# Rotator cuff tears: Is non-surgical management an effective treatment?

Authors:

1. Corresponding author:

   Paul Sealey MSc BSc (hons) MMACP MCSP MAACP HCPC

   Upper Limb Extended Scope Practitioner

   Ashford & St. Peter's Hospitals NHS Foundation Trust, Guildford Road, Chertsey, Surrey, KT16 0PZ.

   Twitter: @sealey_paul

   Email: paul.sealey@nhs.net

2. Jeremy Lewis PhD FCSP MMACP

   Consultant Physiotherapist & Reader in Physiotherapy

   Department of Allied Health Professions and Midwifery, School of Health and Social Work, Wright Building, College Lane Campus, University of Hertfordshire, Hatfield, AL10 9AB

   Twitter: @JeremyLewisPT

   Email: Jeremy.Lewis@londonShoulderClinic.com

**Abstract**

Background:

Rotator cuff related shoulder pain is a common musculoskeletal complaint with an increasing number of people with shoulder pain undergoing surgical repair each year. The relationship between rotator cuff tendon tears and shoulder pain remains equivocal due to the high prevalence of tears in people without symptoms, which suggests that a proportion of people will undergo surgery on tissues not related to their symptoms. As a result there have been suggestions to initially manage atraumatic tears non-surgically.

Objectives:

The objective of this narrative review was to present current evidence regarding the assessment and management of full-thickness rotator cuff tears.

Major Findings:

To date three randomised controlled trials have compared surgical with non-surgical management of rotator cuff tears. Outcomes show a small but non-significant effect in favour of surgery. Only one study has looked at long term outcomes of greater than one year. Overall 129 subjects have completed a course of non-surgical management and therefore low participant numbers may not be sufficient to draw firm conclusions.

Conclusions:

Current evidence currently supports the consideration of a non-surgical approach in the management of people with shoulder symptoms and identified rotator cuff tears, for a

period of time.

**Keywords**

Rotator cuff, shoulder, non-surgical, physiotherapy

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## Introduction

Shoulder pain remains one of the most common musculoskeletal complaints. It has been estimated to account for approximately 2.4% of all general practitioner appointments.[1] The most common clinical presentation is rotator cuff related shoulder pain.[2] The rotator cuff muscles and tendons add stability to the otherwise mobile gleno-humeral joint. However, the definitive contribution of these muscles to stability remains uncertain.[2] Tears involving the rotator cuff are common but the relationship between them and shoulder pain is uncertain due to a high prevalence of asymptomatic individuals.[3,4] It has been shown that in people without symptoms the prevalence of tears may be as high as 54% in those above the age of 60 years.[3] Although the relationship between tears and symptoms is equivocal, there has been a sharp increase in the number of surgical repairs performed. In the United States of America (US) the number of rotator cuff repairs has increased by 141% from 1996 to 2006.[5] Due to the poor correlation between tears and symptoms and the uncertainty of the origin of symptoms recommendations have been made for appropriate non-surgical management before considering surgery.[2,6]

The aim of this narrative review is to explore literature pertaining to the assessment and management of rotator cuff tears and to review current literature on non-surgically managed tears to inform future decisions regarding best practice. A literature search was conducted via electronic searches of EMBASE, CINAHL, AMED and Google Scholar, by the library services at Ashford & St. Peter's Hospitals NHS Foundation Trust, UK and one reviewer (PS). Studies were selected if they discussed outcomes following non-surgical

management of rotator cuff tears and this was easily identifiable in the title or abstract. Articles were excluded if they examined non-surgical management for sub-acromial pain syndrome/impingement or partial thickness tears. Any studies on animals, or research not published in the English language were also excluded. The search terms used for the database search are displayed in Table 1.

**Table 1. Database search strategy**

| Search term | Limited to |
|---|---|
| 1. Rotator cuff tear* OR rotator cuff* AND tear* | Title and abstract |
| 2. Conservative* OR physiotherapy* OR physical therapy* OR exercise* OR rehabilitation* OR non-operative* | Title and abstract |
| 3. 1 AND 2 | |

The initial database search selection yielded 440 results. This was reduced to 46 following an initial review of the title and abstract. Thirteen articles were identified that included the outcomes of non-surgically managed tears; with 3 randomised controlled trials (RCTs) comparing non-surgical management to surgery, and 3 systematic reviews.

## Assessment

*Imaging*

Imaging is often used to confirm a diagnosis of a rotator cuff tear, most commonly ultrasound (U/S) and magnetic resonance imaging (MRI). A Cochrane review recently concluded that MRI, U/S and magnetic resonance arthrography (MRA) all have good diagnostic accuracy and could equally be used to detect full-thickness rotator cuff tears.[7] The diagnostic value of MRI and U/S may be similar but both lack sensitivity for detecting partial thickness tears.[8] Due to the impact of cost, safety and diagnostic accuracy U/S should be the considered the better option.[8] However, surgeons making a clinical decision regarding surgery may wish to have greater information, such as: the tear size, degree of retraction and degree of fatty infiltration which may make the MRI a more viable option.

Whilst imaging has been shown to be accurate in detecting rotator cuff tears it should also be noted that a tear can be present in asymptomatic individuals. When reviewing MRI results of an asymptomatic population it has been reported that 28% of people between 40 and 60 years of age had rotator cuff tears (4% full thickness and 24% partial thickness). When the age of the population increases to 60 years then the number of tears increases to 54% (28% full-thickness tears and 26% partial thickness tears).[3,9] U/S findings confirm this, in a study of people with asymptomatic shoulders, 96% (n=51) from a population of 40 to 70 year olds had identifiable structural abnormalities.[4] Of this 10% were found to have a full-thickness supraspinatus tendon tear and 26% partial-thickness tears.[4]

*Clinical Assessment*

Due to the high incidence of tears in people without symptoms it is difficult to establish a link between the observed structural tear and an individual's symptoms. When producing a positive response (typically pain), orthopaedic special tests are designed to implicate isolated shoulder structures. The sensitivity of a special test establishes whether the test can detect pathology in someone known to have that pathology. In this case the test would establish the correlation between people with a positive clinical test for rotator cuff tears, in a population with a known tear. Imaging or arthroscopy is considered to be the 'gold standard' test typically used for comparison. As imaging has been shown to identify tears in the absence of symptoms, the use of imaging as the gold standard comparator remains uncertain. This is highlighted in several articles examining the clinical utility of orthopaedic special tests in detecting rotator cuff pathology.[10-12]

Hegedus et al[13] has suggested the use of likelihood ratios when determining the utility of clinical tests. A likelihood ratio is taken from subjects with and without the condition of interest.[13] The ratio is the likelihood that a given result would be expected in someone with a rotator cuff tear compared to the likelihood that the same result would be expected in someone without a tear. Based on these likelihood ratios they have extrapolated from the literature the best cluster of tests for rotator cuff tears are; age >65 years, weakness into external rotation (ER) and night pain.[14] For full-thickness tears they suggest; age ≥60 years, a positive painful arc test (pain associated with mid-range shoulder elevation), a positive drop arm test (the inability of the individual to lower from a passively elevated position) and a

positive infraspinatus test (pain or weakness experienced with resisted external rotation in a neutral position).[15] However, the findings of an arthroscopic and clinical study suggested that physiotherapists were unable to diagnose tissue specific pathology at the shoulder.[16]

As a result of the limitations of clinical testing and the high frequency of reported anomalies found in imaging studies there is a need to incorporate an assessment approach that is multifaceted. Understanding an individual's history of shoulder symptoms and acknowledging; the age of the person, their main aggravating movements and functional restrictions, and the location of pain alongside the use of orthopaedic tests, may lead to an index of suspicion of a clinically relevant rotator cuff tear.[13] However, it is important to reiterate that even in the presence of trauma there is no definitive certainty that a tear identified on imaging is the reason for the symptoms, especially in older people.

**Non-surgical management of rotator cuff tears**

Non-surgical management has been advocated in the treatment of rotator cuff tears, particularly in atraumatic degenerative tears.[6,17,18] A recent systematic review reported three randomised controlled trials (RCTs) that had directly compared surgery to non-surgical intervention (A brief overview of these studies is given below and documented in appendix 1).

Kukkonen et al[6] randomly allocated 167 people with a confirmed non-traumatic supraspinatus tendon tear into three groups. Group 1 had physiotherapy only, group 2 underwent an acromioplasty plus physiotherapy, and group 3 had a rotator cuff repair, plus an acromioplasty and physiotherapy. Physiotherapy management consisted of 10 treatments incorporating gleno-humeral range of motion, static and dynamic exercises for gleno-humeral and scapular musculature with increased resistance training up to 6 months. At one year follow up there were no statistically significant differences between the three groups.

Whilst the study failed to show clinical differences there were large differences in terms of cost of treatment with an average cost per patient of €2,417 for group 1, €4,765 in group 2 and €5,709 in group 3. Costs per patient can be considerable prior to surgery which in part is due to imaging costs. When reviewing a total of 92,688 patients in a 90 day period prior to a rotator cuff repair a total of US$161,993,100 was spent.[20] Of that, US$104.5million was spent on imaging, which equated to an average of US$1,128 per patient.[20]

A further study randomly allocated 56 patients with known degenerative cuff tears into surgical (n=25) and non-surgical treatment (n=31).[17] At 12 months there were no statistically significant differences between the two groups using the Constant score (CMS) and Dutch Simple Shoulder Test (DSST). However there was a relatively high drop-out rate of 19.6% and this participant data were not analysed. The study did find statistically significant differences in pain and disability in favour of the surgical group, with the best results found in subjects with an intact rotator cuff at follow-up. However surgery does not necessarily guarantee this outcome, with re-tear rates being reported to be as high as 73%.[17] Re-tear rates are not associated with worse clinical outcomes and therefore the tear being the main driver of pain or functional limitation may be questioned.[1,21]

Moosmayer et al[18] compared physiotherapy to surgical management for small and medium sized tears, i.e. those not exceeding 3cm on sonography. Included were both traumatic and atraumatic tears. At a five year follow up they found that 24% (n=12) of participants from the physiotherapy group went on to have surgery. These subjects had baseline characteristics of high pain levels and low ASES (American Shoulder and Elbow Surgeons) scores compared to those who received favourable outcomes with non-surgical treatment. Demographics including; age, size of tear, muscle atrophy, employment status, smoking history and number of tendons involved were comparable between those successfully treated with physiotherapy and those going on to have surgery following physiotherapy. Physiotherapy intervention consisted of 52 different exercises delivered in twice weekly

treatment sessions over 12 weeks. Exercises consisted of postural correction and the restoration of scapulothoracic and glenohumeral muscular control and stability. Overall both the surgical and physiotherapy groups significantly improved. Although the effect size was small, those undergoing a repair after physiotherapy management had a slightly less favourable outcome than the primary operative group. This suggests that the time of repair may not significantly affect post-operative outcome.

A further prospective cohort study also found comparable data with the previous RCTs.[22] Prior to undergoing surgery participants underwent 12 weeks of physiotherapy. The physiotherapy programme included daily range of motion and flexibility exercises alongside strengthening of the rotator cuff and scapular muscles, performed three times per week. The outcome was deemed successful if the participant no longer required surgery. After 2 years, 74% of the 422 participants did not require surgical repair.[22]

The current evidence supports both surgical and non-surgical management of rotator cuff tears with no significant differences in outcomes. Orthopaedic surgery is based on a biomedical model of pain where surgical repair of damaged tissues will lead to a reduction of the symptoms. As previously reported, asymptomatic rotator cuff tears are prevalent in the general population and therefore this biomedical approach need be considered cautiously. A recent systematic review has reported comparable results from studies comparing sham orthopaedic surgery to real surgery.[20] Pain is complex should no longer

consider it in purely biomedical terms given that it may relate to the perception of threat rather than tissue damage only.[20]

Post-operative instructions following rotator cuff repair commonly involves immobilisation in a sling or abduction wedge for 4 to 6 weeks.[24] This enforces relative rest from aggravating activities and may allow irritable structures time to settle. This is followed by a graduated rehabilitation programme with progressive tissue loading encouraging a return to previously avoided activities. It is therefore unclear as to the mechanisms involved in the positive outcome seen in subjects under-going rotator cuff repair. This may also be said of the clinical effects of physiotherapy as we are currently unable to establish if improvements in a non-surgical approach; are related to the intervention, follow a natural improvement or a physiotherapeutic induced placebo effect.[25]

W**hich individuals may be managed non-surgically?**

Establishing the individuals that are likely to improve with a non-surgically managed rotator cuff tear is difficult. Schmidt et al[26] assessed criteria incorporating clinical practice guidelines, clinical experience and patient and disease factors to determine appropriateness of non-surgical management for rotator cuff tears. They reported that non-surgical treatment was deemed appropriate when people responded to non-surgical management. A repair was deemed appropriate in a healthy person with moderate or severe pain who was not responsive to non-surgical management. Factors shown to influence healing, such as smoking and diabetes, had no effect on the panel's decision on appropriate treatment.

One outcome measure that may be useful to predict success with a non-surgical management approach is the Rotator Cuff Quality-of-Life Index (RCQOL).[27] Those treated successfully with non-surgical measures had a mean baseline measure of 49 on the RCQOL compared with a mean of 33 points in the failure group.[27] A successful outcome was determined if both the person and the treating surgeon deemed that surgery was not required at the three month stage. Further validation of this outcome measure is required before clinical decision making can be made following application of the tool.

Gender, tear size, treating surgeon, functional co-morbidity score and patient reported outcome measures were not predictive of treatment allocation in those presenting with a rotator cuff tear.[28] Those with a high BMI and increasing age are more likely to be allocated

to non-surgical management with age linked to a risk of re-tear and poorer functional outcomes.[28-30]

**Optimal time to surgery**

The optimal time to surgery is still unknown. Those likely to be referred to surgery were those presenting with symptoms of less than one year.[28] A recent systematic review found a minimal difference in favour of the early surgery group (<3 months) but due to limitations and bias within the studies the results should be viewed with caution.[31] The authors also did not include non-surgical outcomes within their study. It has previously been reported that duration of symptoms is not related to the degree of muscle weakness, limited range of motion, tear size, fatty atrophy or validated patient reported outcome measures.[32]

Other studies have found that it is unlikely that outcomes will worsen if a tear is left for 3 months post-trauma.[33-35] Most people who fail non-surgical treatment are likely to request surgery within the first 12 weeks. Beyond 12 weeks of non-surgical management there appears to be no further uptake in people requesting surgery.[25]

Solayar et al[36] reported that a repair should occur prior to muscle fatty infiltration to improve healing rates and functional outcomes. States of fatty infiltration are graded from 0 to 4 with grade 0 being normal muscle and grade 1 showing some fatty streaks. Pathological states of fatty infiltration are graded from 2-4. Grade 2 indicates a higher muscle to fat ratio, grade 3 indicates an equal muscle to fat ratio and grade 4, a higher fat to muscle ratio. It is been reported that re-tear rates are as high as 67% in persons in the grade 2 atrophy or greater.[37] The time for stage 2 to occur takes around 3-4 years with stages 3-4 taking around

6 years.[38] However, it is not known whether non-surgical management can slow or prevent this progression.

There are concerns that if a tear is left then there is likely to be a progression in tear size. However it has been shown that in a population under the age of 65 there was no increase in tear size over 3.5 years.[39] This is in contrast to previous research showing that more than half of the asymptomatic tears become symptomatic within 3 years with an increase in size of tear.[40] A single case study of a 49 year old male showed little progression of tear size, retraction or fatty infiltration over 10 years, in contrast to a 54% increase in size with those over the age of 60.[41,42] Those that do increase in size tend to do so gradually with only a minority increasing by more than 5mm over a three year period.[43] When reviewing asymptomatic tears that become symptomatic the progression of tear size does not always correlate with symptoms.[44] Moosmayer et al[44] found that 13% of subjects remained asymptomatic despite the enlargement of a tear >10mm, with 39% of subjects developing symptoms despite a tear enlargement of ≤5mm.[44]

It has been argued that a non-surgically managed rotator cuff tear may lead to progressive degenerative joint disease, known as rotator cuff arthropathy. This has been reported in a longitudinal study reviewing disease progression in non-surgically managed tears.[45] However, this has been questioned by others who found limited progression of arthropathy at a mean of 7 years.[21]

**What exercises/physiotherapy would be useful clinically in the non-surgically managed RC tear?**

Due to the heterogeneity within the studies reviewed there is no consensus as to the best non-surgical management for rotator cuff tears. In a randomised placebo controlled trial for those presenting with massive tears (>5cm) a treatment programme incorporating anterior deltoid strength was advocated over usual care. [46,47] Therefore this may be recommended in this population. In those with smaller tears treatment should be tailored to the person. Strength training should encompass the person's functional restrictions and main aggravating factors. This has recently been reviewed in rotator cuff tendinopathy subjects.[48]

**Conclusions**

Current literature supports the use of non-surgical intervention for rotator cuff tears.[19] To date only three RCTs have directly compared non-surgical with surgical management, with a total of 129 non-surgically managed participants.[6,17,18] Current literature has yet to address long term outcomes of non-surgical intervention with further longitudinal studies necessary. Therefore further RCTs are required to fully establish best clinical practice in the management of rotator cuff tears.

It has been suggested that surgery is recommended in young, and physically active professional people who need to get fit in a short period of time.[33] This is due to reductions in muscle strength found in those with an on-going tear. However strength limitations have been reported as minimal with an average of 3 kg abduction strength loss in those with a non-surgically managed tear.[45] Strength has also been shown to remain reduced by up to 30% in a surgically repaired tendon.[49,50] However deficits between affected and unaffected sides remain low.[50] Therefore the relevance of this loss of strength in those with rotator cuff tears may have little effect on functional status.

People who present with atraumatic rotator cuff tears present a dilemma as there is little information to guide decisions regarding non-surgical or surgical management.[25] In the first instance current assessment techniques and imaging make it difficult to diagnose a clinically relevant tear. Therefore a key component in the patient assessment is to establish functional restrictions and the implications to the person that these restrictions bring. This

may include difficulty within their occupation or social activities. An initial course of physiotherapy is advocated in the first instance in the management of an atraumatic rotator cuff tear.

**Clinical Recommendations**

Personalising physiotherapy intervention, taking the individual's opinions into account and making treatment person-centred is of critical importance in the management of musculoskeletal pain.[52] An understanding of their beliefs, their expectations and preferences within physiotherapy is vital.[52] If beliefs persist that pain is a sign of tissue damage and that rest or surgery is required then it may be doubtful that the individual will engage in rehabilitation.[51] Addressing these negative illness perceptions through education and counselling will be of relevance to long term outcomes.[52] A person's expectation of outcome and physiotherapy has been demonstrated to influence outcomes and therefore time should be invested in establishing the individuals expectations of care and any preferences for treatment.[52,53] A person's previous experiences of physiotherapy, whether positive or negative, will impact on future outcomes.[25] Finally, prior to the initiation of a management programme patient specific goals should be discussed, negotiated and formalised.[51] This will enable the focus to be on the person and what is important to them, rather than on physiotherapy centred goals such as range of motion or strength.

For patients with a high index of suspicion of a symptomatic tear who fail to improve with non-surgical management, imaging and surgical intervention could be considered. A decision to undergo surgery should be made in collaboration with the person and any relevant others within their life. The individual needs to be educated on the risks and benefits of surgery, including all possible post-operative complications and likely timescales for recovery prior to consent.

**Future research**

Future research should focus on the long term effects of non-surgical management. Of the three RCTs reviewed only one study[18] reviewed long term outcomes (>12 months) with the data reported seemingly suggesting a deterioration in the non-surgically managed group from 2 to 5 years. To what extent this deterioration was significant is unknown and was not alluded to within the study. Longer term outcomes over a 10 year period may be more beneficial in future studies. In addition, definitive understanding of natural history of this condition would inform clinical decision making.

To determine the true effects of non-surgical management a randomised controlled trial comparing sham surgery with rotator cuff repair would enable patients and therapists to be blinded during the trial. This would reduce the degree of placebo induced effects that have been previously associated with orthopaedic surgery.[20]

The development of a person-centred non-surgical management programme taking into account the person's beliefs, expectations and goals should result in better outcomes than a non-specific shoulder rehabilitation programme and could improve patient adherence to exercise to encourage self-management.

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Appendix 1

Review of RCTs comparing non-surgical management versus surgery for rotator cuff tears

| **Study** | **Study design** | **Sampled population** | **Tear type trauma/atraumatic** | **Intervention** | **Results** | **Conclusion** |
|---|---|---|---|---|---|---|
| Kukkonen et al (2014) | RCT | 167 shoulders, >55 years of age<br><br>Group 1: 55 shoulders (24 male, 31 female) mean age 65 years<br><br>Group 2: 57 shoulders (29 male, | Atraumatic,<br><br>Supraspinatus tear comprising <75% of the tendon insertion, Patient's had full active range of motion in the shoulder. | **Group 1:** Physiotherapy: ROM for 6/52, static/dynamic exercises from 6-12/52, resistance training 12-26/52.<br><br>**Group 2** Acromioplasty + Physiontherapy: 3/52 of gentle movement | Mean Constant score at 12 months 74.1 (group 1), 77.2 (group 2), 77.9 (group 3).<br><br>Patient satisfaction at 12 months: 87% | No significant differences between groups |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 28 female), mean age 65 years<br><br>Group 3: 55 shoulders (26 male, 29 female), mean age 65 years. | | then the same as group 1<br><br>**Group 3:** Repair + Acromioplasty + Physiotherapy: 3/52 immobilisation in a sling then exercise as per group 1. | (group 1), 96% (group 2), 95% (group 3) | |
| Heerspink et al (2015) | RCT | 45 patients (60% male in surgery group, 64.5% male in non-surgical | Atraumatic supraspinatus tears. Additional Infraspinatus tears | **Non-surgical:** Subacromial steroid infiltration (max 3), physiotherapy and | Constant-Murley score (CMS), Dutch simple shoulder score (DSST), VAS | No significant differences between groups in terms of CMS |

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|---|---|---|---|---|---|---|
| | | group). Mean age 60.8 (Surgery), 60.5 (non-surgical). | (non-surgery = 1, surgery = 0). Additional Subscapularis tears (non-surgery = 4, surgery = 1) | analgesia<br><br>Physiotherapy: PROM (0-4/52), AROM (4-6/52), Stability training (6-12/52), strengthening 12/52<br><br>**Surgery:** Sling for 6/52, exs 0-6/52 active elbow, wrist, hand and passive shoulder movement. Active movement at 6- | pain and VAS disability.<br><br>Results: Mean CMS at 12 months 81.9 (surgery), 73.7 (non-surgical). Mean DSST 11.0 (surgery), 9.7 (non-surgery). VAS-pain 2.2 (surgery), 3.2 (non-surgery). VAS-disability 2.1 (surgery), 3.5 (non- | or DSST but a small but significant difference in terms of Pain and Function on VAS in favour of surgery. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | 12/52, strengthening 12/52. | surgery). | |
| Moosmayer et al (2014) | RCT | 103 patients (52 repair group, 51 Physiotherapy group) | Rotator cuff tear ≤3cm, traumatic and atraumatic tears included | **Physiotherapy:** programme included 52 different exercises – Rx sessions 40minutes twice weekly for 12/52 + home exercises that the patient could complete correctly (no more than 1-2 at a time).<br><br>NB: The Physiotherapy group had the option to have surgery at any | 12 (24%) of patients in the physiotherapy group went on to have surgery.<br><br>The primary tendon repair group achieved 5.3 points greater in the Constant score, 9.0 points greater in the | Statistically significant differences were seen between primary repaired and non-surgically managed small tears in favour of the surgically managed tears. |

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| | | | | point in the trial<br><br>**Surgery:** Immobilisation in sling for 6/52 with passive exercise 0-6/52, active-assisted exs at 6-12/52 then resisted 12/52. | ASES score and 1.1cm greater on the VAS for pain.<br><br>Mean change in abduction was 14.7° greater in the primary repair group.<br><br>Patient satisfaction was 0.9cm greater on a 10cm scale in favour of the primary | However the differences did not reach clinical importance. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | surgical group at 5 years. | |

Completed PEDro quality appraisal

| Study | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kukkonen et al (2014) | y | y | n | y | n | n | n | y | y | y | y | 6 |
| Heerspink et al (2015) | y | y | n | y | n | n | n | n | y | y | y | 5 |
| Moosmayer et al (2014) | y | y | n | y | n | n | y | y | y | y | y | 7 |

NB one item on the PEDro scale (scale point 1, eligibility criteria) relates to external validity and is therefore not counted in the total PEDro score. RCTs scoring 9-10 on the PEDro scale are of excellent quality, scoring 6-8 studies are of good quality, 4-5 fair quality and <4 poor quality.