

Does adding heavy load eccentric training to rehabilitation of patients with unilateral subacromial impingement result in better outcome? A randomized, clinical trial

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Introduction

Disorders of the rotator cuff are the most common cause of shoulder pain. The supraspinatus tendon is usually the most affected structure due to its position in the subacromial space. In patients with subacromial impingement degenerative changes in the supraspinatus tendon have been shown through histological examinations, similar to those changes found in Achilles and patellar tendinosis. In patella and Achilles tendinopathy eccentric training has been shown to decrease pain and improve function but also repair tendon tissue. Studies involving rotator cuff tendinopathy have shown promising clinical results showing less pain and function after 12 weeks of eccentric training in patients with impingement. Limitations within these studies however leave it unclear whether eccentric training would substantially augment results of traditional conservative treatment.

Aims & Objectives

The aim of this study was to investigate the superior value of adding heavy load eccentric training to a traditional rotator cuff training program in patients with subacromial impingement with respect to increasing strength and decreasing pain and dysfunction.

Methodology

Sixty one patients with subacromial impingement were included. All subjects were recruited by a specialized shoulder surgeon based on a thorough history and physical examination. The inclusion criteria were aged over 18 years, unilateral pain for at least 3 months in the anterolateral region of the shoulder, painful arc, 2 out of 3 impingement tests positive. (HK, Jobe, Neer), 2 out of 4 resistance tests painful (full can abduction at 90degrees, resisted abduction at 0degrees, resisted external or internal rotation with the arm adducted) and pain with palpation of the supraspinatus and or infraspinatus tendon insertion. The exclusion criteria included demonstration of partial or full ruptures of the rotator cuff by a technical investigation (MRI or ultrasound), history of shoulder surgery shoulder fracture or dislocation, traumatic onset of the pain, OA, FS, traumatic glenohumeral instability or shoulder nerve injuries. Patients

with concomitant disorders, such as cervical pathology or systematic musculoskeletal disease were also excluded.

30 patients were randomly allocated to the traditional rotator cuff training (TT) group and 31 were randomly allocated to the traditional rotator training combined with heavy load eccentric training (TT+ET) group. All exercises were performed at home for 12 weeks. Both groups attended one physiotherapy session a week (30 minutes) during the first period of 6 weeks and one every 2 weeks during the second period of 6 weeks (9 sessions in total). The traditional group performed two traditional rotator cuff strengthening exercises at home- internal and external rotation resisted with an elastic band. Each exercise was performed once a day for 3 sets of 10 repetitions. The TT+ET group performed the same exercises as the traditional group and in addition to that a heavy load eccentric exercise – the eccentric phase of the full can abduction in the scapular plane with a dumbbell weight (3 sets of 15 twice per day). No other strengthening exercises were added to the programme. The physiotherapy sessions were aimed at correcting exercise techniques, and included educating the patient, glenohumeral and scapulothoracic mobilizations, scapular setting and posture correction. Dosing the eccentric exercises was based on the pain monitoring model and the conditions for dosing were specified. HHD was used to assess isometric abduction strength, at 3 positions (0degrees, 45degrees and 90degrees of abduction), these positions were varied by inclinometer. Outcome measures included a self-administered shoulder specific questionnaire, the SPADI. Patients also rated their subjective perception of improvement of their shoulder pain.

Results

Both groups showed an overall significant increase of isometric strength over time to 0degrees and 45degrees of scapular abduction and to external and internal rotation. There was a significant increase of strength from 0 to 6 weeks but not from 6 to 12 weeks for abduction and external rotation strength. Internal rotation strength was only significantly increased in both groups when evaluated over the whole 12 week period. The main finding in this study was the 15% higher gain in abduction strength at 90degrees of abduction in the TT+ET group than in the TT group. In the TT+ET group isometric strength to abduction at 90degrees of abduction increased significantly after 12 weeks of treatment however In the TT group it did not significantly increase after 12 weeks.

In both group's pain and function measure with the SPADI score, improved significantly over time however improvement of the SPADI score was not significantly different between the groups. Patient's self-rated perception of improvement was not significantly different in the TT+ET and the TT group both at 6 weeks and at 12 weeks after the start of the intervention. Eccentric training therefore did not result in less pain or better shoulder function than traditional rotator cuff training after 12 weeks.

Discussion

In patella and Achilles tendinopathy eccentric training has been shown to decrease pain, improve function and repair tendon tissue. This study was conducted to investigate if, in patients with subacromial impingement, adding eccentric training exercises to a regular physiotherapy and home exercise program would result in greater improvements in pain, function and strength.

The main finding was that the adding eccentric training exercises to a traditional rotator cuff training program involving individualized physiotherapy treatment and home based exercises resulted in a 15% higher gain in abduction strength at 90degrees of abduction after 12 weeks. However no benefit was found for the addition of eccentric training exercises for measures of shoulder pain and function, as measured by the SPADI. Although a difference in isometric strength of 10%, has previously been shown to be considered clinically significant.

Limitations/Considerations

The PEDro score for the study was high (6) therefore overall the risk of bias was low however there were a number of limitations in the study that may represent sources of bias. Firstly, it was not specified if allocation of the patients to treatment groups was concealed to the surgeon. Inadequately concealed allocation when combined with self-reported outcomes may result in an exaggerated treatment effect. Secondly, both the treating physiotherapist and the assessor that collected the data could not be blinded to the treatment group which may have had an impact on the measurements taken. Additionally it was also not specified if the subjects were blinded. Also there was no control group.

In relation to the outcome measures there were a few points to note. Firstly it states that there was standardized verbal instruction given during the strength measurement using the hand-held dynamometer however it was not specified what these instructions were and whether patients were advised to reproduce pain. There is the possibility that the patient had an element of fear during the first measurements and which would have been reduced by the next measurements. Secondly at the 12th week outcome measures were only obtained from 82% of subjects in the traditional group as one person was on holiday and another lost to follow-up. This is not ideal, as measure of at least one key outcome should be obtained from more than 85% of the subjects. The investigators also highlight the fact that the study may have been underpowered to detect differences between groups in the SPADI score. Previous studies have reported a sample size of 60 in each group is required to detect differences in treatment effect.

The investigators choose not to use an isokinetic device for measuring strength as this would not be clinically relevant. The exercises and measurements would be easy to transfer to clinical practice.

Compliance with the exercise intervention is not reported upon although the patients did have to complete a log book to record pain during the exercise and adverse events.

Natural improvement in pain over time, would allow patients to apply more force on measurements.

The exercise patient actively lifted the arm into the open can position therefore the exercise wasn't purely eccentric. ? Would using pulleys have been a better way of doing this exercise.

There was no long-term follow up therefore it is not clear how long the improvements were maintained.

Conclusions

This study shown that a 12 week traditional rotator cuff home training combined with 9 physiotherapy sessions was successful in increasing isometric strength and decreasing shoulder pain and dysfunction in patients with subacromial impingement. Adding heavy load eccentric training resulted in a higher gain of isometric strength at 90degrees of scapular abduction. This study highlighted that combining a limited amount of physiotherapy treatment session with a home based exercise program is highly effective.

The study raises the question is it worth adding eccentric exercises for a strength gain of 15% when there was no significant difference reported in patients pain and function.