. Prior to the operation, 84% of the patients experienced a reduction in active ROM as measured by a physician. These two figures are not readily comparable, and we would probably consider the physician-measured deficit more accurate. However, Carter et al found that their patients were able to properly quantify motion 85% of the time and that they were able to assess motion as impaired compared with the contralateral side 95% of the time. Thus, the self-assessment measurement seems to be a quite accurate instrument. Thus, the operative procedure and the post-operative rehabilitation protocol did seem to improve the patients' active shoulder ROM, but still did not result in a normal, active ROM in more than half of the patients. ROM per se is seldom reported

in studies, but is most often part of combined objective and subjective scores (Constant or Neer score) or incorporated into a "disability" score or VAS scale measurement [18], but it must be considered a problem that so many patients end up with a reduced ROM. The method of self-assessed ROM limitation does, however, not offer an explanation as to this ROM deficit, primarily whether it is pain- or contracture-induced.

The major limitation of this study is the lack of a control group. Without a control group, we therefore cannot conclude that the improvement in WORC score post-operatively is the result of the operative procedure. As found by Haahr et al [19], Ketola et al [18], and Gebremariam et al [20], a well-structured rehabilitation programme alone might have yielded a comparable improvement. However, in the present study, subjects had all participated in physiotherapeutic rehabilitation programmes for at least 6 months, but still had very high WORC scores suggesting major disability. It seems improbable that a repetition of such a programme would have resulted in a comparable major WORC score reduction.

CONCLUSION

We found a significant improvement in WORC scores at three months and two years after arthroscopic subacromial decompression, and combined arthroscopic subacromial decompression and AC joint resection. However, 13% of the subjects had no better or even worse WORC index scores at the two-year follow-up, and 56% still suffered a ROM restriction at two years post-operatively. Based on our results, we believe that we can inform the patients who comply with our pre-operative definition for impingement syndrome that there is approx. an 80% chance of a noticeable improvement after ASD or ASD+ACJR and a chance of a very good or excellent shoulder status after 45% of the operations. However, a reduction in active ROM may be anticipated in 50-60% of the cases.

CORRESPONDENCE: Lars Konradsen, Birkehaven 26, 3400 Hillerød, Denmark. E-mail: lkonrad@dadlnet.dk

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