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# Treatment of Impingement Syndrome: A Systematic Review of the Effects on Functional Limitations and Return to Work

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**Introduction**: *The goal of this systematic review is to evaluate the effectiveness of different treatments for impingement syndrome and rotator cuff tear on the improvement in functional limitations and concomitant duration of sick leave*. **Methods**: *A systematic search for clinical trials or controlled studies was conducted with the following text words: should,* rotator cuff, impingement, work, sick leave, disabilit,* function.** **Results**: *Nineteen articles were included in this review. For functional limitations, there is strong evidence that extracorporeal shock-wave therapy is not effective, moderate evidence that exercise combined with manual therapy is more effective than exercise alone, that ultrasound is not effective, and that open and arthroscopic acromioplasty are equally effective on the long term. For all other interventions there is only limited evidence*. **Conclusion**: *We found many studies using range of motion and pain as outcome measures but functional limitations were less often used as an outcome measure in this type of research. Duration of sick leave was seldom included as an outcome measure.*

**KEY WORDS:** shoulder impingement syndrome; functional limitations; sick leave; systematic review; treatment outcome.

## INTRODUCTION

Impingement syndrome (or rotator cuff syndrome) of the shoulder is a common disorder. The cumulative incidence of shoulder complaints in general practice is estimated to be 11.2/1000 patients per year, with impingement being the most frequently recorded disorder; rotator cuff tendonitis and chronic subacromial bursitis account for almost 40% (1).

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Many treatments are available for impingement syndrome such as physical therapy, shock-wave therapy, medication, and surgery. In the last decade, several (systematic) reviews on treatment for impingement syndrome were published (2–8). These reviews compared the effectiveness of treatments on a variety of outcome measures, including pain, range of movement, functional limitations, and return to work. Pain was the most common outcome measure, and some studies also had functional limitations as an outcome measure. Hence, the conclusion on effectiveness of various treatments was primarily based on the combination of these outcome measures. Only one review included return to work as a relevant outcome measure (3).

The International Classification of Functioning, Disability and Health (ICF) (9) demonstrates that physical functioning and disability are important consequences of the presence of a disease. Shoulder complaints are often associated with pain, muscle weakness, or restricted range of motion, and these health outcomes may have an impact on the ability of a patient to function in daily life, e.g. return to work. In studies among low-back pain (LBP) patients, it has been well documented that patients were not completely recovered on both pain and functional limitations when they returned to work (10). Several studies among LBP patients have demonstrated that pain, functional limitations, and sickness absence are related, but return to work after a sick leave episode due to LBP does not necessarily imply full recovery on one of the other dimensions (11–15). These results and the ICF model show that functional limitations and work capacity might be more important outcome parameters than the pain experienced by a patient.

Patients frequently ask their occupational physician and medical specialist about their work capacity and what treatment is best to be able to return to work. Many patients may not feel that they can work full time. In one study, 81 patients with a chronic shoulder impingement were asked about their ability to work, and preoperatively 73% felt that they were not able to work full time at their usual job (16). In order to be able to answer questions on work capacity and time to return to work, information is needed on the effect of treatment on the patient's functional abilities as well as on the likelihood of return to work.

Pain and range of motion are very important outcome measures for the involved patients. However, the ICF shows that functional limitations and being able to work are also important effect measures. Since pain, function, and return to work do not improve in the same way, it is important to separate these outcome measures and look at the individual and societal impacts of functional limitations and duration of sick leave. Therefore, the goal of this systematic review is to evaluate the effectiveness of different treatments for impingement syndrome on the improvement in functional limitations and concomitant duration of sick leave.

## METHODS

### Identification and Selection of the Literature

We conducted a systematic search of literature in Pubmed (1966–April 2004), Embase (1980–April 2004), and Cinahl (1982–April 2004). The following text words were used in the search strategy: should* (truncated), rotator cuff, impingement, work, sick leave, disabilit* (truncated), function* (truncated). We only included clinical trials or controlled studies on impingement syndrome. Excluded were studies reporting on

osteoarthritis, rheumatoid arthritis, calcifying tendonitis, or frozen shoulder, and studies on professional athletes, cancer, child [mesh], or animal [mesh].

Impingement syndrome was defined as impingement of the rotator cuff, ranging from tendinosis and bursitis to a rotator cuff tear. This is a combination of stages II and III as defined by Neer (17). These stages represent a continuum of complaints whereby stage III, the rotator cuff tear, can result from a prolonged stage II; tendinosis or bursitis.

Two reviewers (EF and HM) independently screened the abstracts for potential inclusion. References of retrieved articles and review articles were checked for additional studies to be included.

Two reviewers (EF and JK) independently checked whether all selected studies complied with the inclusion criteria: randomized controlled trials (RCTs), quasi-randomized trials, and controlled trials (CTs) that compare treatments or rehabilitation methods after a treatment for impingement syndrome of the shoulder and have sick leave and/or return to work and/or functional limitations as outcome measure. Functional limitations were limited to activities of daily living and, thus, range of motion was not considered to be a functional limitation measure.

## Quality Assessment

For each included study, two reviewers (EF and JK) independently assessed the methodological quality. For methodological quality assessment, a list (18) combining the criteria of the lists of Jadad *et al*. (19) and Verhagen *et al*. (20) was used. This list includes criteria on selection bias, performance bias, attrition bias, and detection bias. These are all criteria for the internal validity of a study. Disagreements between both reviewers were solved by consensus. If disagreements persisted, a third reviewer (HM) made the final decision. A study was regarded to be of high quality when a positive score was given to at least 50% of the items.

## Data Extraction and Analysis

Two reviewers (EF and JK) independently extracted data regarding the sample size, population characteristics, outcome measures on functional limitations and return to work, follow-up, and loss to follow-up. Since the studies were not clinically homogeneous, the results were analyzed using a rating system with levels of evidence (18). These levels are the following: Strong evidence: consistent findings among multiple high quality RCTs; Moderate evidence: consistent findings among multiple low quality RCTs, CCTs and/or one high quality RCT; Limited evidence: one low-quality RCT and/or CCT; and Conflicting evidence: inconsistent findings among multiple trials.

Data were analyzed on the improvement in functional limitations and duration to return to work. Also the interaction between functional limitations and return to work was investigated.

# RESULTS

The literature search resulted in 94 articles. Screening of title and abstract of these articles resulted in 33 relevant articles. Nineteen articles were included in this review. Two articles (21,22) were about the same study, and were thus regarded as

one in the analysis, resulting in 18 included studies. Functional limitations were an outcome measure in 16 of the included studies, and the ability to work or return to work was an outcome measure in four studies, only two studies used both outcome measures.

Several interventions were used in the selected studies; four studies used some form of medication as intervention, seven had a physical therapy intervention of which one study compared this to an operative intervention, three other studies compared two types of operative interventions, and four studies looked at different postoperative physical therapy protocols.

A total of 14 studies was excluded for the following reasons: not about impingement syndrome ($N = 3$), no controlled trials ($N = 4$), and neither sick leave nor functional limitations as outcome measure ($N = 7$).

Table I shows the scores on the methodological quality assessment of the included studies; six studies scored a high methodological quality, ranging from six to eight (55–73%) positive items. The remaining 12 studies were of low quality, ranging from three to five (27–45%) positive items. Table II presents an overview of all the outcome measures used in the selected studies. Table III gives an overview of the included studies and their results, illustrating that the interventions ranged from exercises to surgical procedures.

**Table I.** Methodological Quality Assessment

| Reference | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Quality score (total "+") | Relative score (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (27) | ? | ? | + | + | − | + | + | + | + | + | + | 8 | 73 |
| (28) | + | + | − | + | + | + | ? | ? | + | + | + | 8 | 73 |
| (21, 22) | + | ? | ? | + | − | + | ? | + | + | + | + | 7 | 64 |
| (25) | ? | ? | + | ? | ? | ? | + | + | + | + | + | 6 | 55 |
| (31) | + | − | − | − | − | + | + | + | + | + | ? | 6 | 55 |
| (24) | + | ? | + | + | − | + | ? | ? | − | + | + | 6 | 55 |
| (37) | + | ? | + | − | − | ? | ? | + | + | + | − | 5 | 45 |
| (32) | + | ? | + | − | − | − | ? | ? | + | + | + | 5 | 45 |
| (35) | ? | ? | + | − | − | ? | ? | + | + | + | + | 5 | 45 |
| (34) | ? | ? | + | − | − | + | ? | + | + | − | + | 5 | 45 |
| (39) | + | + | − | ? | ? | + | ? | ? | + | + | − | 5 | 45 |
| (36) | + | + | + | − | − | ? | ? | ? | − | + | ? | 4 | 36 |
| (33) | ? | ? | + | − | − | ? | ? | + | + | + | − | 4 | 36 |
| (30) | + | − | − | − | − | − | ? | − | + | + | + | 4 | 36 |
| (29) | ? | ? | − | + | + | + | ? | ? | − | + | ? | 4 | 36 |
| (23) | ? | ? | + | + | − | + | ? | + | ? | − | ? | 4 | 36 |
| (26) | ? | ? | ? | ? | ? | ? | ? | + | − | + | + | 3 | 27 |
| (38) | + | ? | + | − | − | − | ? | ? | − | + | ? | 3 | 27 |

*Note*. 1: Was the method of randomization adequate? 2: Was the treatment allocation concealed? 3: Were the groups similar at baseline regarding the most important prognostic indicators? 4: Was the patient blinded to the intervention? 5: Was the care provider blinded to the intervention? 6: Was the outcome assessor blinded to the intervention? 7: Were co-interventions avoided or similar? 8: Was the compliance acceptable in all groups? 9: Was the dropout rate described and acceptable? 10: Was the timing of the outcome assessment in all groups similar? 11: Did the analysis include an intention-to-treat analysis?

**Table II.** Instruments Used in Included Studies

| Name | Range | Interpretation |
|---|---|---|
| Constant score | 0–100 | Higher score indicates increased function |
| Shoulder Pain and Disability Index (SPADI) | 0–100 | Higher score indicates more disabilities and pain |
| Shoulder Rating Questionnaire (SRQ) | 17–100 | Higher score indicates increased function and less shoulder symptoms |
| University of California, Los Angeles Shoulder Scale (UCLA) | 2–35 | Higher score indicates increased function and decreased pain |
| University of Pennsylvania Shoulder Score (UPenn) | 0–100 | Higher score indicates increased function |
| VAS functional limitations[a] | 0–10 | Higher score indicates more disabilities |
| Functional Assessment Questionnaire[a] | 0–45 | Higher score indicates increased function |
| Five ADL activities: use back pocket; wash opposite axilla; eat with utensils; wash/comb hair; perform toilet functions[a] | 0–2 | |
| Functional limitations scale[a] | 0–3 | Higher score indicates more disabilities |
| Patients reporting difficulties with sleeping, dressing, working, grooming, sporting[a] | Yes/no | |
| Work-related disability questionnaire[a] | 1–10 | Higher scores indicates more disabilities at work |
| Shoulder function questionnaire[a] | 0–50 | Higher score indicates increased function |

[a]Self-constructed or modified questionnaire.

## RESULTS—COMPARISON OF THE INTERVENTIONS

### Medication

Four studies investigated medication as intervention. All studies compared steroid injections to another form of medication, either injections or oral medication. There is conflicting evidence on the improvement of functional limitations for steroid and analgesic injections; one study found no difference (23), whereas a second study (24) found a significant improvement for steroids. There is limited evidence that steroid injections and oral diclofenac have a similar effect on functional limitations, and that oral diclofenac is superior to analgesic injections (24).

Also, there appears to be limited evidence that steroid injections do not differ from injections with sodium hyaluronate with regard to functional limitations (25). However, this study compared groups on the basis of their satisfaction with the treatment.

There is limited evidence that steroid injections result in a higher ability to work after 1 year when compared to analgesic injections (26).

### Physical Therapy

Seven studies were found on physical therapy interventions. Two studies compared extracorporeal shock-wave therapy (ESWT) to placebo, two studies compared laser to placebo, and three studies compared exercise therapy to no intervention, to manual therapy, and to both surgery and placebo.

**Table III.** Results of Included Studies

| Reference | Quality assessment (%) | Participants | | | | Interventions | Outcomes | Results |
|---|---|---|---|---|---|---|---|---|
| | | *N* | Mean age (year) | Gender (male, %) | Symptom duration (months) | | | |
| Medication | | | | | | | | |
| (23) | 36 | 40 | 56.5 | 20 | 8 | (1) Steroid injection $N = 19$ (2 ml 40 mg triamcinolone + 4 ml 1% lidocaine)<br>(2) Injection with analgesic $N = 21$ (6 ml 1% lidocaine) | Functional limitations[a]: Measured at baseline and 30 months, mean<br>Use back pocket: (1) 0.8, 1.7; (2) 0.8, 1.4<br>Wash opposite axilla: (1) 1.2, 1.8; (2) 1.2, 1.7<br>Eat with utensils: (1) 1.6, 1.9; (2) 1.8, 1.9<br>Wash/comb hair: (1) 1.3, 1.8; (2) 1.4, 1.4<br>Perform toilet functions: (1) 1.5, 1.9; (2) 1.7, 1.9 | No significant difference |
| (24) | 55 | 60 | 53.3 | 36.7 | 2 | (1) Steroid injection $N = 20$ (triamcinolone) | Functional limitations[b]: Measured at baseline and difference baseline—4 weeks, mean (SD) | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | (2) Oral NSAID $N = 20$ (diclofenac) | (1) 1.25 (0.19), 0.85 (0.15); (2) 1.55 (0.16), 0.85 (0.11); (3) 1.25 (0.16), 0.30 (0.10) | Steroid (1) improved significantly more than analgesic (3) ($p \leq 0.01$) |
| | | | | | | (3) Injection with analgesic $N = 20$ (lidocaine) | | NSAID (2) improved significantly more than analgesic (3) ($p \leq 0.05$) |
| | | | | | | | | No significant difference between (1) and (2) |
| (25) | 55 | 78 | 61.0 | 70.5 | 5 | (1) Steroid injection $N = 40$ (38% satisfied, 62% unsatisfied) | Functional limitations[c]: Measured at baseline, 4 and 24 weeks, mean (SD) | |
| | | | | | | (2) Injection with sodium hyaluronate $N = 38$ (42% satisfied, 58% unsatisfied) | (1) Satisfied: 11.9 (3.6), 26.5 (2.0), 25.3 (2.5); unsatisfied: 12.6 (3.9), 15.0 (4.0)) | No significant difference between satisfied groups, satisfied groups improved significantly more than unsatisfied groups ($p < 0.001$) |
| | | | | | | | (2) Satisfied: 13.6 (2.6), 27.6 (3.1), 26.2 (3.1); unsatisfied: 12.8 (3.5), 14.9 (4.4)) | No significant difference between number of satisfied patients |
| (26) | 27 | 31 | 58.5 | 41.9 | Chronic | (1) Steroid injection $N = 17$ (5 ml 0.5% mepivacainhydrochlorid) + 20 mg triamcinolone) | RTW[d]: Measured at 1 year, % | |
| | | | | | | (2) Injection with analgesic $N = 14$ (5 ml 0.5% MVH) | (1) 86; (2) 18 | Significant difference in favor of steroid injection |

**Table III.** Continued

| Reference | Quality assessment (%) | Participants | | | | Interventions | Outcomes | Results |
|---|---|---|---|---|---|---|---|---|
| | | *N* | Mean age (year) | Gender (male, %) | Symptom duration (months) | | | |
| Physical therapy | | | | | | | | |
| (21, 22) | 64, 36 | 34 | 52 | 50 | >6 | (1) ESWT $N = 17$ (71% satisfied, 29% unblinded) | Functional limitations[e]: Measured at baseline, 6 and 12 weeks and 1 year, mean (SD) | |
| | | | | | | (2) Placebo $N = 17$ (53% satisfied, 47% unblinded + ESWT) | (1) 40.7 (13.3), 61.0 (29.6), 66.5 (37.9). Satisfied: 106.4 (32.6); unblinded: 47.94 (40.6) | After 12 weeks, no significant difference between ESWT-group and placebo-group |
| | | | | | | | (2) 42.2 (13.0), 64.2 (25.2), 64.4 (32.7). Satisfied: 109.52 (18.7); unblinded + ESWT: 66.44 (41.4) | After 12 weeks, unsatisfied patients were unblinded and received ESWT if first treatment was placebo (partial crossover) |
| | | | | | | | | After 1 year, no significant difference between the satisfied groups |
| (27) | 73 | 74 | 52.6 | 41.9 | 23 | (1) ESWT $N = 40$ | Functional limitations[f]: Measured at baseline; 1, 2, 3, and 6 months, mean (SD) | |
| | | | | | | (2) Placebo $N = 34$ | (1) 53.6 (20.2), 48.7 (21.0), 46.1 (22.4), 34.7 (26.6), 24.1 (22.9) | No significant difference |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | (2) 59.5 (16.1), 58.5 (19.7), 48.6 (23.8), 39.7 (27.7), 34.9 (31.7) | |
| (28) | 73 | 20 | 53.1 | 40 | 6 | (1) Ultrasound $N = 11$ | Functional limitations[g]: Measured at baseline and 4 weeks; percentage reporting difficulties | |
| | | | | | | (2) Placebo $N = 9$ | | No significant difference |
| | | | | | | | Sleeping: (1) 64, 27; (2) 100, 44<br>Dressing: (1) 73, 45; (2) 89, 44<br>Working: (1) 45, 36; (2) 78, 33<br>Grooming: (1) 73, 36; (2) 89, 33<br>Sporting: (1) 73, 55; (2) 67, 44 | |
| (29) | 36 | 35 | 54.4 | 28.6 | 15 | (1) Laser $N = 19$ | Functional limitations[h]: Measured at baseline, 4 and 8 weeks, mean (SD) | |
| | | | | | | (2) Placebo $N = 16$ | (1) 6.5 (0.6), 2.9 (0.6), 3.6 (0.9); (2) 5.7 (0.6), 2.0 (0.8), 2.9 (1.1) | No significant difference |
| (30) | 36 | 67 | 48.6 | 100 | – | (1) Home exercise therapy $N = 34$ | Functional limitations<br>Shoulder Rating Questionnaire: Measured at baseline and 8–12 weeks, mean (SD) | SRQ (1) improved significantly more than (2) |

**Table III.** Continued

| Reference | Quality assessment (%) | Participants | | | | Interventions | Outcomes | Results |
|---|---|---|---|---|---|---|---|---|
| | | *N* | Mean age (year) | Gender (male, %) | Symptom duration (months) | | | |
| | | | | | | (2) Control group $N = 33$ | (1) 65.9 (2.0), 78.0 (2.3); (2) 72.5 (2.0), 71.1 (2.2) | |
| | | | | | | | Work Related Disability Questionnaire: Measured at pretest, posttest (10 weeks) | |
| | | | | | | | (1) 4.1 (0.3), 2.5 (0.3); (2) 3.8 (0.3), 3.7 (0.3) | Work-related disability: (1) improved significantly more than (2) |
| (31) | 55 | 52 | 43.4 | 57.7 | 5 | (1) Supervised exercise therapy with manual therapy $N = 28$ | Functional limitations[i]: Measured at baseline and 2 months, mean (SD) | |
| | | | | | | (2) Supervised exercise therapy $N = 24$ | (1) 28.3 (4.8), 38.2 (4.7); (2) 28.5 (5.5), 33.3 (7.8) | (1) Improved significantly more than (2) ($p = 0.005$) |
| (32) | 45 | 125 | 47.6 | 52.8 | >3 | (1) Supervised exercise therapy $N = 30$ | RTW[j]: Measured at baseline, 6 months and 2.5 years, % | |
| | | | | | | (2) Arthroscopic acromioplasty $N = 45$ | (1) 43, 31, 20; (2) 53, 38, 41; (3) 55, 43, 36 | No significant difference between groups |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | (3) Placebo laser $N = 50$ | | Differences only for patients who received treatment as planned. After 6 months, 25% of exercise group and 36% of placebo group had surgery. Their improvement after surgery was comparable to those randomized to surgery. They were not included |
| Operative interventions | | | | | | | | |
| (33) | 36 | 41 | 49.9 | 56 | 18.7 | (1) Arthroscopic acromioplasty $N = 22$ | Functional limitations: Return to activities of daily living, mean | |
| | | | | | | (2) Open acromioplasty $N = 19$ | (1) 4 days; (2) 9 days | No information given on significance |
| | | | | | | | RTW: Return to work, mean | |
| | | | | | | | (1) 36 days; (2) 54 days | |
| (34) | 45 | 62 | 40.9 | – | 40.4 | (1) Arthroscopic acromioplasty $N = 32$ | Functional limitations[k]: Measured at baseline and postoperatively[l], mean | |
| | | | | | | (2) Open acromioplasty $N = 30$ | (1) 17.8, 28.8; (2) 16.7, 28.1 | UCLA: no significant difference |

**Table III.** Continued

| Reference | Quality assessment (%) | Participants | | | | Interventions | Outcomes | Results |
|---|---|---|---|---|---|---|---|---|
| | | *N* | Mean age (year) | Gender (male, %) | Symptom duration (months) | | | |
| (35) | 45 | 20 | 43.5 | 65 | 52.8 | (1) Arthroscopic acromioplasty $N = 10$ | Functional limitations[m]: Measured at 2 years, mean (range) | |
| | | | | | | (2) Open acromioplasty $N = 10$ | (1) 29 (14–35); (2) 29 (21–35) | No significant difference |
| Postoperative (36) | 36 | 43 | 46.6 | 60.5 | 40 | (1) Supervised exercise therapy $N = 21$ | Functional limitations[n]: Measured at baseline, 3, 6, and 12 months, mean (range) | |
| | | | | | | (2) Self training $N = 22$ | (1) 54 (20–90), 66 (19–92), 76 (42–100), 80 (40–96); (2) 53 (26–81), 69 (30–99), 77 (32–95), 79 (45–100) | No significant difference |
| | | | | | | | RTW: Sick leave, mean | |
| | | | | | | | (1) 8.0 weeks; (2) 8.5 weeks | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (37) | 45 | 108 | 58.0 | 63.9 | – | | Functional limitations: Measured at baseline, 12, 24, and 52 weeks, mean (SD) | |
| | | | | | | (1) Self-training with instruction from PT $N = 54$ | SPADI: (1) 52.3 (21.6), 26.7 (18.8), 15.3 (15.2), 12.4 (14.4); (2) 60.4 (22.1), 32.0 (19.7), 18.1 (16.1), 12.3 (14.3) | No significant differences |
| | | | | | | (2) Self-training with instruction video $N = 54$ | UPENN: (1) 40.9 (16.3), 66.2 (17.5), 79.6 (17.3), 85.9 (16.7); (2) 37.9 (15.7), 62.6 (17.7), 79.4 (15.5), 85.6 (13.8) | |
| (38) | 27 | 32 | 63.3 | 43.8 | – | | Functional limitations[o]: Measured at most recent follow-up[p], percentage in quartiles of the score | |
| | | | | | | (1) Passive continuous motion $N = 17$ | (1) Excellent: 88%; good: 6%; fair: 6%; poor: 0% | No significant difference between groups both on quartiles and on continuous SPADI-score |

**Table III.** Continued

| Reference | Quality assessment (%) | Participants N | Mean age (year) | Gender (male, %) | Symptom duration (months) | Interventions | Outcomes | Results |
|---|---|---|---|---|---|---|---|---|
| | | | | | | (2) Manual passive range-of-motion $N = 15$ | (2) Excellent: 80%; good: 7%; fair: 7%; poor: 7% | |
| (39) | 45 | 26 | 55.8 | 69.2 | – | (1) Physical therapy + passive continuous motion $N = 14$ | Functional limitations[q]: Measured at baseline and 3 months, mean | |
| | | | | | | (2) Physical therapy $N = 12$ | (1) 68, 81; (2) 75, 88 | No significant difference |

[a] Five ADL activities (0: unable; 1: able, but with difficulties; 2: able).
[b] Functional limitations scale (0: no limit; 3: severe limits).
[c] UCLA.
[d] Able to work.
[e] Adapted constant score: An age- and gender-corrected score was used. Here a score of 105 means a constant-score 5% above the average constant-score for this age group and gender.
[f] SPADI.
[g] Patients reporting difficulties.
[h] VAS functional limitations: Outcomes measured at 4 and 8 weeks are presented as changes with baseline measurements.
[i] Functional Assessment Questionnaire.
[j] Absent from work.
[k] UCLA.
[l] Postoperative measurements took place between 12 and 25 months from baseline measurements.
[m] UCLA.
[n] Constant.
[o] SPADI.
[p] Most recent follow-up: mean 22 months (range 6–45).
[q] Shoulder function questionnaire.

There is strong evidence that extracorporeal shock-wave therapy (ESWT) is no more effective than placebo (21,22,27), moderate evidence that ultrasound therapy is no more effective than placebo (28), and limited evidence that laser is no more effective than placebo (29) with regard to functional limitations.

With regard to the improvement in functional limitations there is limited evidence that exercise is more effective than no intervention (30), and moderate evidence that exercise combined with manual therapy is more effective than exercise alone (31).

There is limited evidence that for the patients who received treatment as planned there is no difference between exercise, arthroscopic acromioplasty and placebo laser on work status (32). However, in this study, 25% of the patients receiving exercise and 36% of the patients receiving placebo laser had surgery after 6 months. Their improvement after surgery was comparable to those randomized to surgery.

### Operative Interventions

Three studies were found on operative interventions. All three studies compared open acromioplasty to arthroscopic acromioplasty. With regard to functional disability there is limited evidence that on the short-term arthroscopic acromioplasty is more effective than open acromioplasty (33), and moderate evidence that on the long term there is no difference (34,35).

There is limited evidence that arthroscopic acromioplasty is more effective than open acromioplasty with regard to time to return to work (33).

### Postoperative Rehabilitation

Four studies were found on postoperative interventions. All four studies compared different forms of exercise therapy. There is limited evidence that there is no difference with regard to functional limitations and duration of sick leave between postoperative supervised exercise therapy and self-training (36). Also, there is limited evidence with regard to functional disability that there is no difference for the compared forms of post-operative therapy; instruction from a physical therapist compared to video instruction for postoperative self-training (37), for postoperative passive continuous motion compared to manual passive range-of-motion (38), and for postoperative physical therapy with passive continuous motion compared to postoperative physical therapy (39).

## RESULTS—COMPARING FUNCTIONAL LIMITATIONS WITH RETURN TO WORK

The four studies with duration of sick leave or work status at follow-up as a primary outcome measure provided similar evidence with regard to effectiveness as the studies using functional limitations as outcome measure.

## DISCUSSION

This review evaluated the effectiveness of different treatments for impingement syndrome on the improvement in functional limitations and concomitant duration of sick leave.

For exercise therapy after an operation for impingement syndrome, several forms of exercise have been compared to each other. All studies showed similar results on functional limitations, suggesting that the presented exercise programs are equally effective.

In the initial search of literature, we found many studies using range of motion and pain as outcome measures, but functional limitations were less often used as an outcome measure in this type of research. Duration of sick leave was seldom included as an outcome measure. Hence, we could compare improvement in functional limitations and duration to return to work for only a few interventions for impingement syndrome. Although recovery on functional limitations is not equal to return to work (11–15), the effectiveness of interventions with regard to ability to work or duration of sick leave does not seem to differ from the effectiveness on functional limitations.

Sick leave is not only a very costly matter for the patient, his employer, and, in the long term, society, it is also expected to have other consequences for the patient. Potential negative consequences include onset of other disorders like depression, impact on career opportunities, and social relationships. A recent review (40) on the consequences of sick leave found that scientific evidence regarding these consequences is insufficient since there are only a few studies on these matters. In this regard, it is recommended to include duration of sick leave more often as an outcome measure. Several studies have compared the use of self-reported data on sick leave duration and data from company records (41–45). When available, data from company records is more accurate. Self-report questionnaires can be sufficient if the recall period is not too long.

The International Classification of Functioning, Disability and Health (ICF) (9) was published in 2001 as a revision of the International Classification of Impairment, Disability and Health (ICIDH). The ICF presents a complex system of the patient and his environment and shows that a questionnaire or measure for functional disability should measure what one is capable to do as well as the influences of this capability on other measures such as ability to work and autonomy. These different aspects of functional disability can be measured by domains like pain, symptoms, physical functioning, emotional functioning, and social functioning. The review by Bot (46) showed that most questionnaires do not cover all domains, and some only cover part of these domains. Different questionnaires measure functional disability in different ways, thus many constructs to measure functional limitations are available. The included studies used six available questionnaires and seven self-constructed questionnaires.

The Neer-classification (17) was not used in this study. This classification was used in some articles, but in clinical practice this distinction is not that clear. A combination of clinical shoulder tests (47) or MRI or ultrasound (48) can be used to correctly diagnose a full thickness rotator cuff tear, but partial tears were less accurately diagnosed by these tests. The diagnostic accuracy of physical examination tests varies for the different stages (49). These tests also lack specificity in comparison with arthroscopic findings (50). The studies used in this review used a combination of diagnostic tests, and described the diagnosis, not the stage within the Neer-classification. Most of the studies were on impingement, only four studies compared an intervention only for tears of the rotator cuff. In this review, the diagnosis of impingement is regarded to be a continuum, also because similar interventions were used for tears and impingement.

## METHODOLOGICAL CONSIDERATIONS

Similar to previous reviews, this review did not result in sound evidence indicating the best treatment for patients with impingement syndromes. This review was not limited to a specific type of treatment, but to the outcome measures functional limitations and return to work.

We chose to include only clinical trials in our review, since these studies often have a better methodological quality than prognostic studies. However, only 6 of the 18 studies were regarded to be of high quality. All included studies were randomized controlled trials. In 60% of the studies where we could not assign a positive score to an item, we were unable to retrieve the necessary information from the article. The treatment allocation and co-interventions were most often not mentioned in the article. Not blinding the care providers occurred in 70% of the studies.

Since there is a lack of high-quality studies with regard to the used outcome measures to answer our research question, it might be useful to do a prognostic review to give an indication of time to functional recovery and time to return to work after a certain intervention.

## CONCLUSION

Since pain, functional disability, and ability to work do not improve in the same way, it is important to distinguish pain from functional disability and ability to work. The aim of this review was to give an indication of the course of improvement in functional limitations and of the duration to return to work after a treatment for impingement syndrome. Contrary to our expectations, functional limitations were not a common outcome measure. We found many studies using range of motion and pain as outcome measures but functional limitations were less often used as an outcome measure in this type of research. Also duration of sick leave or work status was seldom included as an outcome measure. Future studies on the effectiveness of a treatment for impingement syndrome should include functional limitations and duration of sick leave more often as an outcome measure.

There is moderate evidence that exercise combined with manual therapy is more effective than exercise alone. There is limited evidence for the effectiveness of the following interventions: exercise is more effective than no intervention on functional limitations, oral diclofenac is more effective than analgesic injections, both on functional limitations and on ability to work after 1 year. On the short term, arthroscopic acromioplasty is more effective than open acromioplasty with regard to functional limitations and return to work. However, moderate evidence exists that on the long term open and arthroscopic acromioplasty are equally effective with regard to functional limitations.

There is strong evidence that extracorporeal shock-wave therapy is not effective and moderate evidence that ultrasound is not effective. For all other interventions there is only limited evidence that the interventions do not differ in their effect on the improvement in functional limitations.

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