J Shoulder Elbow Surg (2014) 23, 1843-1851

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Extracorporeal shockwave therapy improves short-term functional outcomes of shoulder adhesive capsulitis

Chih-Yu Chen, MD[a,b], Chia-Chian Hu, BS[b], Pei-Wei Weng, MD[b], Yu-Ming Huang, MD[b], Chang-Jung Chiang, MD, PhD[b], Chia-Hsien Chen, MD[b], Yang-Hwei Tsuang, MD, PhD[b], Rong-Sen Yang, MD, PhD[c], Jui-Sheng Sun, MD, PhD[c,d,*], Cheng-Kung Cheng, PhD[a,]**

[a]*Department of Biomedical Engineering, National Yang-Ming University, Taipei, Taiwan*
[b]*Department of Orthopedics, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan*
[c]*Department of Orthopedic Surgery, College of Medicine, National Taiwan University, Taipei, Taiwan*
[d]*Department of Orthopedic Surgery, National Taiwan University Hospital Hsin-Chu Branch, Hsin-Chu City, Taiwan*

Background: The treatment of adhesive capsulitis is a dilemma for orthopaedic rehabilitation specialists. In this study, we assessed whether extracorporeal shockwave therapy (ESWT) improves the functional outcome of primary shoulder adhesive capsulitis.

Methods: In this prospective, randomized, controlled, single-blind clinical trial, we enrolled 40 patients with primary adhesive capsulitis to assess whether ESWT can improve the functional outcome of primary adhesive capsulitis better than oral steroid therapy. Patients were allocated to the oral steroid group or ESWT group with randomization. Functional outcome evaluations were performed using the Constant Shoulder Score (CSS) and Oxford Shoulder Score.

Results: Both groups showed significant improvement in the Oxford Shoulder Score evaluation throughout the study period. In the ESWT group, the total CSS and range of motion (ROM) parameter of the CSS in the ESWT group showed significant improvement from the fourth week that was better than that in the steroid group; the activities–of–daily living (ADL) parameter of the CSS achieved significance and was better than that in the steroid group at the sixth week. For the steroid group, pain was significantly reduced from baseline to the fourth week of the study; ADL and ROM improved at the fourth to 12th week. For the ESWT group, ADL and ROM improvements were significant from baseline to the sixth week.

Conclusion: Our results showed that ESWT can be an alternative treatment, at least in the short-term, for primary adhesive capsulitis of the shoulder. In addition, all of the side effects of ESWT were transient and tolerable.

This study was approved by the Joint Institutional Review Board (TMU-JIRB-201206038) of Taipei Medical University.

*Reprint requests: Jui-Sheng Sun, MD, PhD, Department of Orthopedic Surgery, College of Medicine, National Taiwan University, No. 1 Ren-Ai Road, Taipei 10051, Taiwan. or Cheng-Kung Cheng, PhD, Department of Biomedical Engineering, National Yang-Ming University, No. 155, Sec. 2, Linong Street, Taipei, 11221 Taiwan.

E-mail addresses: drjssun@gmail.com (J.-S. Sun) or ckcheng@ym.edu.tw (C.-K. Cheng).

http://dx.doi.org/10.1016/j.jse.2014.08.010

Level of evidence: Level I, Randomized Controlled Trial, Treatment Study.

Keywords: Adhesive capsulitis; extracorporeal shockwave therapy (ESWT); oral steroids; functional outcome

Adhesive capsulitis is characterized by painful, gradual loss of active and passive shoulder motion resulting from fibrosis and contracture of the joint capsule. Shoulder motion occurs in multiple planes of movement, and loss of shoulder mobility can result in significant functional impairment. Primary adhesive capsulitis is defined as adhesive capsulitis that has no definite etiology, such as full- and partial-thickness rotator cuff tears, calcific tendinopathy, glenohumeral or acromioclavicular arthritis, and cervical radiculopathy.[13,25]

The treatment and evaluation of a stiff and painful shoulder, characteristic of adhesive capsulitis, or ''frozen'' shoulder, is a dilemma for orthopaedic rehabilitation specialists. Treatment options including benign neglect, home-based and supervised physical therapy, oral and intra-articular corticosteroid injections, closed manipulation, and arthroscopic capsular release.[12] The traditional treatment approach to restore shoulder mobility emphasizes mobilization of the shoulder overhead. Forced elevation in a stiff and painful shoulder can be painful and potentially destructive to the glenohumeral joint.[7] Most patients improve with nonsurgical treatment. Failure to obtain symptomatic improvement and the presence of continued functional disability after 6 months of physical therapy are general guidelines for surgical intervention. Diligent postoperative therapy to maintain motion is required to minimize recurrence of adhesive capsulitis.[22,25]

In most cases, adhesive capsulitis is a self-limiting condition of poorly understood etiology that results in shoulder pain and large mobility deficits. In addition, both the prevalence and incidence of adhesive capsulitis are increasing. The natural history of adhesive capsulitis, though typically described as a self-limiting disease process, is not completely understood. Some physiotherapeutic interventions show evidence regarding reducing pain or increasing mobility; there is little evidence to suggest that the disease prognosis is affected, and this raises the need for new, innovative research in the area of adhesive capsulitis and its treatment.[30]

Extracorporeal shockwave therapy (ESWT) has been used in soft-tissue disorders including lateral epicondylitis, plantar fasciitis, and calcific tendinitis of the shoulder.[8,26,33] ESWT stimulates soft-tissue healing, increases blood flow to the treated site, and induces an inflammatory-mediated healing process.[8,27,33] In addition, ESWT has been successfully introduced in the treatment of Dupuytren contracture.[18,23] Because Dupuytren contracture shares a similar pathogenesis with adhesive capsulitis of the shoulder,[15,18,31] we believe that ESWT could be another optimal alternative treatment for primary shoulder adhesive capsulitis.

The purpose of this study is to compare the treatment effects and evaluate the short-term functional outcomes between ESWT and oral steroids for shoulder primary adhesive capsulitis. Our hypothesis is that ESWT will reduce pain, facilitate range of motion (ROM) recovery, and increase the ability to perform activities of daily living (ADL) and thus result in short-term functional outcome improvement in patients with primary adhesive capsulitis.

Materials and methods

This study was a prospective, single-blind, randomized clinical trial, in which the investigator who performed the functional evaluations was blinded from the group assignment and from the randomization procedures. From July 2012 to June 2013, 52 patients with adhesive capsulitis from Shuang-Ho Hospital, New Taipei City, Taiwan, were enrolled in the study. The inclusion criteria were patients older than 18 years with shoulder pain and restriction in ROM (>75% ROM loss in ≥2 directions, ie, abduction, flexion, external rotation, and internal rotation)[3,22] for a duration of at least 3 months and in whom no treatment other than analgesics was prescribed within the past 3 months. In all patients, shoulder radiographs, soft-tissue sonography, and/or shoulder magnetic resonance imaging studies were obtained at least 2 weeks before the beginning of enrollment in the study. We excluded 12 patients with secondary adhesive capsulitis due to rotator cuff problems (3 patients), calcifying tendinitis (3 patients), secondary arthritis (3 patients), fracture (2 patients), or cerebrovascular accident (1 patient). The demographic data of the patients are presented in Table I. Our sample size determination was based on an assumed study power of 80% ($\beta = .5$), a significance level of 5% ($\alpha = .05$), and a predicted difference of 1.0 SD (ie, ±1.0 SD) in mean changes in the measured variables between the 2 groups. Using these parameters and adjusting our α for multiple comparisons, we required approximately 15 patients per group.

Functional outcome evaluations with the Constant Shoulder Score (CSS) and the Oxford Shoulder Score (OSS) were performed at baseline (before treatment), the second week after the first treatment (during treatment), the fourth week after the first treatment (after treatment), and the sixth and 12th weeks after the first treatment (short-term follow-up).[10,20,27] All patients signed an informed consent form before treatment and were trained by a nursing specialist at each follow-up to follow a home-based exercise physical therapy program including passive shoulder rotation, pendulum exercise, shoulder elevation, towel-stretch