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# Surgery for rotator cuff disease (Review)

Coghlan JA, Buchbinder R, Green S, Johnston RV, Bell SN

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**[Intervention Review]**

# Surgery for rotator cuff disease

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## ABSTRACT

### Background

This review is one in a series of Cochrane reviews of interventions for shoulder disorders.

### Objectives

To determine the effectiveness and safety of surgery for rotator cuff disease.

### Search methods

We searched the Cochrane Controlled Trials Register, (*The Cochrane Library* Issue 1, 2006), MEDLINE, EMBASE, CINAHL, Sports Discus, Science Citation Index (Web of Science) in March 2006 unrestricted by date or language.

### Selection criteria

Only studies described as randomised or quasi-randomised clinical trials (RCTs) studying participants with rotator cuff disease and surgical interventions compared to placebo, no treatment, or any other treatment were included.

### Data collection and analysis

Two independent review authors assessed methodological quality of each included trial and extracted data.

### Main results

We included 14 RCTs involving 829 participants. Eleven trials included participants with impingement, two trials included participants with rotator cuff tear and one trial included participants with calcific tendinitis. No study met all methodological quality criteria and minimal pooling could be performed. Three trials compared either open or arthroscopic subacromial decompression with active non operative treatment (exercise programme, physiotherapy regimen of exercise and education, or graded physiotherapy strengthening program). No differences in outcome between these treatment groups were reported in any of these trials. One trial which also included a placebo arm (12 sessions detuned soft laser) reported that the Neer score of participants in both active treatment arms improved significantly more than those who received placebo at six months.

Six trials that compared arthroscopic with open subacromial decompression reported no significant differences in outcome between groups at any time point although four trials reported a quicker recovery and/or return to work with arthroscopic decompression. Adverse events, which occurred in three trials and included infection, capsulitis, pain, deltoid atrophy, and reoperation, did not differ between surgical groups.

**Authors' conclusions**

Based upon our review of 14 trials examining heterogeneous interventions and all susceptible to bias, we cannot draw firm conclusions about the effectiveness or safety of surgery for rotator cuff disease. There is "Silver" (www.cochranemsk.org) level evidence from three trials that there are no significant differences in outcome between open or arthroscopic subacromial decompression and active non-operative treatment for impingement. There is also "Silver" level evidence from six trials that there are no significant differences in outcome between arthroscopic and open subacromial decompression although four trials reported earlier recovery with arthroscopic decompression.

## PLAIN LANGUAGE SUMMARY

**Surgery for rotator cuff disease**

This summary of a Cochrane review presents what we know from research about the effect of surgery for rotator cuff disease. The review shows that surgery:

may not lead to any difference in pain compared with different exercise programs.

The review shows that arthroscopic surgery:

may not lead to any difference in outcome in the long run compared with open surgery but people might recover sooner.

There was not enough information in the included studies to tell whether surgery would make a difference in the ability to use your shoulder normally, your quality of life, your shoulder's range of motion, your strength, the chance that your symptoms might come back, the time it takes to return to work or sports and whether people are satisfied with surgery.

Side effects that occurred in the studies included pain, infection, difficulty moving the shoulder after the operation, wasting of the shoulder muscle, and the need to have another surgical procedure. There were no differences in side effects in the people who had arthroscopic surgery compared with those who had open surgery.

**What is rotator cuff disease and what is surgery?**

The rotator cuff is a group of tendons that hold the shoulder joint in place. The rotator cuff lets people lift their arm and reach overhead. In a lot of people, wear and tear of the rotator cuff tendons is a normal part of ageing and they may not have symptoms. However many people will develop pain in their shoulder at some time as the tendons degenerate further and tears in the rotator cuff tendons develop. There may also be inflammation of the shoulder tendons or bursa (another part of the shoulder that helps it move). Often the pain is made worse by sleeping on the affected shoulder and moving the shoulder in certain directions. Often there will be pressure on the tendons by the overlying bone when lifting the arm up. This is called impingement. It may become difficult to use the shoulder in every day activities, sports or work.

To diagnose rotator cuff disease, a doctor will examine your shoulder and ask you questions about your ability to move it, and the situations that cause pain.

If the pain does not go away by itself or with various treatments like steroid injections or physiotherapy or both, surgery can be performed. Surgery on your rotator cuff may include removing part of your bone to take the pressure off the rotator cuff tendons (acromioplasty), removing any swollen or inflamed bursa (the small sack of fluid around the joint), and removing any damaged tissue to help heal the remaining tissue. This is called a 'decompression'. If one of the tendons of the rotator cuff is torn, the doctor might use special stitches to repair it. This is called a 'repair'.

Some procedures can be performed arthroscopically (surgical instruments are inserted through a small incision or key hole and an endoscope to visualise the area and to guide the doctor is inserted through another incision), which can mean a shorter recovery time.

## BACKGROUND

This Cochrane review is one of an updated series of Cochrane reviews of interventions for shoulder disorders. The original review on all interventions for shoulder pain (Green 1998) has now been split into a series of reviews that examine interventions for shoulder pain separately. While surgery was a studied intervention in our original review, at that time no randomised controlled trials meeting the inclusion criteria were identified.

Shoulder disorders are a common cause of musculoskeletal morbidity in the community, affecting 7 to 30% of adults at any one time (Bjelle 1989; Chard 1991; Green 1998; Pope 1997). Although not life-threatening, they cause pain or stiffness or both and often result in substantial utilisation of health care resources, absenteeism from work and disability. Shoulder pain is the third most common musculoskeletal reason for seeking medical care after back and neck pain, and accounts for 1.2% of all general practice encounters in Australia (Bot 2005; Bridges-Webb 1992). It also accounts for up 10% of all referrals to physiotherapists (Peters 1994).

Rotator cuff disease is the most common cause of shoulder pain seen by physicians and its incidence is expected to grow as the population ages but is increasingly active and less willing to accept functional limitations (Gomoll 2004). A wide range of conditions are included under this umbrella term, including rotator cuff tendonitis or tendinopathy, supraspinatus, infraspinatus or subscapularis tendonitis, subacromial bursitis, partial and complete rotator cuff tears. There is currently no uniformity in how these conditions are labeled and defined (Green 1998). Among published trials for rotator cuff disease, inclusion criteria most commonly include the presence of positive impingement signs including a painful arc with abduction and pain with resisted movements, and/or normal passive range of motion (Green 1998).

The pathophysiology of rotator cuff disease has traditionally been viewed as a continuum ranging from impingement syndrome to partial- and full-thickness rotator cuff tears (Neer 1983). Intrinsic degeneration of the rotator cuff tendons possibly arising from relative hypoperfusion (or lack of blood supply) of an area close to the insertion of the greater tuberosity, together with repetitive microtrauma, is now thought to contribute to the aetiology of rotator cuff disease (Ogata 1990 ). Based upon magnetic resonance imaging scans, asymptomatic partial- and full-thickness rotator cuff tears have been demonstrated to occur in 4% of individuals < 40 years old and in more than 50% of individuals > 60 years old (Sher 1995 ). While a large proportion of patients with rotator cuff disease may be asymptomatic, studies have shown that 50% of individuals with asymptomatic rotator cuff tears develop pain within five years (Yamaguchi 2001) . Shoulder pain persists or recurs in 40 to 50% of individuals within one year after initial presentation (Chard 1991; Croft 1996; van der Windt 1996). It also has a substantial impact upon quality of life (MacDermid 2004). Therefore effective treatment that shortens the duration of symptoms and disability has the potential to be of significant value in terms of reduced morbidity and costs to both the individual and the community.

The diagnosis of rotator cuff disease is predominantly made by history and physical examination. Patients may present with impingement-type symptoms, manifest as pain at night and at rest, as well as a painful arc with or without features of a torn rotator cuff tendon manifest by painful weakness and atrophy. Plain radiographs may exclude other causes of shoulder pain such as glenohumeral osteoarthritis, the presence of calcific deposits which are usually situated just proximal to the rotator cuff insertion or an acromial spur that might impinge on the rotator cuff. Elevation of the humeral head which together with narrowing of the subacromial space might indicate the presence of a large rotator cuff tear (Weiner 1970). Specific 'outlet view' x-rays may be useful in defining the shape of the acromion and may be helpful in surgical planning. The diagnostic utility of imaging modalities such as ultrasound and MRI for rotator cuff disease *per se* has not been determined, although they are both equally useful for detecting full thickness rotator cuff tears and have lesser accuracy for detection of partial-thickness tears (Dinnes 2003).

The objectives of treatment of symptomatic rotator cuff disease are to relieve pain and restore movement and function of the shoulder. Conservative treatments that have been advocated include non-steroidal-anti-inflammatory drugs (NSAIDs), glucocorticoid injections and physiotherapy, while surgery (decompression +/- rotator cuff repair) is usually reserved for those who fail to respond to non-operative treatment (Gomoll 2004). Some people have argued that earlier surgical intervention may result in better outcomes, decreased cost and earlier return to work (Suenaga 2000; Wittenberg 2001).

Surgical procedures that may be used to treat rotator cuff disease include subacromial bursectomy, debridement of partial tears, subacromial decompression (acromioplasty) and/or removal of calcific deposits. If a significant partial or full thickness tear is present in the cuff this can be repaired. Often a combination of procedures is performed. For example surgery for a rotator cuff tear may include acromioplasty for subacromial decompression, excision of the subacromial bursa, removal of bony spurs at the acromio-clavicular level, cuff debridement or cuff repair or both. Some procedures can be performed arthroscopically (insertion of surgical instruments into the surgical area using small incisions ('key holes') rather than through a large incision that opens up the whole area), which may result in less morbidity and shorter recovery time enabling earlier return to work and/or sport (Hata 2001). Potential risks of surgery include complications related to the anaesthetic or comorbidities, infection, post-operative capsulitis (or frozen shoulder), wasting of the deltoid muscle, ongoing pain and failed rotator cuff repair. Many surgical techniques have been described in the literature but evidence of their efficacy comes mainly from retrospective

or prospective case series. A recent Cochrane systematic review investigating the efficacy and safety of interventions specifically for rotator cuff tears included four trials that included a surgical arm (Ejnisman 2003).There were no randomised controlled trials comparing active non-operative treatment to surgery. From two trials (Montgomery 1994; Ogilvie-Harris 1993), the authors concluded that open surgical repair may be superior to arthroscopic debridement/decompression for overall improvement at five year and nine year follow up. The aim of this review was to examine the efficacy and safety of surgery for rotator cuff disease.

# OBJECTIVES

To determine the effectiveness and safety of surgery in the treatment of rotator cuff disease of the shoulder.

# METHODS

## Criteria for considering studies for this review

### Types of studies

Randomised or quasi-randomised (methods of allocating participants to a treatment which are not strictly random, e.g., date of birth, hospital record number or alternation) clinical trials (RCTs) were considered for inclusion in this review. Studies reported in abstracts without data were included in the 'Studies awaiting assessment' category and we contacted authors for further detailed data. There were no language restrictions on included studies and non-English articles were translated.

### Types of participants

Studies of adults (18 years and over) with rotator cuff disease, confirmed by physical examination, magnetic resonance imaging (MRI), ultrasound or arthrogram were included. Studies of adults undergoing surgery for benign or malignant tumours, adhesive capsulitis, shoulder instability, joint replacement or fractures were excluded.

### Types of interventions

All randomised controlled comparisons of surgical techniques (open or arthroscopic) versus placebo, or another modality, or no treatment, or comparison of one type of surgical technique to another, were included, and comparisons established according to intervention.

### Types of outcome measures

We examined all outcomes at all time points reported in the trials. Primary outcomes that were considered were pain, disability or function measured using shoulder-specific instruments (e.g. Constant score, University of California and Los Angeles Shoulder scale (UCLA) or American Shoulder and Elbow Surgeons Shoulder Score (ASES)), participant evaluated success of treatment and adverse effects. Secondary outcomes that were considered were quality of life, range of motion (active and passive), strength, recurrence of symptoms, return to work and sport, and participant satisfaction with treatment.

## Search methods for identification of studies

We searched the following databases for randomised or quasi-randomised trials:
1. Cochrane Controlled Trials Register (*The Cochrane Library* Issue 1, 2006);
2. OVID MEDLINE, 1966 to March 2006;
3. OVID CINAHL, 1982 to March 2006;
4. OVID SPORTdiscus, 1949 to March 2006;
5. EMBASE 1980 to March 2006;
6. Science Citation Index (Web of Science) 1945 to March 2006.
Searches were conducted in March 2006 and were not restricted by date. In addition, we handsearched the *Proceedings of the 2004 American Academy of Orthopaedic Surgeons*, the *9th International Conference of Shoulder Surgery (ICSS) Washington 2004*, the *Quebec Orthopaedic Society Annual Meeting 2004*, *The Shoulder and Elbow Society of Australia Meeting, 2004*, *The 5th Academic Congress of the Asian Shoulder Association 2005 Beijing*. We used reference lists and citation tracking to ensure all relevant articles were retrieved. The search strategy for the electronic data bases within OVID, and adapted for other databases is detailed in Appendix 1.

## Data collection and analysis

**Study selection**
Following identification of potential trials for inclusion by the previously outlined search strategy, two of three review authors (JC, RJ, RB) independently reviewed the methods sections of all identified trials according to predetermined criteria (*see* 'Selection criteria'). All articles were coded and details of source, intervention, population and funding recorded. Any disagreements were resolved by consensus.
**Methodological quality assessment**
Two of three review authors (JC, RJ, RB) independently assessed the methodological quality of each included trial. Disagreements were resolved by consensus with a third review author.
As in our previous reviews of interventions for shoulder pain, the methodological quality of included trials was assessed based upon whether the trials met key methodological criteria (appropriate

randomisation, allocation concealment, blinding of participants and outcome assessment for this review, number lost to follow up and intention to treat analysis). Failure to fulfill these criteria was considered to have potentially biased the overall outcome of the trial. We assessed whether each quality assessment item was met, unmet, or unclear, and derived an overall assessment of the validity of the results of individual trials by assigning one of three categories- low risk of bias (all criteria met), moderate risk of bias (one or more criteria partially met), and high risk of bias (one or more criteria not met). Allocation concealment was also ranked as: A: adequate; B: unclear; C: inadequate; or D: not used. All other information concerning the above criteria was recorded on a pre-piloted data extraction sheet and later transposed into the Table of Included Studies. We assessed methodological quality of trials in this qualitative way as opposed to using a numerical or summary scale due to concerns regarding the validity of such scales and lack of information about whether all the criteria included in such scales impact on the overall outcome of the trial.

**Data extraction**

Two of three review authors (JC, RJ, RB) independently extracted data from the included trials including source of funding, study population, number and experience of surgeons in each trial, duration of operation, intervention, analyses and outcomes using standardised data extraction forms. We contacted the authors of original studies to obtain more information if needed.

In order to assess efficacy, raw data for outcomes of interest (means and standard deviations for continuous outcomes and number of events for dichotomous outcomes) were extracted where available in the published reports. An available case analysis was used for trials where there was loss to follow up to address the potential for attrition bias (Schulz 1995).

**Analysis**

The results of each RCT were plotted as point estimates, i.e., relative risks (RRs) with corresponding 95% confidence interval for dichotomous outcomes, and mean and standard deviation for continuous outcomes. To expedite rapid and easier updating of the review we extracted all results that could be extracted from the included trials. When the results could not be shown in this way, for example if reported as median scores only, they were described in the table of 'Characteristics of included studies'. For continuous data where no standard deviations were reported, we calculated the standard deviation using the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions*. For continuous measures, preference was given to analyse the results with mean differences (MDs) because these results are easier to interpret for clinicians/readers. The studies were first assessed for clinical homogeneity with respect to the duration of the disorder, control group and outcomes. For studies judged to be clinically heterogeneous we planned to describe them separately and not combine them in a meta-analysis. For studies judged as clinically homogeneous, we planned to test statistical heterogeneity using Q test (chi squared)($P = 0.10$) and I-squared ($I^2$ ) > 50. We planned to pool clinically and statistically homogeneous studies using the fixed-effect model, and clinically homogeneous and statistically heterogeneous studies using the random-effects model. A sensitivity analysis was planned to assess for any bias attributable to allocation concealment, and subgroup analyses to assess the effect of age and physical activity on outcome.

**Clinical Relevance Tables**

Clinical relevance tables were compiled under additional tables for selected important outcomes, to improve the readability of the review. In the clinical relevance tables, for dichotomous outcomes (for example, patient reported success), the baseline risk was entered directly from the observed events in the control group displayed on the RevMan Metaview screen. The control (placebo) event rate (expressed as a percentage) was used. It is the sum of all the events in the placebo group divided by the total patient numbers in the placebo group. The number needed to treat to benefit (NNTB) was calculated as one divided by the absolute risk difference, for outcomes derived from one trial. For continuous outcomes (for example, overall pain measured on a visual analogue scale), absolute change (benefit) was calculated from the mean difference and expressed as a per cent and in the original units. Relative difference in the change from baseline was calculated as the absolute benefit divided by the baseline mean of the control (placebo) group.

**Grading the strength of the evidence**

A common system for grading the strength of scientific evidence for a therapeutic agent has been described in the Cochrane Musculoskeletal Group (CMSG) module scope and in the Evidence-based Rheumatology BMJ book (Tugwell 2004) and was used to rank the evidence included in this systematic review. Four categories are used to rank the evidence from research studies from highest to lowest quality:

***Platinum Level Evidence:*** A published systematic review that has at least two individual controlled trials each satisfying the following: 1. Sample sizes of at least 50 per group. If they do not find a statistically significant difference, they are adequately powered for a 20% relative difference in the relevant outcome. 2. Blinding of patients and assessors for outcomes. 3. Handling of withdrawals> 80% follow up (imputations based on methods such as Last Observation Carried Forward (LOCF) acceptable). 4. Concealment of allocation.

***Gold Level Evidence:*** The gold ranking is given to evidence if at least one randomised clinical trial meets all the following criteria for the major outcome as reported: 1. Sample sizes of at least 50 per group. If they do not find a statistically significant difference, they are adequately powered for a 20% relative difference in the relevant outcome. 2. Blinding of patients and assessors for outcomes. 3. Handling of withdrawals> 80% follow up (imputations based on methods such as Last Observation Carried Forward (LOCF) acceptable.) 4. Concealment of allocation.

***Silver Level Evidence:*** The silver ranking is given if a systematic review or randomised trial does not meet the above criteria. Silver ranking would also include evidence from at least one study of non-randomised cohorts who did or did not receive therapy or evidence from at least one high quality case-control study. A randomised trial with a 'head to head' comparison of agents is considered silver ranking unless a reference is provided to a comparison of one of the agents to placebo showing at least a 20% relative difference.
***Bronze Level Evidence:*** The bronze ranking is given to evidence if at least one high quality case series without controls (including simple before/after studies in which the patient acts as their own control) or is derived from expert opinion based on clinical experience without reference to any of the foregoing (for example, argument from physiology, bench research or first principles).

In this review, as only RCTs were included, the bronze ranking of evidence was not applicable. The ranking is included in the synopsis and abstract of this review, and in the clinical relevance tables (in 'Additional Tables').

# RESULTS

## Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
The search strategy retrieved 4235 studies after de-duplication. Forty-one potentially eligible studies were identified. Of these, two were only available in abstract form (Jian 2005; Zhao 2005). Based upon the abstracts we were unable to assess eligibility for inclusion and these studies are listed under 'Studies awaiting assessment'. Twenty-five studies were excluded (Alvarez 2005; Anderson 1999; Boileau 2002; Bottoni 2000; Connor 2000; Edmonds 2003; Fabbriciani 2004; Gerdesmeyer 2003; Gilbertson 2003; Hayes 2004; Jensen 2001; Likar 2001; Machner 2001; Melillo 1997; Montgomery 1994; Motycka 2004; Ogilvie-Harris 1993; Peters 1997; Roddey 2002; Rompe 2001; Schroder 2001; Shibata 2001; Tillander 1998; Watson 1985; Weber 1997). The reasons for exclusion are listed in the table 'Characteristics of excluded studies'. One of the excluded trials was translated from German (Peters 1997).
Fourteen trials involving 829 participants met inclusion criteria (Boehm 2005; Brox 1993; Gartsman 2004; Haahr 2005; Husby 2003; Ingvarrson 1996; Iversen 1996; Murphy 1999; Norlin 1989; Rahme 1998; Rubenthaler 2001; Sachs 1994; Spangehl 2002; T'Jonck 1997). The number of trial participants were generally small, ranging from 20 to 125. Details of the 14 included studies are given in the table 'Characteristics of included studies' and are described below. One of these studies was translated from Norwegian (Iversen 1996). For three of the trials, additional publications report post hoc open follow up data from the original trial participants (Brox 1993; Haahr 2005; Norlin 1989).
Eleven trials included participants described as having impingement and used similar inclusion criteria (*see* the table of 'Characteristics of included studies') (Brox 1993; Haahr 2005; Husby 2003; Ingvarrson 1996; Iversen 1996; Murphy 1999; Norlin 1989; Sachs 1994; Spangehl 2002; T'Jonck 1997). Five studies specifically included participants described as having Stage II impingement syndrome according to Neer criteria (Brox 1993; Husby 2003; Murphy 1999; Sachs 1994; T'Jonck 1997). Three trials compared either open (Rahme 1998) or arthroscopic (Brox 1993; Haahr 2005) surgery to active non-operative treatment. Non-operative treatment consisted of either an exercise programme or placebo (12 sessions of detuned soft laser) in one trial (Brox 1993); a physiotherapy regimen of exercise and education in one trial (Rahme 1998); and a graded physiotherapy strengthening program in one trial (Haahr 2005). In the only trial that included a placebo arm, recruitment to the placebo arm was halted prematurely after an interim analysis in 68 participants who had completed six months follow up demonstrated significantly more improvement in median Neer score in the two active arms (Brox 1993)(*see* the table of 'Characteristics of included studies').
Six trials compared arthroscopic subacromial decompression to open subacromial decompression (Husby 2003; Iversen 1996; Norlin 1989; Sachs 1994; Spangehl 2002; T'Jonck 1997); one trial compared two different open techniques (Neer versus modified Neer) (Ingvarrson 1996); and one trial compared two different arthroscopic techniques (Holium laser versus electrocautery) (Murphy 1999).
Two trials included participants with rotator cuff tear (Boehm 2005; Gartsman 2004). One trial compared arthroscopic rotator cuff repair with and without arthroscopic subacromial decompression (Gartsman 2004) and one trial compared two different suture materials and techniques (transosseous repair with nonabsorbable No. 3 Ethibond using modified Mason-Allen suture technique versus transosseous repair with 1.0 mm absorbable polydioxane cord (PDS) using modified Kessler suture technique) (Boehm 2005).
One trial included participants with calcific tendinitis ( Rubenthaler 2001). This trial compared open versus arthroscopic removal of calcium deposits.

Outcome measures varied across studies but included measures of shoulder function (Constant score, UCLA score, ASES, score, Neer score, PRIM score and Patte score)(these are briefly described in 'Additional tables (Table 1; Table 2; Table 3; Table 4; Table 5; Table 6'), pain using various scales, range of motion, and various measures of participant satisfaction and participant evaluation of success of treatment. Duration of follow up ranged from 12 months in several trials (Haahr 2005; Murphy 1999; Rahme 1998; Sachs 1994; T'Jonck 1997) to 96 months in one trial (Husby 2003). One trial did not clearly define the last follow-up time point (Iversen 1996).

The trials varied in the number of participating surgeons from a single surgeon (Gartsman 2004; Norlin 1989; Rubenthaler 2001) to five surgeons (Boehm 2005). Only one trial did not describe their surgical technique (Gartsman 2004).

## Risk of bias in included studies

No trials met all methodological quality criteria and overall the results of each trial were highly susceptible to bias. The methodological assessment of each trial is summarised in the table 'Characteristics of included studies'.

Allocation concealment was adequate in one trial (Haahr 2005), inadequate in one trial (Murphy 1999) and unclear in 12 trials (Boehm 2005; Brox 1993; Gartsman 2004; Husby 2003; Ingvarrson 1996; Iversen 1996; Norlin 1989; Rahme 1998; Rubenthaler 2001; Sachs 1994; Spangehl 2002; T'Jonck 1997). Trial authors described various methods of allocation including random numbers (Boehm 2005; Gartsman 2004; Haahr 2005; Rahme 1998), 'random permuted blocks' (Brox 1993), allocation 'drawn from a hat' (Murphy 1999) and 'closed envelopes' (Husby 2003).

No trials blinded both participants and outcome assessment. Eight trials did not report blinding, three trials blinded the participants (Boehm 2005; Gartsman 2004; Murphy 1999) and three trials blinded the outcome assessor (Brox 1993; Husby 2003; Spangehl 2002). Three trials had no loss to follow up and appeared to have performed an intention to treat analysis in that all patients who entered the trial were included in the analysis as far as we could determine from the trials (Murphy 1999; Norlin 1989; T'Jonck 1997). Loss to follow up varied from 4% (Brox 1993) to 41% (Spangehl 2002) in the remaining trials, and analyses were reported according to available cases only. One trial reported that six participants in the non-operative treatment group crossed over to the surgery group some time during the follow-up period, but as far as we can tell, the authors have analysed these participants' outcomes in the non-operative treatment group (Haahr 2005). Another trial reported that 12 of 21 participants originally allocated to non-operative treatment had surgery after six months follow up; the authors analysed the outcomes of these participants as a separate group (Rahme 1998), although we included these participants in the group they were originally allocated, that is, non-operative treatment.

## Effects of interventions

### Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingement syndrome

Results of the three trials (257 participants) that compared open or arthroscopic decompression to non-operative treatment could not be pooled because the trials used different outcome measures at different time points.

One trial of 90 participants found no difference between arthroscopic subacromial decompression and a graded physiotherapy strengthening program in mean change in Constant score: Mean Difference (MD) -4.6 (95% CI -12.48 to 3.28), MD -1.4 (95% CI -10.43 to 7.63) and MD -4.5 (95% CI -13.73 to 4.73) at three, six and 12 months respectively (Comparisons and Data 01, outcome 01). Similarly there were no differences between treatment groups for PRIM score at 12 months: MD 0 (95% CI -4.77 to 4.77) (Comparisons and Data Analyses 01, outcome 02) or number of participants with a good or excellent Constant score (> 80) at 12 months: RR 1.05 (95% CI 0.49 to 2.25)(Comparisons and Data 01, outcome 03 and Additional Tables, Table 7)(Haahr 2005). No adverse effects were reported. Six participants (14.6%) in the physiotherapy group were operated on within the 12 months of the study (five because of unsatisfactory improvement during exercises and in one case because a labral lesion was suspected). Their outcome at 12 months was not as good (mean Constant score 41 (range 17 to 78) versus 57.0 and 52.7 in the physiotherapy and surgery groups respectively).

Another trial (42 participants) found no difference between open subacromial decompression and a physiotherapy regimen of exercise and education at 6 months for the number of participants who reported success of treatment (defined as 100% reduction from baseline in VAS pain score): RR 1.07 (95% CI 0.34 to 3.4), 5/21 versus 4/18 in the surgery and non-operative treatment groups respectively; and success and partial success of treatment (defined as > 50% reduction from baseline in VAS pain score); RR 1.71 (95% CI 0.81 to 3.63), 12/21 and 6/18 in the surgery and non-operative treatment groups respectively (Comparisons and Data Analyses 01, outcomes 04, 05; and Additional Tables Table 8 (Clinical Relevance Table) (Rahme 1998). After six months, 12 of the 18 participants (66.7%) in the non-operative treatment group underwent subacromial decompression. The authors did not include these patients in their 12-month analysis according to their original group allocation. At 12 months, success of treatment was reported in 11/21 participants in the surgery group and 5/18 in the non-operative treatment group (1/6 participants who did not cross over and 4/12 who had surgery at six months); RR 1.89 (95% CI 0.81 to 4.41) (calculated by the review authors) (Comparisons and Data Analyses 01, outcome 04). Results were similar for success and partial success (Comparisons and Data Analyses 01, outcome 05). No adverse effects were reported.

The third trial (125 participants) reported no differences in median Neer score at three months and six months between surgery and an exercise programme (Difference adjusted for gender = 3.6 (95% CI -0.2 to 7.4) at three months and 2.0 (95% CI -1.4 to 5.4) at six months (Additional Table, Table 9); the authors also report no differences in the median pain scores (pain on activity, pain at rest, and pain at night) between surgery and non-operative treatment, even after adjustment for gender (data not reproduced in this

review) (Brox 1993). Participants in both groups that received active treatment were reported to have improved significantly more than those in the placebo group at six months (median differences in Neer score compared with placebo 13.0 (95% CI 7 to 20) and 19.5 (95% CI 12 to 27) for the exercises and surgery groups respectively, other placebo comparative data not reported.) No adverse effects were reported.

**Arthroscopic versus open subacromial decompression for impingement syndrome**

Results of the six trials (268 participants) that compared arthroscopic to open subacromial decompression could not be pooled because the trials used different outcome measures at different time points (Husby 2003; Iversen 1996; Norlin 1989; Sachs 1994; Spangehl 2002; T'Jonck 1997), apart from mean UCLA score at 12 months in two of four studies that reported this outcome (Husby 2003; T'Jonck 1997). Mean UCLA score did not differ between arthroscopic and open surgery at three months: MD 0.0 (95% CI -4.53 to 4.53) (Husby 2003); six months: MD 1.0 (95% CI -3.96 to 5.96) (Husby 2003); 12 months: pooled WMD 1.61 (95% CI -1.22 to 4.44) (Husby 2003; T'Jonck 1997); 96 months: MD 0.0 (95% CI -4.0 to 4.0) (Husby 2003); last follow up (time unclear): MD 0.40 (95% CI -3.34 to 4.14) (Iversen 1996) (Comparisons and Data Analyses 02, outcome 01). Similarly, the proportion of participants with a 'good/excellent' UCLA score at 'last follow up' (varied at unspecified time) did not differ between the two surgery groups: RR 1.0 (95% CI 0.68 to 1.48) in one trial (Spangehl 2002), and RR 0.94 (0.65 to 1.35) in a second trial (Iversen 1996) (Comparisons and Data Analyses 02, outcome 02). Constant score, measured in one trial (T'Jonck 1997), did not differ between the two surgery groups: MD 6.20 (95% CI -6.14 to 18.54) (Comparisons and Data Analyses 02, outcome 03).

There were no differences between the two surgery groups in participant evaluation of success of outcome using various measures and at differing time points as measured in four studies (Husby 2003; Sachs 1994; Spangehl 2002; T'Jonck 1997) (Comparisons and Data Analyses 02, outcome 04-07).

Data from two trials (Husby 2003; Sachs 1994) indicated there were no differences between the two surgery groups in terms of pain. Results reported for Husby et al (Husby 2003) were pain scores at rest: MD 1.0 (95% CI -13.59 to 15.59), MD -8.60 (95% CI -17.40 to 0.20), MD -2.70 (95% CI -7.82 to 2.42), MD not estimable at 3, 6, 12 and 96 months respectively; and in pain with activity: MD 0.0 (95% CI -19.77 to 19.77), MD -12.0 (95% CI -30.46 to 6.46), MD -3.0 (95% CI -20.67 to 14.67), MD 0.0 (95% CI -12.86 to 12.86) at 3, 6, 12 and 96 months respectively (Comparisons and Data Analyses 02, outcome 08, 09 and Additional Tables Table 10 (Clinical Relevance Table)). Sachs et al (Sachs 1994) reported equivalent pain scores for the two groups at time points to one year. Spangehl et al (Spangehl 2002) reported that the open procedure was better for pain and function (P = 0.01) at last follow up (12 to 49 months).

Measures of mobility did not differ between groups at one year in two trials: active elevation MD 2.2 degrees (95% CI -13.43 to 17.83), passive abduction MD 15 degrees (95% CI -2.68 to 32.68); passive external rotation in neutral MD -10.7 degrees (95% CI -30.72 to 9.32) and passive internal rotation in 90 degrees of abduction MD 3.6 degrees (95% CI -5.71 to 12.91) (T'Jonck 1997)(Comparisons and Data Analyses 02, outcome 10). Sachs et al (Sachs 1994) reported that participants in the arthroscopic group had more flexion at two to six weeks postoperatively than those in the open group but there were no differences in other directions of movement at that time and no other differences between groups at other time points to one year. Norlin et al (Norlin 1989) reported that participants in the arthroscopic group had a full range of motion two days after surgery and this was maintained throughout the rehabilitation period, whereas range of motion was markedly restricted after immobilisation in the open group but was improved during the rehabilitation period (at 3 months mean (range) of active abduction and active flexion in the open group was 140 degrees (70 to 180 degrees), and 156 degrees (90 to 180 degrees), respectively. These were reported to be significantly different to the arthroscopic group (P = 0.004 and P = 0.015 respectively).

Muscle strength, reported in three trials (Husby 2003; Sachs 1994; T'Jonck 1997), did not differ between the two surgery groups at any time point (Comparisons and Data Analyses 02, outcome 11-14).

Two trials reported the duration of the operation time which was significantly shorter in the arthroscopic groups (mean (range): 50 minutes (27 to 90) and 82 minutes (50 to 120) in the arthroscopic and open groups respectively (Husby 2003); mean 40 and 66 minutes in the arthroscopic and open groups respectively, P < 0.001(Norlin 1989). One trial reported that the arthroscopic group were treated on an outpatient basis while mean hospitalisation was 1.6 days in the open group (Sachs 1994).

The time to recover from the operation, return to work or activities of daily living or both was reported in various units and using different measures of variance in five trials (and thus, we have not independently analysed the data in this review). Husby et al (Husby 2003) and Iverson et al (Iversen 1996) report no differences between arthroscopic and open surgery groups in the mean (SD) length of post operative sick leave: 5.7 (4.8) weeks versus 10 (14) weeks; and 5.6 (5.7) months versus 4.3 (3.2) months, respectively. Norlin et al (Norlin 1989) report a mean postoperative recovery time of 2.5 months (range two to three months) in the arthroscopic group and 6.7 months (range 3 to 16 months) in the open group (statistical significance not reported), while Sachs et al (Sachs 1994) report a time to return to activities of daily living and work of 4 and 36 days in the arthroscopic group versus 9 and 54 days in the open group (no measures of variance reported).Spangehl (Spangehl 2002) reported no differences in time to return of activities of daily living, sport or work between groups.

There was no statistically significant differences between groups in occurrence of adverse events (Additional Tables, Table 11).

Three trials reported no adverse events (Husby 2003; Norlin 1989; T'Jonck 1997). One trial reported one superficial wound infection in the open group which responded to antibiotics (Sachs 1994). One trial reported post operative stiffness in seven participants (arthroscopy = 4, open = 3)(Spangehl 2002). Iversen et al reported adverse events at four weeks: pain (nine in each group), capsulitis (five in the arthroscopy group), atrophy of the deltoid muscle (two in the arthroscopy group) and deep wound infection (one in the arthroscopy group) (Iversen 1996). Table 11).

**Open subacromial decompression - Neer technique versus modified Neer technique for impingement syndrome**

A single trial (20 participants) that compared Neer to a modified Neer technique for open subacromial decompression did not report measures of variance, precluding data extraction (Ingvarrson 1996). The authors reported a significant difference between groups favouring the modified approach in abduction at eight weeks but this could not be verified from the data presented (Additional Tables, Table 7). There was delayed wound healing in one patient (treatment group not specified).

**Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome**

A single trial (49 participants) reported that participants in the electrocautery group had higher UCLA scores at one week post-operation (MD -3.0, 95% CI -5.24 to -0.76) but the analysis was not adjusted for the finding that patients in this group had higher UCLA scores at baseline (Murphy 1999). At all other time points (1, 2, 3, 6, 12 months) the mean UCLA score did not differ between groups (Comparison and Data 03, outcome 01). There were no differences in the ASES score between the two groups at baseline or any other time point (Comparison and Data 03, outcome 02). One participant in the laser group developed a reflex sympathetic dystrophy which resolved. Laser was associated with significantly higher hospital charges (cautery: $5039 (SD 1273), laser: $6166 (SD 1270), P = 0.003).

**Open versus arthroscopic removal of calcium for calcific tendinitis**

Data from one small trial (38 participants) reported no significant differences between groups in subjective ratings of shoulder function: MD -0.50 (95% CI -2.08 to 1.08), pain relief: MD -0.30 (95% CI -1.46 to 0.86), average duration of post-operative physiotherapy: MD 5 weeks (95% CI -10.51 to 20.51) or average duration of incapacity to work: MD -4 weeks (95% C -5.27 to 4.47) at a mean of 16 months follow up (Comparisons and Data 04, outcome 01 - 04 and Additional Tables Table 12 (Clinical Relevance Table)) (Rubenthaler 2001). No complications were observed in either group.

**Transosseous rotator cuff repair with Ethibond using modified Mason-Allen suture technique versus transosseous repair with polydioxane cord (PDS) using modified Kessler technique**

One trial (98 participants) reported no differences between groups for any outcome at two years follow up: participant satisfaction: 'Would agree to have operation again', RR 1.02 (95% CI 0.91 to 1.14); and 'Outcome good or excellent', RR 1.02 (95% CI 0.85 to 1.22) (Comparisons and Data 05, outcome 01, 02 respectively) (Boehm 2005). Re-tear of the rotator cuff at two years measured on sonography did not differ between groups: RR 1.82 (95% CI 0.97 to 3.42), 18/44 in the PDS group versus 11/49 in the ethibond group (Comparisons and Data 05, outcome 03). The proportion of participants with a Constant score >75 also did not differ between groups; RR 0.99 (95% CI 0.87 to 1.12), 91% in the PDS suture group versus 92% in the Ethibond group (Comparisons and Data 05, outcome 04). Seven participants had complications requiring revision surgery (two in each group because of pain and two in the ethibond group and one in the PDS group because of infection).

**Arthroscopic rotator cuff repair with subacromial decompression versus rotator cuff repair alone**

Data from one trial (93 participants) reported no difference in outcomes between participants who had rotator cuff repair with or without arthroscopic decompression: mean ASES at 12 months MD 2.30 (95% CI -2.96 to 7.56) (Comparisons and Data 06, Outcome 01) (Gartsman 2004). No adverse effects were reported for either treatment group.

None of the preplanned subgroup or sensitivity analyses were performed due to small sample sizes, small number of trials in most comparisons and heterogeneity of interventions and outcomes.

## DISCUSSION

Based upon our review of 14 trials, all highly susceptible to bias, we cannot draw firm conclusions about the efficacy or safety of surgery for rotator cuff disease. Three trials reported no difference in outcome between open or arthroscopic surgery compared with active non-operative treatment for impingement syndrome. Whether this is a true effect or due to the poor quality of the trials remains unknown. A significant number of participants in the non-operative treatment groups of two trials (12/18 participants (Rahme 1998) and 6/41 participants (Haahr 2005) were reported to have subsequently undergone surgery suggesting that they may not have been satisfied with non-operative treatment.

None of the six trials that assessed arthroscopic to open decompression reported significant differences at any time point between groups for outcomes of pain, UCLA score and participant evaluation of success, or adverse events including post-operative capsulitis or re-operation. In general there was also no differences between groups for range of shoulder movement although two trials reported an earlier improvement in movements in the arthroscopic group. On the other hand, two trials reported shorter operation

time and four trials reported a quicker recovery and/or return to work and/or activities of daily living with arthroscopic decompression. The latter has previously been hypothesised to be due to preservation of the deltoid muscle with the arthroscopic approach. Other advantages of arthroscopic surgery are reported to include smaller scars and the ability to access the gleno-humeral joint to exclude other causes of shoulder pain. As the trials were all of poor quality, it is not possible to draw any final conclusions about the comparative efficacy and safety of open compared to arthroscopic decompression.

This review has highlighted the paucity of methodologically rigorous, clearly reported randomised controlled trials of adequate sample size and duration of follow up. Only one trial adequately concealed treatment allocation (Haahr 2005), and only one trial reported their sample size calculation (Brox 1993). Timing of assessment and outcome measures also varied between trials limiting our ability to pool data and compare outcome between trials again highlighting the need to develop a standard set of outcome measures for shoulder trials (Green 1998).

Surgical trials pose many challenges including the need to take into account the training and experience of the surgeons, differing surgical techniques and peri-operative and post-operative care and difficulty blinding participants and outcome assessment. In addition there is a lack of uniformity in the way shoulder disorders are labelled and defined. For example, 11/14 trials that we reviewed included participants with 'impingement' but the inclusion criteria were either poorly reported or differed across studies.

Further well-designed trials are needed to determine the value of surgery for rotator cuff disease.

# AUTHORS' CONCLUSIONS

## Implications for practice

There is little evidence to support or refute the effectiveness of surgery for rotator cuff disease. All reviewed trials were highly susceptible to bias. There is "Silver" level evidence from three trials that there is no difference in outcome between surgery and active non-operative treatment for impingement and from six trials that there are no differences in pain, function or participant evaluation of success for arthroscopic compared to open subacromial decompression although there was a trend for earlier recovery with arthroscopic decompression reported in four trials. At present, the decision to undergo surgery may depend largely upon patient preference or failed non-operative treatment or both. At present the choice of surgical technique depends upon the training and expertise of the surgeon and patient preference.

## Implications for research

There is a need for further high quality trials investigating the efficacy of surgery for rotator cuff disease. Trials should clearly define and describe their inclusion criteria, report the training and expertise of the surgeon/s, and blind outcome assessment (and participants) if feasible. Further work in also needed in developing standard criteria to define shoulder disorders and in developing a minimum core set of outcome measures including those outcomes such as 'life participation' outcomes that may be most important to patients.

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Sher JS, Uribe JW, Posada A, Murphy BJ, Zlatkin MB. Abnormal findings on magnetic resonance imaging of asymptomatic shoulders. *Journal of Bone and Joint Surgery* 1995;**77**:10–5.

**Suenaga 2000**
Suenaga N, Minami A, Kaneda K. Post operative subcoracoid impingement syndrome in patients with rotator cuff tears. *Journal of Shoulder and Elbow Surgery* 2003;**12** (2):139–43.

**Tugwell 2004**
Tugwell P, Shea B, Boers M, Brooks P, Simon L, Strand V, et al.*Evidence Based Rheumatology*. 1. BMJ Books, 2004.

**van der Windt 1996**

van der Windt DA, Koes BW, Boeke AJ, Deville W, De Jong BA, Bouter LM. Shoulder Disorders in general practice: prognostic indicators of outcome. *British Journal of General Practice* 1996;**46**(410):519–23.

**Weiner 1970**

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**Wittenberg 2001**

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**Yamaguchi 2001**

Yamaguchi K, Tetro A, Blam O, Evanoff B, Teefey S, Middleton W. Natural history of asymptomatic rotator cuff tears: a longitudinal analysis of asymptomatic tears detected sonographically. *Journal of Shoulder and Elbow Surgery* 2001;**10**:199–203.

* *Indicates the major publication for the study*

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies *[ordered by study ID]*

**Boehm 2005**

| | |
|---|---|
| Methods | Randomised controlled trial, inpatient setting in Germany<br>Randomisation method: computerized randomisation list<br>Allocation concealment: unclear<br>Blinding: participants blinded, sonographer was blinded for assessment of retear; unclear whether the other outcome assessors were blinded<br>Loss to follow up: 7 (7%)<br>Intention to treat analysis: not stated; data presented for available case analysis only<br>Overall validity: high risk of bias |
| Participants | 100 participants, 68 male, age range 38-69 years<br>Inclusion criteria: repairable non-traumatic full thickness Bateman types 1 to 3 tears of the rotator cuff (1 cm-5 cm in largest diameter), suitable for bone to bone repair<br>Exclusion criteria: previous shoulder surgery; presence of an os acromiale; neurologic deficit in the upper limb; cervical disc disease; systemic diseases involving the locomotor system (rheumatoid arthritis, lupus erythematosus, scleraderma, Marfan's syndrome,the Ehler-Danlos syndrome); metastatic malignancy before surgery; gleno-humeral osteoarthritis above grade 1 of Samilson and Prieto on AP radiographs; intraoperative findings of tears of the subscapularis requiring repair, and signs of instability |
| Interventions | Group 1 (N = 50): Open rotator cuff repair using non-absorbable braided No. 3 Ethibond (0.7 mm diameter) and a modified Mason Allen technique)<br>Group 2 (N = 50): Open rotator cuff repair using 1.0 mm absorbable braided PDS cord and a modified Kessler technique |
| Outcomes | Assessed at 2 years<br>1. Constant Score<br>2. Subjective assessment of willingness to undergo the same surgery again (Scale 1-6)<br>3. Subjective rating of outcome as excellent, good, satisfactory, poor.<br>4. Rate of further tear<br>5. Need for revision surgery |
| Notes | Two from group 1 excluded because of fibromyalgia. Five in group 2 did not return for clinical examination at 2 years.<br>Results recorded as percentages.<br>Adverse outcomes: Overall seven patients had complications which required revision surgery, in four for pain (2 in each group) and in three for infection (two in group1 and one in group 2).<br>Funding: Nil; specific comment stating no benefits have been or will be received |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Brox 1993**

| | |
|---|---|
| Methods | Randomised controlled trial set in hospital surgery and physiotherapy departments in Norway<br>Randomisation method: random permuted blocks<br>Allocation concealment: unclear<br>Blinding: outcome assessors blinded, participants not blinded<br>Loss to follow up: 5 (4%)<br>Intention to treat analysis: analysed in group allocated, but excluding n=5 lost to follow-up (i.e. available case analysis)<br>Overall validity: high risk of bias |
| Participants | 125 participants, 66; mean age 48 years (no variance reported)<br>Inclusion criteria: aged 18-66; pain in shoulder > 3 months; resistant to physiotherapy, NSAIDS, steroids; dysfunction or pain on abduction; normal passive gleno-humeral ROM; pain during two of three isometric-eccentric tests (abduction at 0 degrees and 30 degrees and external rotation); positive results in tests for impingement; positive response to subacromial injection of local anaesthetic into the subacromial space<br>Exclusion criteria: arthritis of acromioclavicular joint; cervical syndrome; rupture of the rotator cuff; gleno-humeral instability; bilateral muscular pain with tenderness; severely decreased ability to relax shoulder, neck, and temporo-mandibular joints on examination; reluctant to accept one or more study treatments |
| Interventions | Group 1 (N = 45): arthroscopic subacromial decompression<br>Group 2 (N = 50): exercise regime over three to six months supervised by one experienced physiotherapist<br>Group 3 (N = 30): placebo laser- 12 sessions of detuned soft laser treatment over 6 weeks |
| Outcomes | Assessed at baseline, 3, 6 months<br>Primary outcome measure was change in overall Neer score from baseline to six months<br>1) Neer score<br>2) Self assessed degree of pain on 9-point VAS scale (1 = no pain, 9 = worst possible) with activity, at rest and at night;<br>3) Emotional distress on the Hopkins symptom checklist (25 items) (only reported at baseline in trial) |
| Notes | Outcomes reported as medians, and thus we could not extract data into the Comparisons and Data tables; primary outcome in Additional tables 08. Trial authors also report components of primary outcome separately; we have not reported the components in this review.<br>Authors performed an interim analysis of 68 participants who completed 6 months follow up and found that surgery or exercises were superior to placebo, and thus stopped allocating participants to placebo (hence the smaller number in placebo); the authors did not appear to statistically adjust for the interim analysis in the final analysis.<br>No differences were found between the three groups in duration of sick leave to six months (median 3 months) and daily intake of analgesics. Participants in both groups that received active treatment improved significantly more that those in the placebo group at 6 months: median differences between exercises (13. 0 (95% CI 7 to 20)) and surgery (19.5 (95% CI 12 to 27)) compared with placebo (mean change in Neer score -0.3 with placebo compared with 10.8 in the exercise group and 20.2 in the surgery group).<br>Treatment costs were higher for those given surgery (720 pounds) versus those given supervised exercises (390 pounds) reported to be due to hospitalisation in the surgical group.<br>Adverse outcomes: Nil<br>Funding: Norwegian Research Council<br>A second paper by Brox was written in 1999 assessing these patients at 2.5 years but the outcome assessment was no longer blinded, and the results have not been included in this review |
| ***Risk of bias*** | |

**Brox 1993** (*Continued*)

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Gartsman 2004**

| | |
|---|---|
| Methods | Randomised controlled trial, inpatient setting in USA<br>Randomisation method: random number table<br>Allocation concealment: unclear, theatre nurse consulted a random number table to place the patient in group one or two but it is not specifically stated whether this was concealed from the investigators<br>Blinding: participants-yes; outcome assessors- unclear<br>Loss to follow up: nil reported<br>Intention to treat analysis: appears that participants remained in allocated group<br>Overall validity: high risk of bias |
| Participants | 93 participants, 51 male, age range 37-81<br>Inclusion criteria: isolated repairable tear; full thickness supra-spinatus tear; type 2 acromium diagnosed on x-ray outlet views by the senior author<br>Exclusion criteria: type 1 or 3 acromion; tendon repair; partial repair; concomitant procedures (acromio-clavicular joint excision, labral repair); prior surgery; workers compensation patients |
| Interventions | Group 1 (N = 47): Arthroscopic rotator cuff repair with acromioplasty.<br>Group 2 (N = 46): Arthroscopic rotator cuff repair without acromioplasty |
| Outcomes | Participants were seen in the clinic at baseline, 2, 6 weeks, and 3, 6 and 12 months, but it is unclear whether outcome assessment for the trial was performed at each time point.<br>1) American Shoulder and Elbow Score (ASES) at 0 and 12 months |
| Notes | Tear length was significantly different between groups (20.1 mm (range 10-25) in Group 1 and 22.5 mm (range 15-51) in group 2 (P = 0.032) and this was included as a covariate in the repeated measures analysis. There was no difference between groups in change in ASES score at 12 months (61.1 versus 60.2 in the arthroscopic and open groups respectively, P = 0.363. The variances of the mean changes in scores were not reported.<br>Adverse outcomes: Not reported.<br>Funding: Nil stated |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Haahr 2005**

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|---|---|
| Methods | Randomised controlled trial; setting: inpatients, Denmark<br>Randomisation method: computer generated random sequence<br>Allocation concealment: adequate (sealed envelope, allocation unknown to the investigator)<br>Blinding: no, neither participants nor outcome assessors were blinded<br>Loss to follow up: 6 (7%)<br>Intention to treat: reported to have analysed participants in allocated group<br>Overall validity: moderate to high risk of bias |
| Participants | 90 participants, (6 dropped out after randomisation but before commencement of the study), mean age 44 years<br>Inclusion criteria: shoulder symptoms for 6 months to 3 years; age 18-55 years; subacromial impingement defined as pain on abduction of the shoulder with painful arc, positive impingement sign (Hawkins sign), positive impingement test (pain relief 15 minutes following injection of local anaesthetic into the subacromial space); normal passive glenohumeral movement.<br>Exclusion criteria: impaired rotation in the gleno-humeral joint; history of acute trauma; previous surgery or previous fracture in the proximity of affected shoulder; known osteoarthritis in the acromioclavicular joint or gleno-humeral joints; calcifications exceeding 2 cm in the rotator cuff tendons; signs of rupture of the cuff; cervical root syndromes |
| Interventions | Group 1 (41 participants): Investigation of shoulder stability, followed by arthroscopic subacromial decompression (bursectomy with partial resection of the antero-inferior acromion and coracoacromial ligament); followed by physiotherapist instruction to perform increasingly active exercises including exercises for strengthening the rotator cuff muscles<br>Group 2 (43 participants): 19 sessions of 60 minutes 3 times a week for 2 weeks, twice a week for 3 weeks and once a week for 7 weeks; treatment consisted of heat and cold packs or soft tissue treatments, followed by active training of the periscapular muscles and strengthening of the stabilising muscles of the shoulder joint |
| Outcomes | Assessed at baseline, 3, 6, 12 months<br>1) Change in Constant score from baseline to 3, 6, 12 months<br>2) PRIM Score at baseline and 12 months |
| Notes | Mean and 95% confidence intervals (CIs) reported for Constant and PRIM score; we calculated standard deviation from 95% CIs for data analysis; authors report subscores of Constant and PRIM scores. Constant and subscores of Constant score ane reported in Additional Table 07.<br>Six participants (14%) in Group 2 were operated on within the 12 months of the study (five because of unsatisfactory improvement during exercises and in one case because a labral lesion was suspected). Mean Constant score at 12 months in these six patients was 41 (range 17 to 78) which was lower than the mean scores in the surgery and exercise groups overall at 12 months.<br>Adverse outcomes: Nil reported.<br>Funding: Medical Research Unit of Ringkjoebing County, Denmark<br>A second paper by Haahr and Andersen published in 2006 reported outcomes of trial patients at 4 to 8 years. Self-reported outcomes after 4-8 years did not differ between treatment groups |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Yes | A - Adequate |

**Husby 2003**

| | |
|---|---|
| Methods | Randomised controlled trial, set in hopsital, Norway<br>Randomisation method: 'closed envelopes'<br>Allocation concealment: unclear<br>Blinding: outcome assessors blinded, participants not blinded<br>Loss to follow up: 5 (12%)<br>Intention to treat analysis: not stated but all patients completed within their surgical allocation; available case analysis only<br>Overall validity: high risk of bias |
| Participants | 39 participants, 15 males, age range 27-61 years<br>Inclusion criteria: positive Neer's impingement sign; positive local anaesthesia subacromial injection test<br>Exclusion criteria: substantial rotator cuff degeneration or rupture; arthrosis in the glenohumeral or acromioclavicular joints or any other concomitant lesions; reduced range of motion |
| Interventions | Group 1 (N = 15): arthroscopic subacromial decompression (acromioplasty)<br>Group 2 (N = 19): open subacromial decompression (acromioplasty) |
| Outcomes | Assessed at baseline, 1, 3, 6, 12, 96 months post operatively<br>1. Self reported VAS pain at rest and with activity;<br>2. ROM- humero-scapular rhythm, ROM in flexion, ROM in abduction, ROM in external rotation, painful shoulder arc (results not presented in the paper).<br>3. Isokinetic muscle strength tested on a Cybex 6000 dynamometer. Internal and external rotation was tested in the standing position with the feet apart and the elbow at 90 degrees of flexion. Angular velocities were 60 degrees/s and 180 degrees/s and the pateints repeated these 5 times at each velocity. The mean value of the 5 repetitions of total work was the isokinetic parameter used to evaluate muscle strength.<br>4. UCLA shoulder rating score<br>5. Subjective overall satisfaction with surgery VAS |
| Notes | The average duration of surgery including diagnostic arthroscopy of the shoulder joint was 82 (50 - 120) min in the ASD group and 50 (27 - 90) min in the OSD group, P < 0.0001.<br>Adverse outcomes: Nil<br>Funding: Nil stated. |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Ingvarrson 1996**

| | |
|---|---|
| Methods | Randomised controlled trial; inpatient setting in Sweden<br>Randomisation type: unclear<br>Allocation concealment: unclear<br>Bliniding unclear (outcome assessors or participants)<br>Loss to follow up: 1 (5%)<br>Intention to treat analysis: not stated but all patients completed within their surgical allocation; but available case analysis only<br>Overall validity: high risk of bias |
| Participants | 20 participants, 11 male, age range 25-70<br>Inclusion criteria: chronic impingement syndrome; pain >12 months not resolved by physiotherapy, subacromial injection; diagnosis confirmed by relief of pain with local anaesthetic injection in subacromial space.<br>Exclusion criteria: not stated. |
| Interventions | Group 1 (N = 10): Open anterior acromioplasty using Neer's technique<br>Group 2 (N = 10): Open anterior acromioplasty with a modified technique not detaching the deltoid origin.<br>All patients were in hospital for 1 day.<br>Active arm movements allowed on the first day after the operation.<br>Physiotherapy before the operation, at 4 weeks and 8 weeks post operation |
| Outcomes | Assessed at baseline and 4 and 8 weeks postoperatively<br>1) Active range of motion of the shoulder was measured for flexion (elevation); extension, abduction and intenral and external rotation with the arm at the side |
| Notes | Data reported in table and text differed; we extracted data from the table.<br>Authors only report means with no measure of variance for outcomes, precluding data extraction into the Comparisons and Data tables. We have placed data in Additional tables 09.<br>Adverse outcomes: delayed wound healing in one patient (group not specified) and no other complications in either group. Operating time was 10 minutes less in Group 2 (34 minutes versus 44 minutes).<br>Funding: nil stated |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Iversen 1996**

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|---|---|
| Methods | Randomised controlled trial, set in hospital in Norway<br>Randomisation method: unclear<br>Allocation concealment: unclear<br>Blinding: neither outcome assessors nor participants were blinded<br>Loss to follow up: 5 (12.1%)<br>Intention to treat analysis: all patients completed within surgical allocation but available case analysis only<br>Overall validity: high risk of bias |
| Participants | 46 participants, 27 male, age range 22-65<br>Inclusion criteria: shoulder pain > 12 months; no improvement with physiotherapy or corticosteroids injections; pain on abduction 30-90 degrees; positive impingement sign relieved by subacromial local analgesic injection<br>Exclusion criteria: rheumatological or neurological disease; clinical signs of ruptured supra-spinatus; abnormal acromio-clavicular joint and/or abnormal cervical spine on X-ray and clinically; sick leave due to shoulder < 12 months |
| Interventions | Group 1 (N = 23): arthroscopic (closed percutaneous) acromioplasty<br>Group 2 (N = 23): open acromioplasty |
| Outcomes | Unclear what time points outcomes were assessed<br>1. UCLA shoulder score<br>2. Duration of sick leave |
| Notes | The paper was in Norwegian and the relevant sections translated into English, however the method of randomisation and the timing of the final outpatient visit and hence the time of the UCLA measurement were not reported.<br>Adverse outcomes at 4 weeks include : pain in Group 1 (n = 9) and Group 2: (n = 9); capsulitis Group 1 (n = 5) ; atrophy of deltoid Group 1 (n = 2); deep wound infection Group 1 (n = 1).<br>Funding: nil stated |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Murphy 1999**

| | |
|---|---|
| Methods | Randomised controlled trial, inpatients in USA<br>Randomisation method: 'drawing from a hat'<br>Allocation concealment: inadequate<br>Blinding: unclear for outcome assessors, participants blinded<br>Loss to follow up: none reported<br>Intention to treat analysis: not stated but all patients completed within their surgical allocation<br>Overall validity: high risk of bias |
| Participants | 48 participants (49 shoulders), 30 male, mean age 46 years group 1, 49 years group 2<br>Inclusion criteria: diagnosis of stage 2 impingement; no improvement of symptoms despite a course of physical therapy; chronic symptoms >4 month; no previous decompression surgery on affected side; and |

**Murphy 1999** (*Continued*)

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| | good pain relief from a subacromial injection of local anaesthetic<br>Exclusion criteria: not stated. |
| Interventions | Group 1 (N = 25): arthroscopic acromioplasty: electrocautery used to ablate the bursa and periosteum, release the coraco-acromial ligament and maintain haemostasis.<br>Group 2 (N = 24): arthroscopic acromioplasty: laser used for this procedure |
| Outcomes | Assessed at 1 week, 1, 2, 3, 6 and 12 months<br>1. UCLA score<br>2. ASES score<br>3. Cost of hospitalization<br>4. Duration of operation<br>5. Blood loss - assessed by surgeon |
| Notes | Cost of hospitalization was 23% higher in Group 2 compared with Group 1 (Group 1: $5039 (SD 1273) , Group 2: $6166 (SD 1270), P = 0.003), attributed to the cost of the disposable tip for the laser and special equipment charges. The operation time was not sigificantly different between groups (Group 1: 122 minutes, Group 2: 144 minutes). There were no differences between groups with respect to blood loss.<br>Adverse outcomes: 1 patient in group 2 developed reflex sympathetic dystrophy which resolved.<br>Funding: Nil stated. |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | No | C - Inadequate |

**Norlin 1989**

| | |
|---|---|
| Methods | Randomised controlled trial; setting: inpatients, Sweden<br>Randomisation method: unclear<br>Allocation concealment: unclear<br>Loss to follow up: nil<br>Blinding: unclear if participants or outcome assessors were blinded<br>Intention to treat analysis: not stated but all patients completed their surgical allocation<br>Overall validity: high risk of bias |
| Participants | 20 participants, 14 male, age range 23-58 years<br>Inclusion criteria: unsuccessful non-operative treatments (physiotherapy, NSAIDS, > 3 steroid injections into the subacromial space); positive impingement signs; positive response to injection of local anaesthetic into the subacromial space<br>Exclusion criteria: symptoms for the acromioclavicular joint; full thickness rotator cuff tear |
| Interventions | Group 1 (N = 10): Arthroscopic subacromial decompression including release of the coraco-acromial ligament<br>Group 2 (N = 10): Open acromioplasty (Neer)<br>All participants were hospitalised for 2 days post-operatively. Participants in the open group were immo- |

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|---|---|
| | bilised for 3 weeks, with only pendulum exercises permitted while participants in the arthroscopic group immediately started active exercises |
| Outcomes | Assessed at 3 months<br>1) Active range of motion: abduction and flexion<br>2) Post-operative recovery time |
| Notes | We were unable to extract any data from this study for analysis. Mean and range of active range of motion was only reported for the open surgery group at 3 months (mean active abduction 140 degrees (range 70 to 180 degrees; mean active active flexion 156 degrees (range 90 to 180 degrees). These were reported to be significantly different to the arthroscopic group (P = 0.004 and P = 0.015 respectively). All participants in the arthroscopic group were reported to have a full range of motion two days after surgery and this was maintained throughout the rehabilitation period, whereas range of motion was markedly restricted after immobilisation in the open group but was improved during the rehabilitation period.<br>Time of surgery was shorter in the arthroscopic group (mean 40 min) compared with the open group (mean 66 min), P < 0.001.<br>Post-operative recovery time was 2.5 months (range 2 - 3) in the arthroscopy group and 6.7 months (range 3 -16) in the open group (no statistical comparison reported).<br>Roentgenographic outliet views of the shoulder showed all osteophytes were completely removed in both groups. The undersurface of the acromion was flat in the open group and slightly concave in the arthroscopic group.<br>Adverse outcomes: Nil<br>Funding: Nil stated.<br>A second paper by Lindh and Norlin in 1999 reviewed the same patients at 2 years and included a UCLA score. This had not been prospectively planned in the original study.<br>The mean UCLA score was 29 for both groups (range 14-35 points for the Neer open acromioplasty, 21-35 points for the ASD group ) Women showed a median score value of 24 points (range, 19-27 points) , compared with 32 points for men (range 14-35 points; P < 0.005). Radiographic examinations showed that no subacromial osteophytes had recurred.<br>Functional results in the arthroscopic group were good and similar to those after open surgery. Both methods seem to result in adequate subacromial decompression, including bone resection |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Rahme 1998**

| | |
|---|---|
| Methods | Study design: Randomised controlled trial; set in hospital surgery department, Sweden<br>Randomisation method: ' blocked randomisation' - no further details<br>Allocation concealment adequate: unclear<br>Blinding: Neither participants nor outcome assessors were blinded<br>Losses to follow up: 3 (7.1%) from conservative therapy group<br>Intention to treat analysis: No - see Notes<br>Overall validity of results: high risk of bias |
| Participants | 42 participants, mean age 42 years (range 28-68 years)<br>Inclusion criteria: isolated shoulder disease; working age; pain at rest for at least 12 months and accentuated by elevation; positive impingement sign (pain elicited by forced elevation and internal rotation); positive impingement test (pain on elevation markedly reduced by local anaesthetic injection into subacromial space)<br>Exclusion criteria: patients with gleno-humeral osteoarthrosis; patients requiring resection of the acromio-clavicular joint |
| Interventions | Group 1 (21 participants): open anterior acromioplasty (Neer technique) with any portion of the acromion which extended beyond the anterior border of the clavicle being osteomised vertically before removing the area of the anteroinferior surface of the acromion; followed by a physiotherapy regime including exercise and education, starting about 3 months after surgery.<br>Group 2 (21 participants): conservative therapy; physiotherapy regime including exercise and education<br>The physiotherapy regime was based mainly on the prinicples of Bohmer: information to the patient on functional anatomy and biomechanics of the shoulder; advice on how to avoid positions for 'wear and tear' of the subacromial structures; unloaded movements of the shoulder; measures to normalize the scapulohumeral rhythm and to increase postural awareness; strengthening of the shoulder muscles and endurance training.<br>Submaximal training of the rotator cuff was started about three months after the operation in group1 and when pain had subsided in group 2. Initially all patients were seen 2-3 times per week and the intervals between treatments were successively increased as the patient became more familiar with the object of the exercises |
| Outcomes | Outcomes measured at 6 and 12 months<br>1) relative reduction in pain: based on total pain score, calculated by sum of VAS score for pain at rest and VAS score for pain during a POP ('pour out of a pot manoeuvre') and the HIN ('hand in neck' manoeuvre); then the total pain score (at 6 and 12 months) was subtracted from the inital rating, this difference divided by the inital pain score to calcluate the relative reduction in pain ratio; participants with a reduction of > 50% (ratio > 0.5) classified as 'successes', successes further divided into complete pain relief (ratio >1.0), and partial pain relief (ratio 0.51 to 0.99), participants with < 50% reduction (ratio < 0.5) were classified as failures |
| Notes | The authors analysed 12 participants who crossed over from Group 2 (conservative therapy) to surgery after 6 months as a separate group. We included these participants in the group they were originally allocated to (Group 2).<br>Adverse events: not reported<br>Acknowledgements: none reported |

***Risk of bias***

| Item | Authors' judgement | Description |
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**Rahme 1998** (*Continued*)

| | | |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Rubenthaler 2001**

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|---|---|
| Methods | Randomised controlled trial, inpatient setting in Germany<br>Randomisation method: unclear, 'drawing numbers from an envelope'<br>Allocation concealment: unclear<br>Blinding: unclear (participants and outcome assessors)<br>Number of withdrawals and drop outs: 5 (13%)<br>Intention to treat analysis: unclear<br>Overall validity: high risk of bias |
| Participants | 38 participants, 33 followed up (7 male), mean age 51.1 years.<br>Inclusion criteria: chronic calcifying tendinopathy; failure of intensive non operative treatments.<br>Exclusion criteria: not stated. |
| Interventions | Group 1 (N = 14): Arthroscopic (endoscopic) subacromial decompression and removal of calcium deposit.<br>Group 2 (N = 19): Open subacromial decompression and removal of calcium deposit |
| Outcomes | Assessed at baseline and approximately 16 months<br>1. Self reported pain rating (VAS 0-10 where 0 = pain free and 10 = maximum pain)<br>2. Self reported function rating (VAS 0-10 where 0 = unlimited and pain-free function (i.e. no limit of shoulder function) and 10 = total shoulder dysfunction or total loss of function)<br>3. Subjective Constant and Murley Score (function)<br>4. Patte Score<br>5. Duration of physiotherapy<br>6. Duration of incapacity to work<br>7. Ultrasound examination of calcium deposits |
| Notes | Mean and SD given for pain, function, average duration of physiotherapy and incapacity to work limiting data extraction to only these outcomes. No measures of variance were reported for other outcomes. No differences between groups were reported for Constant and Murley score and Patte score (results shown graphically). Five partial calcium deposits were found on ultrasound post-operatively (group not reported) and these were stated to be much smaller than pre-operatively.<br>Adverse outcomes: Nil.<br>Funding: Nil stated. |

***Risk of bias***

| **Item** | **Authors' judgement** | **Description** |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Sachs 1994**

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|---|---|
| Methods | Randomised controlled trial; inpatient setting in the USA<br>Randomisation method: not stated<br>Concealment allocation: unclear<br>Blinding: Neither outcome assessors nor participants were blinded<br>Loss to follow up: 3 (6.8%)<br>Intention to treat analysis: not stated but participants completed within their allocated surgical group; available case analysis only.<br>Overall validity: high risk of bias |
| Participants | 44 participants, 23 male, age range 28-77 years<br>Inclusion criteria: anterior shoulder pain on elevation-Stage II Impingement syndrome; pain on lying on the shoulder; subacromial crepitus; subtle loss of ROM particularly internal rotation; symptoms > 6 months; failed conservative treatment with medication (NSAIDS) or physiotherapy; positive response to local anaesthetic injection into the subacromial space; and negative arthrogram results<br>Exclusion criteria: Patients who refused randomisation |
| Interventions | Group 1 (N = 19): arthroscopic subacromial decompression (Ellman)<br>Group 2 (N = 22): open subacromial decompression (Neer) |
| Outcomes | Assessed at 12 months<br>1) Participant overall evaluation on ordinal scale: worse, unchanged, mild improvement, moderate improvement, complete improvement<br>2) Pain on 10-point VAS scale<br>3) ROM (technique not described): flexion, abduction, external rotation, internal rotation.<br>4) Supraspinatus strength (patient elevated arm against measured resistance in the scapular plane with the palm down, the index was recorded as the strength of the involved arm divided by the strength of the normal arm, expressed as %)<br>5) Participant evaluation of ability to sleep on the affected side, perform light activity with the arm at their side, use their hand at shoulder level, and use their hand overhead on an ordinal scale: normal (excellent) , minimally limited (good), very limitied (fair), or unable to perform (poor).<br>5) Return to activities of daily living and work<br>6) Length of hospital stay |
| Notes | We dichotomised the participant evaluation scale and present results for proportion with moderate or complete improvement at 12 months in this review<br>Mean pain, ROM, and strength were only presented graphically without measures of variance and data were therefore unable to be extracted independently for this review. No statisticial analysis was presented. Arthroscopic paitnes udes narcotic analgeis for an average of 6 days versus 9 days in the open group. However pain scores for the two groups were equivalent at 2, 6, 12, 26 and 52 weeks. At 2 and 6 weeks postsurgery, participants in the arthroscopy group had more flexion than those in the open group (statistical significance not tested) but there were no differences between groups at 12, 26 or 52 weeks. No differences between groups were reported for pain or strength. Arthroscopic participants returned to activities of daily living and work in an average of 4 and 36 days respectively while the open group returned to activities of daily living and work after 9 and 54 days respectively. No differences between groups were reported for ability to sleep on the affected side, perform light activity with the arm at their side, use their hand at shoulder level, and use their hand overhead. Open patients were hospitalised for an average of 1.6 days and all arthroscopic patients were treated on an outpatient basis.<br>All failures, open group (n = 1) and arthroscopic (n = 2) were due to post operative pain and all occurred in participants with worker's compensation claims. The two arthroscopic failures underwent another |

**Sachs 1994** (*Continued*)

| | |
|---|---|
| | acromioplasty with resection of the acromio-clavicular joint and eventually had a good result.<br>Adverse outcomes: one superficial wound infection in the open group which responded to antibiotics.<br>Funding: Southern California Kaiser Permanente Research Foundation |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**Spangehl 2002**

| | |
|---|---|
| Methods | Randomised controlled trial, inpatients in Canada<br>Randomisation method: unclear<br>Allocation concealment: unclear<br>Blinding: outcome assessor blinded, participants not blinded<br>Loss to follow up: 25/87 (29%)<br>Analysed as intention to treat: available case analysis only, but in group originally allocated<br>Overall validity: high risk of bias |
| Participants | 87 participants enrolled, data for N = 62; 49 males, mean age of 39 years in the arthroscopic group, 43 years in the open group (range not stated)<br>Inclusion criteria: positive clinical diagnosis of shoulder impingement (forced forward elevation (Neer sign) and forced internal rotation at 90 degrees abduction (Hawkins sign) which was refractory to non-operative treatment; diagnosis of impingement confirmed by subacromial injection of local anaesthetic.<br>Exclusion criteria: known or suspected full- thickness rotator cuff tear |
| Interventions | Group 1 (N = 32): Arthroscopic acromioplasty<br>Group 2 (N = 30): Open acromioplasty (Neviaser technique, subperiosteal reflection of the delto trapezial aponeurosis to protect the deltoid insertion; this differs slightly from the Neer technique but similar enough to be combined with the Neer open technique for comparison with arthroscopic techniques) |
| Outcomes | Assessed at last follow up (time ranged from 12-49 months)<br>1) 7-question VAS scale to assess pain and function (0 = least pain with best function, 10 = most pain with worst function)<br>2) Participant evaluation- satisfied versus somewhat satisfied or not satisfied with operation<br>3) Rate of recovery (time to return to activities of daily living, sport and work)<br>4) Adverse events |
| Notes | VAS pain and function presented only as mean scores with no measure of variance thus we could not extract these data for this review.<br>Both techniques provided similar improvement with respect to subjective improvement, overall satisfaction, UCLA score and shoulder strength but the open procedure was reported to be better for pain and function (P = 0.01). Participants receiving worker's compensation faired worse than non compensation patients for pain and function (P < 0 .001).<br>No differences between groups were reported for time to return to activities of daily living, sport and work.<br>Adverse outcomes: n = 7 had post operative stiffness: group 1 (n = 4), group 2 (n = 3); 5 patients in |

**Spangehl 2002** (*Continued*)

| | |
|---|---|
| | group 1 underwent an open acromioplasty and most did not improve signficantly after the operation; four participants (2 in each group) had repeat surgery, 2 for persistent pain thought to be due to instability, one had a closed manipulation for stiffness, and one from the open group had a diagnostic arthroscopy for ongoing pain.<br>Funding: Nil stated. |

***Risk of bias***

| Item | Authors' judgement | Description |
|---|---|---|
| Allocation concealment? | Unclear | B - Unclear |

**T'Jonck 1997**

| | |
|---|---|
| Methods | Randomised controlled trial, inpatient setting in Belgium<br>Randomisation type: unclear<br>Allocation concealment: unclear<br>Blinding: unclear for outcome assessors and participants<br>Loss to follow up: nil<br>Intention to treat analysis: Yes<br>Overall validity: high risk of bias |
| Participants | 32 participants (36 shoulders), 15 male, age range 28-74<br>Inclusion criteria: positive stage II impingement (forced elevation (Neer), forced internal rotation (Hawkins), typical painful arc,and supraspinatus test (Jobe))<br>Exclusion criteria: nil stated. |
| Interventions | Group 1 (N = 17): Arthroscopic subacromial decompression- coraco-acromial ligament was detached.<br>Group 2 (N = 15): Open subacromial decompression- Neer |
| Outcomes | Assessed at 12 months<br>1) Participant evaluation - satisfied versus not satisfied with operation<br>2) Modified UCLA shoulder rating scale<br>3) Constant score<br>4) Range of motion assessed with a goniometer: active and passive elevation, glenohumeral abduction, passive abduction, passive external rotation in neutral position and in 90 degree-90 degree position, passive horizontal adduction, passive internal rotation in 90 degrees-90 degrees position.<br>5) Rotation and abduction shoulder strength test using the Cybex II dynamometer<br>6) Scapular position and rotation.<br>Movements and strength were compared within group to the non-operative arm (Results are not presented in the review) |
| Notes | There were 36 shoulders in 32 patients and it is unclear which patients had bilateral operations. It is also unclear whether the bilateral operations were open or arthroscopic. We wrote to the authors for clarification but to date have not received a response.<br>Adverse outcomes: Nil stated.<br>Funding: Nil stated. |

**T'Jonck 1997** (*Continued*)

| *Risk of bias* | | |
|---|---|---|
| **Item** | **Authors' judgement** | **Description** |
| Allocation concealment? | Unclear | B - Unclear |

ASD: Arthroscopic subacromial decompression
ASES: American Shoulder and Elbow Surgeons Score
HIN: 'hand in neck'
POP: 'pour out of a pot'
PRIM: Project on Research and Intervention in Monotonous work score
NSAIDS: non-steroidal anti-inflammatory drugs
OSD: open subacromial decompression
ROM: range of movement
SD: standard deviation
UCLA: University of California and Los Angeles
VAS: visual analogue scale

## Characteristics of excluded studies *[ordered by study ID]*

| Study | Reason for exclusion |
|---|---|
| Alvarez 2005 | Not involving surgery as an intervention: comparing two types of injection drug for subacromial tendinosis |
| Anderson 1999 | Not involving surgery as an intervention: comparing physiotherapy techniques |
| Boileau 2002 | Not involving the rotator cuff: comparing surgery involving shoulder arthroplasty (replacement) |
| Bottoni 2000 | Not involving the rotator cuff: comparing surgery and non surgery for shoulder instability |
| Connor 2000 | Not randomised: retrospective analysis of revision surgery for failed anterior acromioplasty |
| Edmonds 2003 | Not involving the rotator cuff: comparing surgery and non- surgery for shoulder instability |
| Fabbriciani 2004 | Not involving the rotator cuff: comparing arthroscopic and open surgery for Bankhart lesion |
| Gerdesmeyer 2003 | Not involving surgery as an intervention: comparing extracorporeal shock wave therapy (EWST) with placebo |
| Gilbertson 2003 | Not involving surgery as an intervention: assessing acupuncture for pain relief |
| Hayes 2004 | Not involving surgery as an intervention- two methods of post operative exercise programmes were compared |

(*Continued*)

| | |
|---|---|
| Jensen 2001 | Not involving a surgical procedure. Two methods of intraoperative lavage were compared. The outcomes were not included in our protocol criteria |
| Likar 2001 | Not involving surgery as an intervention: comparing TENS with placebo post operatively for pain relief |
| Machner 2001 | Not randomised: a matched pair analysis of transosseus sutures versus suture anchor repair of the supraspinatus |
| Melillo 1997 | Not randomised: treatment allocation was by patient preference which resulted in unequal distribution in group size. Sub group of same cohort from Montgomery 1994 study |
| Montgomery 1994 | Not randomised: treatment allocation was by patient preference which resulted in unequal distribution in group size |
| Motycka 2004 | Not randomised: retrospective review comparing debridement versus suture in large rotator cuff repairs |
| Ogilvie-Harris 1993 | Not randomised: prospective cohort study comparing arthroscopic subacromial decompression and debridement versus open repair and acromioplasty |
| Peters 1997 | Not randomised. All patients given subacromial local anaesthetic and steroid. If it worked the patients remained with physiotherapy. If it did not have a long term effect the patients had surgery |
| Roddey 2002 | Not involving surgery as an intervention: Comparing two instructional approaches to home exercises following full thickness rotator cuff repair |
| Rompe 2001 | Not randomised: allocated to either extracorporeal shock wave therapy (ESWT) or surgery on the basis of health insurance coverage |
| Schroder 2001 | Not randomised: comparing arthroscopic subacromial decompression and open subacromial decompression |
| Shibata 2001 | Not involving surgery. two different drugs were injected into the shoulder and the outcomes compared |
| Tillander 1998 | Not randomised: matched pair review of changes in calcification after arthroscopic subacromial decompression |
| Watson 1985 | Not involving surgery as the intervention of the randomised controlled trial: comparing post operative splinting of the arm in abduction versus resting arm at the side |
| Weber 1997 | Not randomised: retrospective review of treatment of partial thickness tears by arthroscopic or open surgery |

ESWT: extracorporeal shock wave therapy

## DATA AND ANALYSES

**Comparison 1. Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Mean change in Constant score | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 1.1 3 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.2 6 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.3 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2 Mean PRIM score at 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 3 Constant score >80 at 12 months | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 4 Success (reduction of 100% pain score from baseline) | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 4.1 6 months | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |
| 4.2 12 months | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |
| 5 Success and partial success (reduction 100% pain score or reduction 51-99% pain score from baseline) | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 5.1 6 months | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |
| 5.2 12 months | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |

**Comparison 2. Arthroscopic versus open subacromial decompression for impingement syndrome**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Mean UCLA score | 3 | | Mean Difference (IV, Fixed, 95% CI) | Subtotals only |
| 1.1 3 months | 1 | 32 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.2 6 months | 1 | 32 | Mean Difference (IV, Fixed, 95% CI) | 1.0 [-3.96, 5.96] |
| 1.3 12 months | 2 | 63 | Mean Difference (IV, Fixed, 95% CI) | 1.61 [-1.22, 4.44] |
| 1.4 96 months | 1 | 34 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.5 Last follow -up (time unclear) | 1 | 41 | Mean Difference (IV, Fixed, 95% CI) | 0.40 [-3.34, 4.14] |
| 2 Good or excellent UCLA score | 2 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 2.1 Last follow-up (12-49 months; mean 25 months) | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |
| 2.2 Last follow-up (time unclear) | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Not estimable |
| 3 Mean Constant score at 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 4 Mean participant evaluation of outcome of operation (VAS 0-100) | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |

| | | | |
|---|---|---|---|
| 4.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 4.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 4.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 4.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 5 Participant evaluation -moderately or completely improved following operation (12 months) | 1 | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 6 Participant evaluation- satisfied versus somewhat satisfied or not satisfied with operation (12-49 months) | 1 | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 7 Participant evaluation - satisfied versus not satisfied with operation at 12 months | 1 | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 8 Mean pain at rest (VAS 0-100) | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 8.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 8.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 8.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 8.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 9 Mean pain during activity (VAS 0-100) | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 9.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 9.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 9.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 9.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 10 Mean range of movement at 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 10.1 Active elevation | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 10.2 Abduction (passive) | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 10.3 External rotation (passive) in the neutral position | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 10.4 Internal rotation (passive) in 90 degrees abduction | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 11 Mean muscle strength (total work, joules): External rotation at 60 degrees/sec | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 11.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 11.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 11.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 11.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 12 Mean muscle strength (total work, joules): External rotation at 180 degrees/sec | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 12.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 12.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 12.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 12.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 13 Mean muscle strength (total work, joules): Internal rotation at 60 degrees/sec | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |

| | | | |
|---|---|---|---|
| 13.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 13.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 13.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 13.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 14 Mean muscle strength (total work, joules): Internal rotation at 180 degrees/sec | 1 | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 14.1 3 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 14.2 6 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 14.3 12 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 14.4 96 months | 1 | Mean Difference (IV, Fixed, 95% CI) | Not estimable |

**Comparison 3. Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Mean UCLA score | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 1.1 1 week | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.2 1 month | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.3 2 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.4 3 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.5 6 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 1.6 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2 Mean ASES score | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 2.1 1 week | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2.2 1 month | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2.3 2 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2.4 3 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2.5 6 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |
| 2.6 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Not estimable |

**Comparison 4. Open versus arthroscopic removal of calcium for calcific tendinitis**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Mean shoulder function (VAS) at 16 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 2 Mean pain score (VAS) at 16 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 3 Mean time of physiotherapy (weeks) | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |
| 4 Mean incapacity to work (weeks) | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |

**Comparison 5. Open repair of rotator cuff - comparison of two suture materials**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Satisfaction: Would agree to have the operation again at 2 years | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 2 Outcome rated as good or excellent at 2 years | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 3 Rate of retear of the rotator cuff on sonography at 2 years | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |
| 4 Constant score > 75 | 1 | | Risk Ratio (M-H, Fixed, 95% CI) | Totals not selected |

**Comparison 6. Arthroscopic rotator cuff repair with and without arthroscopic subacromial decompression**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Mean ASES score at 12 months | 1 | | Mean Difference (IV, Fixed, 95% CI) | Totals not selected |

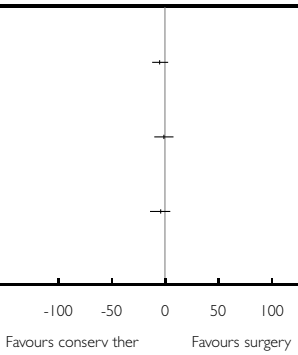
**Analysis 1.1. Comparison 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem., Outcome 1 Mean change in Constant score.**

Review: Surgery for rotator cuff disease

Comparison: 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.

Outcome: 1 Mean change in Constant score

| Study or subgroup | Surgery N | Mean(SD) | Conservative therapy N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Haahr 2005 | 41 | 15.5 (20.28) | 43 | 20.1 (16.25) | | -4.60 [ -12.48, 3.28 ] |
| 2 6 months | | | | | | |
| Haahr 2005 | 41 | 19.9 (22.81) | 43 | 21.3 (19.17) | | -1.40 [ -10.43, 7.63 ] |
| 3 12 months | | | | | | |
| Haahr 2005 | 41 | 18.5 (23.13) | 43 | 23 (19.82) | | -4.50 [ -13.73, 4.73 ] |



### Analysis 1.2. Comparison 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem., Outcome 2 Mean PRIM score at 12 months.

Review: Surgery for rotator cuff disease

Comparison: 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.

Outcome: 2 Mean PRIM score at 12 months

| Study or subgroup | Surgery N | Mean(SD) | Conservative therapy N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| Haahr 2005 | 41 | 17.6 (11.41) | 43 | 17.6 (10.89) | | 0.0 [ -4.77, 4.77 ] |

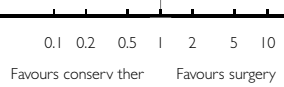

### Analysis 1.3. Comparison 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem., Outcome 3 Constant score >80 at 12 months.

Review: Surgery for rotator cuff disease

Comparison: 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.

Outcome: 3 Constant score >80 at 12 months

| Study or subgroup | Surgery n/N | Conservative therapy n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Haahr 2005 | 10/40 | 10/42 | | 1.05 [ 0.49, 2.25 ] |



### Analysis 1.4. Comparison 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem., Outcome 4 Success (reduction of 100% pain score from baseline).

Review: Surgery for rotator cuff disease

Comparison: 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.

Outcome: 4 Success (reduction of 100% pain score from baseline)

| Study or subgroup | Surgery n/N | Conservative therapy n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| 1 6 months | | | | |
| Rahme 1998 | 5/21 | 4/18 | | 1.07 [ 0.34, 3.40 ] |
| 2 12 months | | | | |
| Rahme 1998 | 11/21 | 5/18 | | 1.89 [ 0.81, 4.41 ] |

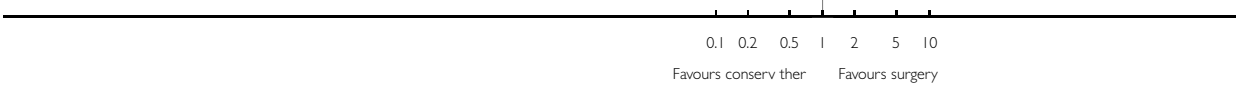

### Analysis 1.5. Comparison 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem., Outcome 5 Success and partial success (reduction 100% pain score or reduction 51-99% pain score from baseline).

Review: Surgery for rotator cuff disease

Comparison: 1 Open or arthroscopic subacromial decompression versus active non-operative treatment or placebo for impingem.

Outcome: 5 Success and partial success (reduction 100% pain score or reduction 51-99% pain score from baseline)

| Study or subgroup | Surgery n/N | Conservative therapy n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| 1 6 months | | | | |
| Rahme 1998 | 12/21 | 6/18 | | 1.71 [ 0.81, 3.63 ] |
| 2 12 months | | | | |
| Rahme 1998 | 16/21 | 11/18 | | 1.25 [ 0.80, 1.93 ] |

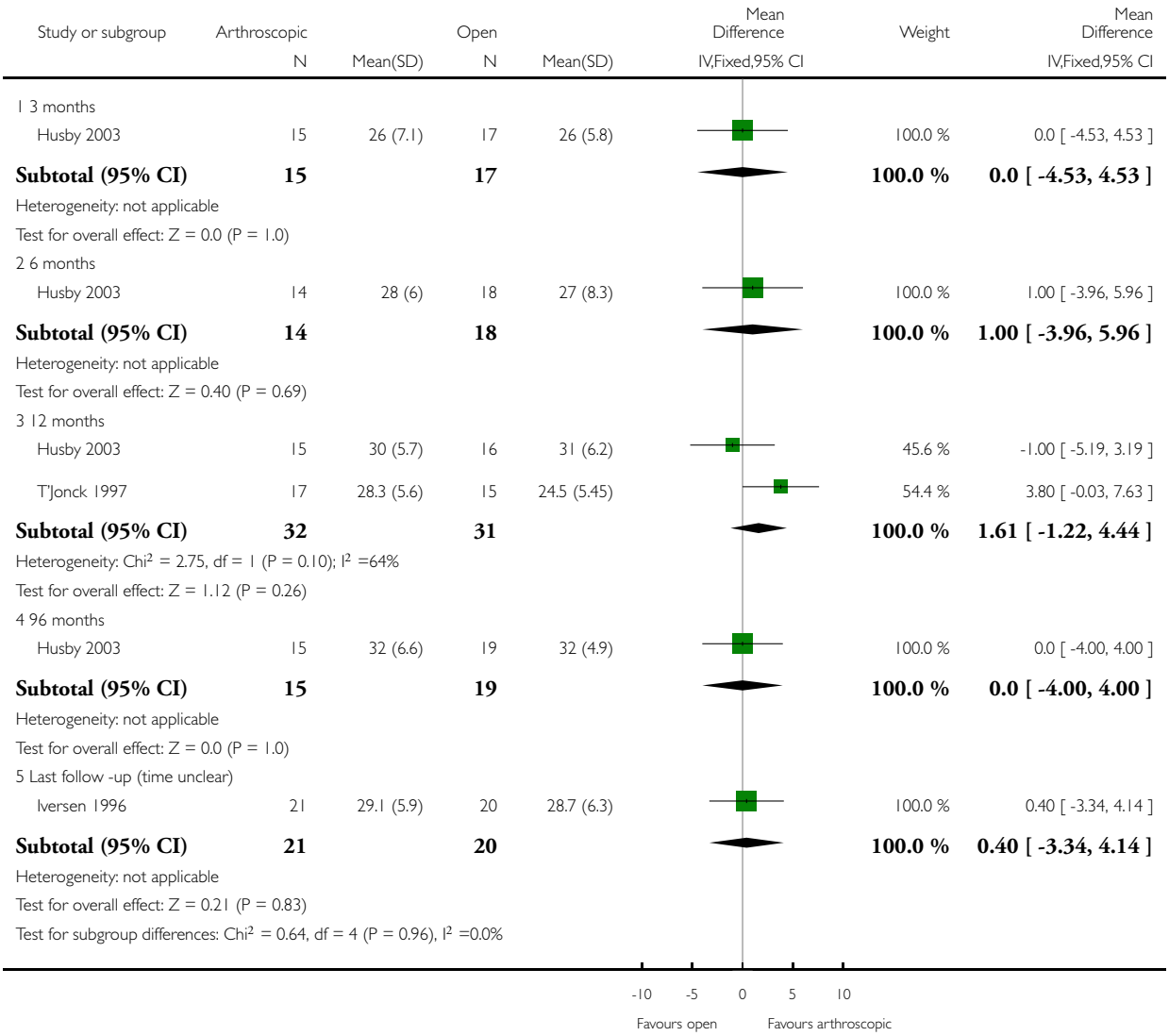


## Analysis 2.1. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 1 Mean UCLA score.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 1 Mean UCLA score

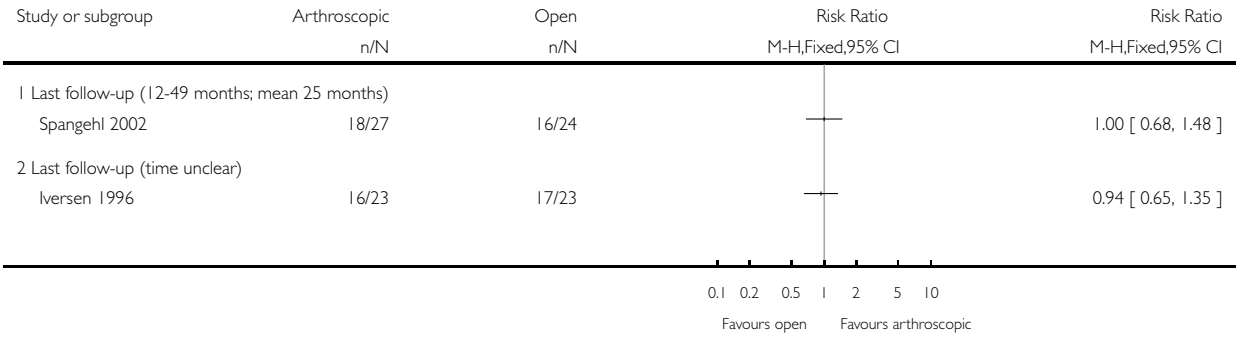


### Analysis 2.2. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 2 Good or excellent UCLA score.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 2 Good or excellent UCLA score

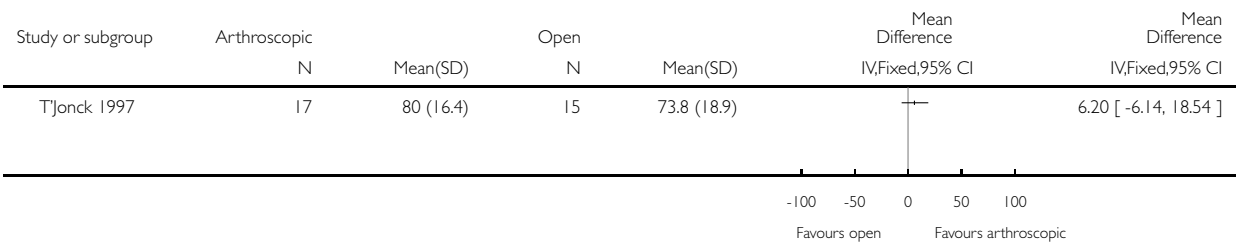



### Analysis 2.3. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 3 Mean Constant score at 12 months.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 3 Mean Constant score at 12 months



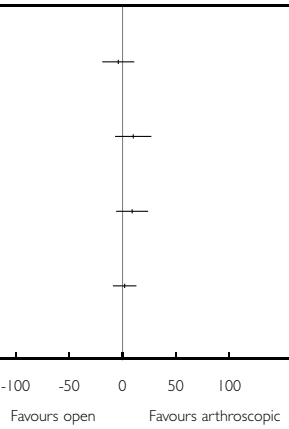
### Analysis 2.4. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 4 Mean participant evaluation of outcome of operation (VAS 0-100).

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 4 Mean participant evaluation of outcome of operation (VAS 0-100)

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 15 | 84 (26) | 17 | 88 (16) | | -4.00 [ -19.20, 11.20 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 88 (16) | 18 | 78 (31) | | 10.00 [ -6.59, 26.59 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 15 | 94 (11) | 16 | 85 (28) | | 9.00 [ -5.81, 23.81 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 15 | 95 (16) | 19 | 93 (18) | | 2.00 [ -9.45, 13.45 ] |



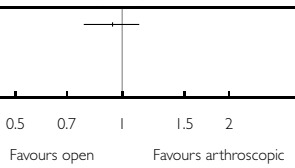

### Analysis 2.5. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 5 Participant evaluation -moderately or completely improved following operation (12 months).

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 5 Participant evaluation -moderately or completely improved following operation (12 months)

| Study or subgroup | Arthroscopic n/N | Open n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Sachs 1994 | 17/19 | 21/22 | | 0.94 [ 0.78, 1.12 ] |

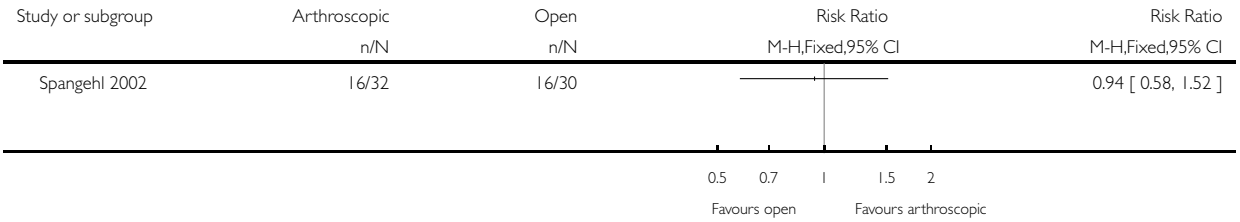


### Analysis 2.6. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 6 Participant evaluation- satisfied versus somewhat satisfied or not satisfied with operation (12-49 months).

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 6 Participant evaluation- satisfied versus somewhat satisfied or not satisfied with operation (12-49 months)

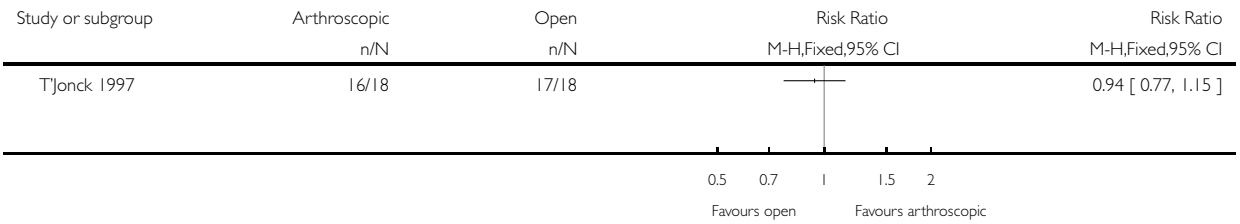



### Analysis 2.7. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 7 Participant evaluation - satisfied versus not satisfied with operation at 12 months.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 7 Participant evaluation - satisfied versus not satisfied with operation at 12 months



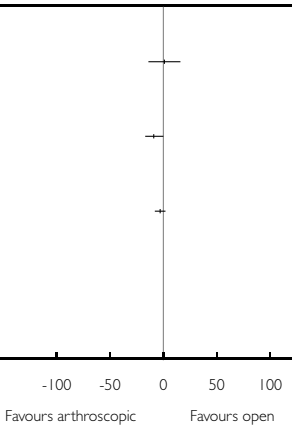
### Analysis 2.8. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 8 Mean pain at rest (VAS 0-100).

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 8 Mean pain at rest (VAS 0-100)

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 15 | 14 (24) | 17 | 13 (17) | | 1.00 [ -13.59, 15.59 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 3.4 (5.5) | 18 | 12 (18) | | -8.60 [ -17.40, 0.20 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 15 | 2.4 (4.6) | 16 | 5.1 (9.3) | | -2.70 [ -7.82, 2.42 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 15 | 0 (0) | 19 | 1.1 (4.6) | | Not estimable |



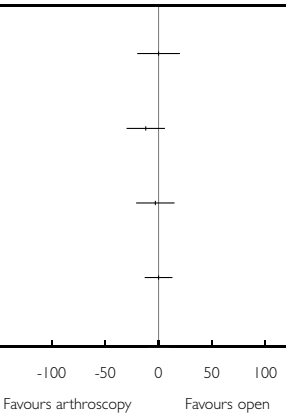
## Analysis 2.9. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 9 Mean pain during activity (VAS 0-100).

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 9 Mean pain during activity (VAS 0-100)

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 15 | 29 (28) | 17 | 29 (29) | | 0.0 [ -19.77, 19.77 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 16 (17) | 18 | 28 (35) | | -12.00 [ -30.46, 6.46 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 15 | 15 (22) | 16 | 18 (28) | | -3.00 [ -20.67, 14.67 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 15 | 12 (19) | 19 | 12 (19) | | 0.0 [ -12.86, 12.86 ] |



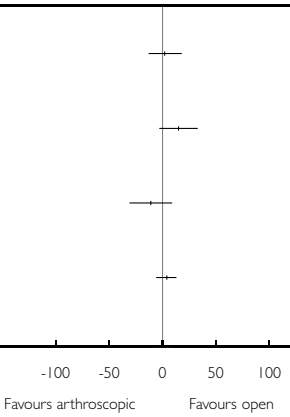
### Analysis 2.10. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 10 Mean range of movement at 12 months.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 10 Mean range of movement at 12 months

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 Active elevation | | | | | | |
| T'Jonck 1997 | 17 | 144.6 (23.5) | 15 | 142.4 (21.6) | | 2.20 [ -13.43, 17.83 ] |
| 2 Abduction (passive) | | | | | | |
| T'Jonck 1997 | 17 | 153.9 (22.4) | 15 | 138.9 (27.9) | | 15.00 [ -2.68, 32.68 ] |
| 3 External rotation (passive) in the neutral position | | | | | | |
| T'Jonck 1997 | 17 | 47.6 (19.2) | 15 | 58.3 (35.2) | | -10.70 [ -30.72, 9.32 ] |
| 4 Internal rotation (passive) in 90 degrees abduction | | | | | | |
| T'Jonck 1997 | 17 | 37 (15.6) | 33 | 33.4 (16.5) | | 3.60 [ -5.71, 12.91 ] |



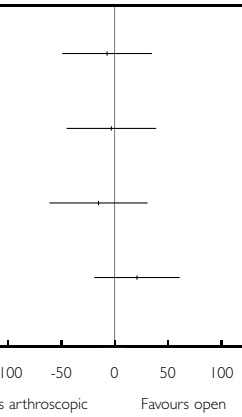
### Analysis 2.11. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 11 Mean muscle strength (total work, joules): External rotation at 60 degrees/sec.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 11 Mean muscle strength (total work, joules): External rotation at 60 degrees/sec

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 11 | 103 (51) | 13 | 110 (55) | | -7.00 [ -49.45, 35.45 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 116 (58) | 17 | 119 (61) | | -3.00 [ -45.00, 39.00 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 13 | 122 (62) | 17 | 137 (65) | | -15.00 [ -60.72, 30.72 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 13 | 149 (54) | 18 | 128 (59) | | 21.00 [ -19.06, 61.06 ] |



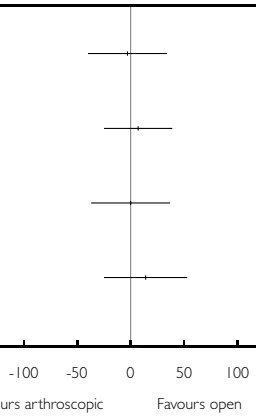
### Analysis 2.12. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 12 Mean muscle strength (total work, joules): External rotation at 180 degrees/sec.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 12 Mean muscle strength (total work, joules): External rotation at 180 degrees/sec

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 11 | 67 (49) | 13 | 70 (43) | | -3.00 [ -40.21, 34.21 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 75 (48) | 17 | 68 (43) | | 7.00 [ -25.40, 39.40 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 13 | 79 (54) | 17 | 79 (49) | | 0.0 [ -37.47, 37.47 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 13 | 93 (55) | 18 | 79 (54) | | 14.00 [ -24.94, 52.94 ] |



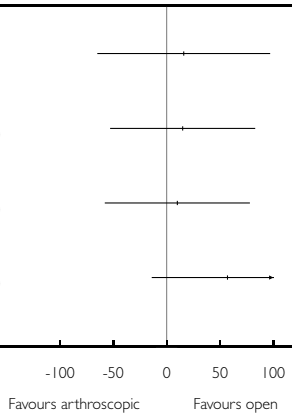
### Analysis 2.13. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 13 Mean muscle strength (total work, joules): Internal rotation at 60 degrees/sec.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 13 Mean muscle strength (total work, joules): Internal rotation at 60 degrees/sec

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 11 | 190 (99) | 13 | 174 (104) | | 16.00 [ -65.36, 97.36 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 198 (101) | 17 | 183 (89) | | 15.00 [ -52.74, 82.74 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 13 | 205 (98) | 17 | 195 (89) | | 10.00 [ -58.03, 78.03 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 13 | 245 (110) | 18 | 188 (84) | | 57.00 [ -14.28, 128.28 ] |



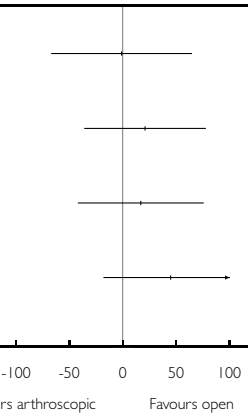
### Analysis 2.14. Comparison 2 Arthroscopic versus open subacromial decompression for impingement syndrome, Outcome 14 Mean muscle strength (total work, joules): Internal rotation at 180 degrees/sec.

Review: Surgery for rotator cuff disease

Comparison: 2 Arthroscopic versus open subacromial decompression for impingement syndrome

Outcome: 14 Mean muscle strength (total work, joules): Internal rotation at 180 degrees/sec

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 3 months | | | | | | |
| Husby 2003 | 11 | 120 (82) | 13 | 121 (82) | | -1.00 [ -66.84, 64.84 ] |
| 2 6 months | | | | | | |
| Husby 2003 | 14 | 136 (90) | 17 | 115 (69) | | 21.00 [ -36.43, 78.43 ] |
| 3 12 months | | | | | | |
| Husby 2003 | 13 | 140 (90) | 17 | 123 (70) | | 17.00 [ -42.17, 76.17 ] |
| 4 96 months | | | | | | |
| Husby 2003 | 13 | 160 (97) | 18 | 115 (73) | | 45.00 [ -17.59, 107.59 ] |



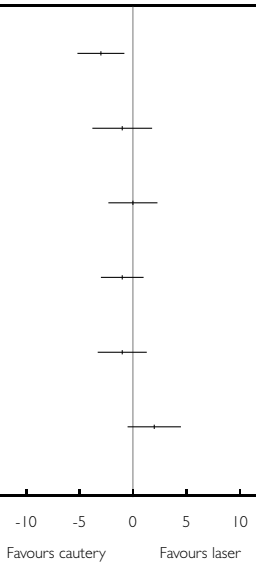
## Analysis 3.1. Comparison 3 Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome, Outcome 1 Mean UCLA score.

Review: Surgery for rotator cuff disease

Comparison: 3 Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome

Outcome: 1 Mean UCLA score

| Study or subgroup | ASD laser N | Mean(SD) | ASD cautery N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| 1 1 week | | | | | | |
| Murphy 1999 | 24 | 18 (4) | 25 | 21 (4) | | -3.00 [ -5.24, -0.76 ] |
| 2 1 month | | | | | | |
| Murphy 1999 | 24 | 23 (5) | 25 | 24 (5) | | -1.00 [ -3.80, 1.80 ] |
| 3 2 months | | | | | | |
| Murphy 1999 | 24 | 27 (3) | 25 | 27 (5) | | 0.0 [ -2.30, 2.30 ] |
| 4 3 months | | | | | | |
| Murphy 1999 | 24 | 28 (4) | 25 | 29 (3) | | -1.00 [ -2.99, 0.99 ] |
| 5 6 months | | | | | | |
| Murphy 1999 | 24 | 28 (5) | 25 | 29 (3) | | -1.00 [ -3.32, 1.32 ] |
| 6 12 months | | | | | | |
| Murphy 1999 | 24 | 32 (4) | 25 | 30 (5) | | 2.00 [ -0.53, 4.53 ] |



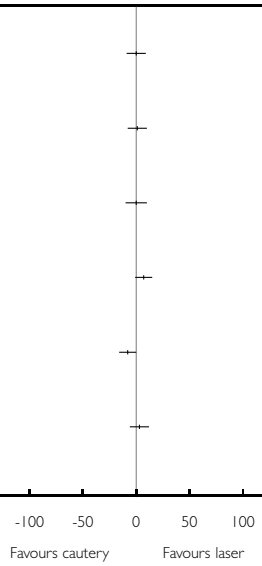
## Analysis 3.2. Comparison 3 Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome, Outcome 2 Mean ASES score.

Review: Surgery for rotator cuff disease

Comparison: 3 Arthroscopic subacromial decompression - Holium laser versus electrocautery for impingement syndrome

Outcome: 2 Mean ASES score

| Study or subgroup | ASD laser | | ASD cautery | | Mean Difference | Mean Difference |
|---|---|---|---|---|---|---|
| | N | Mean(SD) | N | Mean(SD) | IV,Fixed,95% CI | IV,Fixed,95% CI |
| 1 1 week | | | | | | |
| Murphy 1999 | 24 | 45 (18) | 25 | 45 (14) | | 0.0 [ -9.05, 9.05 ] |
| 2 1 month | | | | | | |
| Murphy 1999 | 24 | 57 (17) | 25 | 56 (16) | | 1.00 [ -8.25, 10.25 ] |
| 3 2 months | | | | | | |
| Murphy 1999 | 24 | 66 (14) | 25 | 66 (20) | | 0.0 [ -9.64, 9.64 ] |
| 4 3 months | | | | | | |
| Murphy 1999 | 24 | 78 (13) | 25 | 71 (15) | | 7.00 [ -0.85, 14.85 ] |
| 5 6 months | | | | | | |
| Murphy 1999 | 24 | 74 (15) | 25 | 82 (12) | | -8.00 [ -15.62, -0.38 ] |
| 6 12 months | | | | | | |
| Murphy 1999 | 24 | 88 (16) | 25 | 85 (16) | | 3.00 [ -5.96, 11.96 ] |



## Analysis 4.1. Comparison 4 Open versus arthroscopic removal of calcium for calcific tendinitis, Outcome 1 Mean shoulder function (VAS) at 16 months.

Review: Surgery for rotator cuff disease

Comparison: 4 Open versus arthroscopic removal of calcium for calcific tendinitis

Outcome: 1 Mean shoulder function (VAS) at 16 months

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| Rubenthaler 2001 | 14 | 1.4 (2.25) | 19 | 1.9 (2.34) | | -0.50 [ -2.08, 1.08 ] |


## Analysis 4.2. Comparison 4 Open versus arthroscopic removal of calcium for calcific tendinitis, Outcome 2 Mean pain score (VAS) at 16 months.

Review: Surgery for rotator cuff disease

Comparison: 4 Open versus arthroscopic removal of calcium for calcific tendinitis

Outcome: 2 Mean pain score (VAS) at 16 months

| Study or subgroup | Arthroscopy N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| Rubenthaler 2001 | 14 | 1.6 (0.99) | 19 | 1.9 (2.31) | | -0.30 [ -1.46, 0.86 ] |

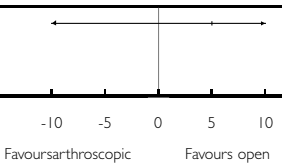
### Analysis 4.3. Comparison 4 Open versus arthroscopic removal of calcium for calcific tendinitis, Outcome 3 Mean time of physiotherapy (weeks).

Review: Surgery for rotator cuff disease

Comparison: 4 Open versus arthroscopic removal of calcium for calcific tendinitis

Outcome: 3 Mean time of physiotherapy (weeks)

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| Rubenthaler 2001 | 14 | 22 (13) | 19 | 17 (31) | | 5.00 [ -10.51, 20.51 ] |




### Analysis 4.4. Comparison 4 Open versus arthroscopic removal of calcium for calcific tendinitis, Outcome 4 Mean incapacity to work (weeks).

Review: Surgery for rotator cuff disease

Comparison: 4 Open versus arthroscopic removal of calcium for calcific tendinitis

Outcome: 4 Mean incapacity to work (weeks)

| Study or subgroup | Arthroscopic N | Mean(SD) | Open N | Mean(SD) | Mean Difference IV,Fixed,95% CI | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|
| Rubenthaler 2001 | 14 | 4.6 (6.8) | 19 | 5 (7.4) | | -0.40 [ -5.27, 4.47 ] |

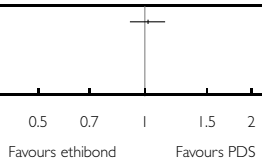
### Analysis 5.1. Comparison 5 Open repair of rotator cuff - comparison of two suture materials, Outcome 1 Satisfaction: Would agree to have the operation again at 2 years.

Review: Surgery for rotator cuff disease

Comparison: 5 Open repair of rotator cuff - comparison of two suture materials

Outcome: 1 Satisfaction: Would agree to have the operation again at 2 years

| Study or subgroup | PDS Suture n/N | Ethibond suture n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Boehm 2005 | 45/48 | 46/50 | | 1.02 [ 0.91, 1.14 ] |



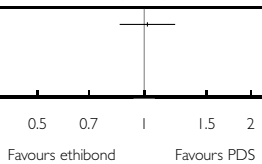

### Analysis 5.2. Comparison 5 Open repair of rotator cuff - comparison of two suture materials, Outcome 2 Outcome rated as good or excellent at 2 years.

Review: Surgery for rotator cuff disease

Comparison: 5 Open repair of rotator cuff - comparison of two suture materials

Outcome: 2 Outcome rated as good or excellent at 2 years

| Study or subgroup | PDS suture n/N | Ethibond suture n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Boehm 2005 | 40/48 | 41/50 | | 1.02 [ 0.85, 1.22 ] |



### Analysis 5.3. Comparison 5 Open repair of rotator cuff - comparison of two suture materials, Outcome 3 Rate of retear of the rotator cuff on sonography at 2 years.

Review: Surgery for rotator cuff disease

Comparison: 5 Open repair of rotator cuff - comparison of two suture materials

Outcome: 3 Rate of retear of the rotator cuff on sonography at 2 years

| Study or subgroup | PDS suture n/N | Ethibond suture n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Boehm 2005 | 18/44 | 11/49 | | 1.82 [ 0.97, 3.42 ] |

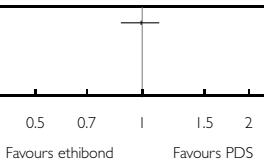

### Analysis 5.4. Comparison 5 Open repair of rotator cuff - comparison of two suture materials, Outcome 4 Constant score > 75.

Review: Surgery for rotator cuff disease

Comparison: 5 Open repair of rotator cuff - comparison of two suture materials

Outcome: 4 Constant score > 75

| Study or subgroup | PDS suture n/N | Ethibond suture n/N | Risk Ratio M-H,Fixed,95% CI | Risk Ratio M-H,Fixed,95% CI |
|---|---|---|---|---|
| Boehm 2005 | 40/44 | 45/49 | | 0.99 [ 0.87, 1.12 ] |



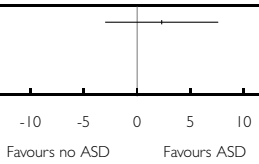
**Analysis 6.1. Comparison 6 Arthroscopic rotator cuff repair with and without arthroscopic subacromial decompression, Outcome 1 Mean ASES score at 12 months.**

Review: Surgery for rotator cuff disease

Comparison: 6 Arthroscopic rotator cuff repair with and without arthroscopic subacromial decompression

Outcome: 1 Mean ASES score at 12 months

| Study or subgroup | with ASD | | without ASD | | Mean Difference | Mean Difference |
|---|---|---|---|---|---|---|
| | N | Mean(SD) | N | Mean(SD) | IV,Fixed,95% CI | IV,Fixed,95% CI |
| Gartsman 2004 | 47 | 91.5 (10.3) | 46 | 89.2 (15.1) | | 2.30 [ -2.96, 7.56 ] |




## ADDITIONAL TABLES

**Table 1. Neer Shoulder Score description**

| Subsection | Points out of 100 |
|---|---|
| VAS Pain in previous week (self reported) | 35 |
| Clinical testing of function (muscle strength, reaching ability and stability) | 30 |
| Active range of motion | 25 |
| Anatomical or radiological examination | 10 |
| | |
| | |

**Table 2. Constant and Murley Score description**

| Subsections | Points out of 100 |
|---|---|
| VAS of pain (self reported) | 15 |
| Function (activities of daily living) and movement | 20 |
| Range of movement | 40 |

**Table 2. Constant and Murley Score description** (*Continued*)

| | |
|---|---|
| Force | 25 |
| | |

**Table 3. Patte Score description**

| Subsections | Points out of 100 |
|---|---|
| Pain | 30 |
| Function Index | 40 |
| Muscle strength | 15 |
| Disability | 10 |
| If questionnaire is completed for dominant shoulder | 5 |

**Table 4. University of Los Angeles (UCLA ) score description**

| Subsections | Points out of 35 |
|---|---|
| Pain | 10 |
| Function (activities of daily living) | 10 |
| Flexion (active elevation) | 5 |
| Strength | 5 |
| Satisfaction | 5 |

**Table 5. American Shoulder and Elbow Surgeons (ASES) Score description**

| Subsections | Score |
|---|---|
| Self assessed Pain (VAS) | 10 |
| Self assessed Instability (VAS) | 10 |
| Self assessed Activities of daily living | 30 |
| Range of motion (goniometer) | Measurements recorded |
| Signs ( 0-3 severe) | recorded Yes/No and severity |

**Table 5. American Shoulder and Elbow Surgeons (ASES) Score description** (*Continued*)

| | |
|---|---|
| Strength (0-5) | 20 |
| Instability (0-3 very lax) | recorded Yes/ No and degree of laxity |

**Table 6. Project on Research and Intervention in Monotonous work (PRIM) score description**

| Subsections | Points |
|---|---|
| Worst pain and discomfort in past 3 months | 9 |
| Average pain and discomfort in past 3 months | 9 |
| Impaired activity (work and ADL) | 9 |
| Average pain and discomfort in past 7 days | 9 |
| Total PRIM | 36 |

**Table 7. Ingvarsson 1996 Mean degrees of movement before, 4 and 8 weeks post surgery**

| Movement | Time | Neer decompression | modified Neer |
|---|---|---|---|
| Flexion | baseline | 115 | 125 |
| | 4 weeks | 130 | 140 |
| | 8 weeks | 150 | 160 |
| Extension | baseline | 40 | 40 |
| | 4 weeks | 40 | 45 |
| | 8 weeks | 50 | 55 |
| Abduction | baseline | 105 | 80 |
| | 4 weeks | 120 | 135 |
| | 8 weeks | 145 | 160 |
| External rotation | baseline | 45 | 50 |
| | 4 weeks | 55 | 55 |
| | 8 week | 60 | 65 |
| Internal rotation | baseline | 65 | 70 |

**Table 7. Ingvarsson 1996 Mean degrees of movement before, 4 and 8 weeks post surgery** (*Continued*)

| | | | |
|---|---|---|---|
| | 4 weeks | 70 | 70 |
| | 8 weeks | 70 | 70 |

**Table 8. Clinical relevance table: subacromial decompression vs non-operative treatment**

| Outcome | Patients (trials) | Control event rate | Wt absolute RD | Wt Rel% change | NNT(B) or NNT(H) | Significance | Quality of evidence |
|---|---|---|---|---|---|---|---|
| Success (reduction of 100% pain score from baseline) at 6 months | 39(1) | 22%<br>22 patients out of 100 | 2%<br>2 more patients out of 100 | 7% (I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-25, 28) | (66% (W), 240%(I)) | | | |
| Success (reduction of 100% pain score from baseline) at 12 months | 39 (1) | 28%<br>28 patients out of 100 | 25%<br>25 more patients out of 100 | 89% (I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-5,54) | (19%(W), 341%(I)) | | | |
| Success + partial success (51-100% reduction in pain from baseline) at 6 months | 39(1) | 33%<br>33 patients out of 100 | 24%<br>24 more patients out of 100 | 71% (I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-7, 54) | (19%(W), 263%(I) | | | |
| Success + partial success (51-100% reduction in pain from baseline) at 12 months | 39(1) | 61%<br>61 patients out of 100 | 15%<br>15 more patients out of 100 | 25% (I) | n/a | Not statistically significant | Silver |

**Table 8. Clinical relevance table: subacromial decompression vs non-operative treatment** (*Continued*)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 95% confidence interval | | | (-14, 44) | (20%(W), 93%(I)) | | | |
| Legend | | | Wt= weighted RD=risk difference | Wt Rel = weighted relative percent change<br>I = improvement<br>W = worsening | Number needed to benefit or harm<br>n/a = not applicable | | |

**Table 9. Brox 1993 Median Neer score**

| Median Neer score | ASD | Supervised exercises | Placebo laser | ASD v exer (95%CI) | sex-adjusted (95%CI) |
|---|---|---|---|---|---|
| Baseline | 64 | 67.5 | 65.5 | | |
| 3 months | 84.0 | 74.0 | 61.0 | 7.5 (0,15) | 3.6 (-0.2, 7.4) |
| 6 months | 87.0 | 86.0 | 66.0 | 4.0 (-2, 11) | 2.0 (-1.4, 5.4) |
| | | | | | |

**Table 10. Clinical relevance table: arthroscopic vs open subacromial decompression**

| Outcome | Patients (trials) | Control baseline m | Wt absolute change | Relative % change | NNT(B) or NNT(H) | Significance | Quality of evidence |
|---|---|---|---|---|---|---|---|
| Mean pain at rest at 3 months (visual analogue scale 0-100) | 32 (1) | 37 | 1%<br>(1 more point on a 0-100 scale) | 3%(W) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-14%(I), 16%(W)) | (38%(I), 43%(W) | | | |
| Mean pain at rest at 6 months (visual analogue scale 0-100) | 32 (1) | 37 | -9%<br>(9 fewer points on a 0-100 scale) | 24%(I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-17%(I), 0%) | (46%(I), 0%) | | | |

**Table 10. Clinical relevance table: arthroscopic vs open subacromial decompression** (*Continued*)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mean pain at rest at 12 months (visual analogue scale 0-100) | 31 (1) | 37 | -3% (3 fewer points on a 0-100 scale) | 8%(I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-8%(I), 2% (W)) | (22%(I), 5% (W)) | | | |
| Mean pain at rest at 96 months (visual analogue scale 0-100) | 34 (1) | 37 | Not estimable. | n/a | n/a | n/a | Silver |
| 95% confidence interval | | | | | | | |
| Mean pain during activity at 3 months (visual analogue scale 0-100) | 32 (1) | 67 | 0% (0 fewer points on a 0-100 scale) | 0% | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-20%(I),20% (W)) | (30%(I), 30% (W)) | | | |
| Mean pain during activity at 6 months (visual analogue scale 0-100) | 32 (1) | 67 | -12%(I) (12 fewer points on a 0-100) | 18%(I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-30%(I), 6% (W)) | (45%(I), 9% (W)) | | | |
| Mean pain during activity at 12 months (visual analogue scale 0-100) | 31 (1) | 67 | -3%(I) (3 fewer points on a 0-100 scale) | 4%(I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-21%(I), 15%(W)) | (31%(I), 22% (W)) | | | |

**Table 10. Clinical relevance table: arthroscopic vs open subacromial decompression** (*Continued*)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mean pain during activity at 96 months (visual analogue scale 0-100) | 34 (1) | 67 | 0% (0 fewer points on a 0-100 scale) | 0% | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-13%(I), 13%(W)) | (19%(I), 19%(W) | | | |
| Legend | | m=mean | | I = improvement W = worsening | NNT = number needed to benefit or harm n/a=not applicable | | |

**Table 11. Adverse events - arthroscopic vs open subacromial decompression for impingement**

| Adverse event | #pts (#trials) | RR (95% CI) |
|---|---|---|
| Infection | 87 (2) | 1.07 (0.12, 9.91) |
| Capsulitis | 108 (2) | 2.68 (0.31, 23.16) |
| Pain | 46 (1) | 1.00 (0.49, 2.06) |
| Deltoid atrophy | 46 (1) | 5.00 (0.25, 98.75) |
| Re-operation | 103 (2) | 2.96 (0.85, 10.39) |

**Table 12. Clinical relevance table: arthroscopic vs open removal of calcium**

| Outcome (scale) | Patients (trials) | Control baseline m* | Wt absolute change | Relative % change | NNT(B) or NNT(H) | Significance | Quality of evidence |
|---|---|---|---|---|---|---|---|
| Mean pain score at 16 months (visual analogue scale 0-10) | 33 (1) | 8.9 | - 3% (0.3 fewer points on a 0-10 scale) | 3% (I) | n/a | Not statistically significant | Silver |
| 95% confidence interval | | | (-15%(I), 9%(W)) | (17%(I), 10%(W)) | | | |

**Table 12. Clinical relevance table: arthroscopic vs open removal of calcium** (*Continued*)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Legend | | m=mean | | I = improvement<br>W = worsening | NNT = number needed to benefit or harm<br>n/a=not applicable | | |

# APPENDICES

## Appendix 1. OVID search strategy

1. exp shoulder/
2. shoulder$.tw.
3. exp shoulder joint/
4. exp shoulder pain/
5. exp rotator cuff/
6. rotator cuff$.tw.
7. exp Tendons, Para-Articular/
8. exp acromion/
9. acromion$.tw.
10. exp scapula/
11. musculotendinous cuff$.tw.
12. or/1-11
13. exp joints/
14. exp tendons/
15. exp tendinitis/
16. exp bursitis/
17. exp calcinosis/
18. exp calcium/
19. exp joint diseases/
20. or/13-19
21. 12 and 20
22. exp Shoulder Impingement Syndrome/
23. subacromial impingement.tw.
24. ((shoulder$ or rotator cuff or scapula or subacromial or acromion) adj5 (joint$ or tendon$ or bursitis or calcinosis or calcium or impinge$)).tw.
25. or/21-24
26. exp surgery/
27. surg$.tw.
28. su.fs.
29. exp Decompression, Surgical/
30. decompress$.tw.
31. bursectom$.tw.
32. acromioplast$.tw.
33. (calcium adj remov$).tw.

34. exp DEBRIDEMENT/
35. debrid$.tw.
36. exp ARTHROSCOPY/
37. arthroscop$.tw.
38. or/26-37
39. 25 and 38
40. randomized controlled trial.pt.
41. controlled clinical trial.pt.
42. randomized controlled trials.sh.
43. random allocation.sh.
44. double blind method.sh.
45. single-blind method.sh.
46. clinical trial.pt.
47. clinical trials.sh.
48. clinical trial.tw.
49. ((singl$ or doubl$ or trebl$ or tripl$) and (mask$ or blind$)).tw.
50. placebos.sh.
51. placebo$.tw.
52. random$.tw.
53. Research Design/
54. comparative study.sh.
55. evaluation studies.sh.
56. follow-up studies.sh.
57. prospective studies.sh.
58. control$.tw.
59. prospectiv$.tw.
60. volunteer$.tw.
61. or/40-60
62. (animal not human).mp.
63. 61 not 62
64. 39 and 63

## WHAT'S NEW

Last assessed as up-to-date: 3 September 2007.

| Date | Event | Description |
|---|---|---|
| 9 November 2008 | Amended | Converted to new review format.<br>CMSG ID: C083-R |

## HISTORY

Protocol first published: Issue 1, 2006

Review first published: Issue 1, 2008

## CONTRIBUTIONS OF AUTHORS

JC was responsible for coordinating the updated review; designing the search strategy, selecting trials, performing quality assessment and data extraction for the updated review; analysing and interpreting results for the updated review; and writing the updated review.

RB was responsible for conceiving the initial review; performing the quality assessment and data extraction for the initial review and supervising and performing this for the updated review, analysing the data and interpreting the results of both the initial and updated review; and writing both the initial and updated review.

SG was responsible for conceiving the initial review; designing and performing the searches, selecting trials and performing the quality assessment for the initial review; analysing and interpreting the results of the initial review; writing the initial review; and contributing to writing the updated review.

RJ was responsible selecting trials for the updated review; performing the quality assessment and data extraction for the updated review; analysing and interpreting results for the updated review; and contributing to writing the updated review.

SNB was responsible for providing a clinical perspective in interpretation of data for the updated review.

## DECLARATIONS OF INTEREST

No author in this review has any known conflict of interest in regard to this review. Simon Bell is an orthopaedic surgeon.

## SOURCES OF SUPPORT


### Internal sources

- Department of Clinical Epidemiology at Cabrini Hospital, Australia.
- Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia.

### External sources

- Australasian Cochrane Centre, Melbourne, Australia.
- Cochrane Musculoskeletal Group, Canada.


## INDEX TERMS

## Medical Subject Headings (MeSH)

Muscular Diseases [*surgery]; Randomized Controlled Trials as Topic; Rotator Cuff [*surgery]; Rotator Cuff Injuries; Shoulder Pain [*surgery]

## MeSH check words

Humans