



REVIEW ARTICLE

# Evidence for minimally invasive therapies in the management of chronic calcific tendinopathy of the rotator cuff: a systematic review and meta-analysis



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**Background:** This meta-analysis assessed the short-term to midterm effectiveness of minimally invasive treatments in the management of calcifying tendinopathy of the shoulder cuff, a common source of chronic shoulder pain that leads to pain, a decreased active range of motion, and loss of muscular strength. When conservative therapies fail, minimally invasive treatment options can be considered before resulting to surgery.

**Materials and methods:** The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed to conduct this review. A systematic literature search was conducted in May 2013 to identify all studies that examined the short-term to midterm effectiveness of minimally invasive treatments for chronic calcifying tendinopathy. The primary end points were identified as function, pain, and total resorption rates. Grades of Recommendation Assessment, Development and Evaluation (GRADE) was used to assess the quality of evidence.

**Results:** Included were 20 studies (1544 participants). Common methodological flaws were related to randomization. In general, there is moderate-quality GRADE evidence that high-energy extracorporeal shockwave therapy has a significant effect on pain relief and functional status compared with other interventions. There is variable-quality GRADE evidence on the efficiency of other interventions.

**Conclusion:** High-energy extracorporeal shockwave therapy is the most thoroughly investigated minimally invasive treatment option in the short-term to midterm and has proven to be a safe and effective treatment. Ultrasound-guided needling is safe but has not been proven to be more effective than an ultrasound-guided subacromial corticosteroid injection in recent level I research, and further research will have to prove its effectiveness.

**Level of evidence:** Level II, Meta-Analysis.

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**Keywords:** Shoulder; rotator cuff; calcific; tendinopathy; treatment; evidence based; minimally invasive

Investigational Review Board approval was not required for this study.

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Calcific tendinopathy of the rotator cuff is a disorder characterized by inflammation around deposits of calcium carbonate apatite crystals in the tendons and is a common source of pain in the shoulder. Calcific deposits are found in between 2.7% and 22% of individuals during routine

examination,<sup>55</sup> and clinical symptoms occur in 34% to 45%.<sup>4</sup> Approximately 80% of the deposits are located in the supraspinatus tendon.<sup>3,4,37</sup> Most individuals with calcific tendinopathy are aged between 30 and 50 years, with women affected 1.5 times more often than men.<sup>21,32,60</sup> Clinical features of the disease are shoulder pain, a decrease in active range of motion, and loss of muscular strength. The disease in some patients is self-limiting without therapy. The natural course of spontaneous resolution of the calcific deposit is variable, however, and was reported in 9.3% after 3 years and in 27% after 10 years.<sup>4</sup> Uthoff et al<sup>56</sup> described that the progress of the disorder passes through 4 phases in the following order: cell-mediated calcification/formative stage, resting stage, resorptive stage/deposit phagocytosis, and ending with complete recovery of the tendon. Most patients can be treated conservatively with pain medication, physiotherapy, and prudent use of subacromial corticosteroid injections. Approximately 10% of patients are resistant to conservative treatment and appear to remain in a prolonged formative phase with chronic symptoms.<sup>56</sup> These patients can be treated with other modalities such as surgery, whereby an open or arthroscopic procedure can achieve complete clinical improvement in 80% to 100%.<sup>45</sup> Surgery, however is costly, requires a long rehabilitation, and perioperative complications may occur.<sup>20</sup>

There are nonsurgical alternatives such as extracorporeal shockwave therapy (ESWT),<sup>2,11,17,19,25,27,33,40-43,47</sup> transcutaneous electronic nerve stimulation (TENS),<sup>40</sup> and ultrasound-guided percutaneous needling.<sup>1,14,29,49,50,52</sup> Because the natural course of calcific tendinopathy is variable and the time required for a spontaneous disappearance often is too long and unacceptable for the patient's quality of life, the treatment should be effective in the short-term and midterm, minimally invasive, with minimal risk for complications, and inexpensive. The aim of this systematic review was therefore to present an evidence-based overview of the short-term and midterm (3-6 month) effectiveness of various nonsurgical and minimally invasive treatments in pain reduction, improvement of shoulder function, and reduction in size of calcific deposits for patients with chronic calcific tendinopathy of the shoulder. This information can support the development of evidence-based guidelines and give direction to future research on calcifying tendinopathy of the rotator cuff.

## Materials and methods

### Inclusion criteria

#### Studies

The literature search performed for this review was limited to published original randomized (RCT), quasi-randomized controlled (qRCT), and controlled clinical trials (CCT) concerning the minimally invasive treatment of chronic calcifying tendinopathy of the rotator cuff with at least 3 months of follow-up.

### Participants

Inclusion was limited to articles reporting results for patients older than 18 years with symptoms of calcific tendinopathy of the rotator cuff for more than 6 months who did not respond to conservative treatment with nonsteroidal anti-inflammatory drugs, physiotherapy, or subacromial corticosteroid injections. The diagnosis of calcifying tendinopathy had to be established by analysis of standard radiographs or ultrasonograms, or both, of the shoulder, with morphologic type I and type II deposits corresponding to the classification of Gartner and Simons.<sup>16</sup> We excluded trials involving patients with evidence of a rotator cuff tear (physical examination, ultrasonographic, or magnetic resonance imaging), systemic inflammatory disorders, previous surgery to the shoulder, shoulder instability, neurologic disorders or dysfunction of the upper limb, ESWT/needling within the last year, acute bursitis, and osteoarthritis of the glenohumeral or acromioclavicular joint.

### Interventions

Six interventions were included: ESWT, radial SWT (RSWT), ultrasound-guided percutaneous needling, transcutaneous electronic nerve stimulation (TENS), laser therapy, and ultrasound therapy. SWTs can be classified according to the amount of energy released by the sonic pulses expressed as energy flux density (EFD) in  $\text{mJ}/\text{mm}^2$ .<sup>38</sup> There is no universal agreement concerning the thresholds of these subdivisions. For the present study, we distinguished between low-energy SWT having an EFD of  $<0.20 \text{ mJ}/\text{mm}^2$  and high-energy SWT having an EFD of  $>0.20 \text{ mJ}/\text{mm}^2$ .<sup>5,61</sup>

### Outcome measures

This study focused on outcome measures for pain, shoulder function, and change of the size of the calcific deposit pertaining to the effect of the different treatments for calcifying tendinopathy of the rotator cuff.

### Search strategy for identification of studies for this review

To identify all studies pertaining to the treatment of calcifying tendinopathy of the rotator cuff in adults, the following databases were searched: Medline (1966 to May 2013), Cochrane Database of Systematic Reviews (1988 to May 2013), Cochrane Clinical Trial Register (1988 to May 2013), PEDro (1988 to May 2013), CINAHL (1988 to May 2013), and Embase (1988 to May 2013). A range of keywords relevant to the review was grouped into four categories to maximize the search result. The PubMed/Medline search is defined in Table I. The search was independently performed by two reviewers (J.L. and I.S.).

The "find similar" function in Medline and Embase and references of retrieved publications were also used to add studies potentially meeting the inclusion criteria that were missed by the electronic search. Papers outside the English language were considered if translation was possible. Abstracts from scientific meetings, unpublished reports, and review articles were excluded.

### Methods of the review

#### Selection of trials

Trials were selected by reviewing the title and abstract to identify potentially relevant articles for our review. The full manuscript

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