

## Supraspinatus Repair Using Extracorporeal Shock Wave Therapy – A Case Report

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### Abstract

**Objective:** To determine, in a case study of a patient with a supraspinatus tear, if a tear with no healing for several years can be healed with shock wave therapy. Design- Single subject case study. The subject was a 43-year-old male (height 172.7 cm, weight 65.1 kg) who was referred to physical therapy for right shoulder discomfort and pain. Per his report, the first occurrence was 15 years ago while playing in a football game.

**Results:** The patient was requested to start physical therapy using extracorporeal shock wave or FOCUS wave therapy. The FOCUS was directed at the belly of the supraspinatus tendon. The patient was treated for 4 weeks, 2 times per week which included 8 treatments. The subject regained full pain-free PROM, AROM, strength & stability throughout the right shoulder after eight treatment sessions over four weeks. He was able to return to full activities which included reaching behind and overhead activities such as throwing a football. Patient DASH scores after treatments were 100/100.

**Conclusions:** Although this was a case study, focused pulse wave technology has been used to reduce inflammation in disorders such as plantar fasciitis. It has not been used to heal rotator cuff tears. This technology may offer a good potential tool for healing partially torn tendons.

**Keywords:** Extracorporeal shock wave; Rotator cuff damage, Partial supraspinatus tear

### Introduction

Rotator cuff tears are a major cause of pain during activities of daily living. Rotator cuff tears are a widespread musculoskeletal pathology and a major cause of shoulder pain [1]. They are seen in 30–50% of the general population older than 50 years of age [2]. The impact of this condition on earnings, missed workdays, and disability payments is high [2]. Multiple factors can contribute to rotator cuff tears including familiar genetics, overuse, mechanical impingement, age-related degeneration and micro trauma and smoking [2-6]. Family genetics that predispose injury can extend out past second cousins [7]. The most common rotator cuff tear is

the supraspinatus tear [8].

Multiple tests are used to diagnose supraspinatus tears including the full can and empty can and the zero-degree abduction tests [9]. Together they have diagnostic value but these tests have difficulty distinguishing between partial and full thickness tears [10]. Further, full thickness tears usually enlarge over time whereas partial thickness tears can also enlarge but sometimes do not as assessed by MRI [11]. However, when the shoulder was repaired, most were still repaired 10 years later [12]. The long term follow-up of rotator cuff injuries shows that physical therapy is just as effective as surgical repair in shoulder injuries when looking at the results one year later [13]. With physical therapy approximately 1/3 of people had an enlargement in tear size 1 year later [13]. Smaller symptomatic full-thickness tears have been shown to have

a slower rate of progression, similar to partial-thickness tears [6].

Exercise with physical therapy has been touted as a good means to repair full and partial thickness tears. But a recent review indicates that the evidence is poor for the effective use of exercise due to poor methodologies in the research articles that make them not reliable [14]. In multiple studies there was no clear advantage to physical therapy compared to surgical intervention in healing rotator cuff tears. But no clear and consistent type of physical therapy program has been tested repeatedly.

A newer type of intervention is called a pressure wave and it is also known as an extracorporeal shock wave [15]. It has been used clinically for over 20 years, but only recently used in the United States [16]. It can use ultrasound pulses or electromechanical pressure waves. It is in two forms, both using ultrasound. One is radial in which the sound dispersed over a large area [17]. This mode has lower power compared to the more focused ultrasound shock wave therapy and the power which is usually electrohydraulic and generates a radial pressure wave [17]. Radial shock waves may be better for reducing spasticity [18]. High pressure shock waves (focused extracorporeal shock waves) (F-SW) have enough power to disrupt tissue and cause a healing response [19]. High energy F-SW ( $> 0.5 \text{ J/mm}^2$ ) can be used to destroy tissue, such as kidney stones in lithotripsy. F-SW devices used in physical therapy offer low and medium energy F-SW ( $0.01\text{-}0.55 \text{ mJ/mm}^2$ ) [20,21]. F-SW damages tissue to cause an inflammatory response [20,21]. These high power devices are much more effective than the radial machines for reducing inflammation in the plantar fascia and other areas it has been shown to be beneficial [19,22]. It has been shown to be effective for tennis elbow [23,24]. It can be used to reduce inflammation [25] and aid in tendon repair and bone growth [26]. They have also been shown to benefit Achilles tendonitis [15]. F-SW has not been used to stimulate supraspinatus repair. The hypothesis to be tested here is that shock wave therapy can repair supraspinatus tears. This is a case report using ultrasound imaging to assess the extent of the repair.

### Case Description: Subject History and Systems Review

The subject was a 43-year-old male (height 172.7 cm, weight 65.1 kg) who was referred to physical therapy for right shoulder discomfort and pain. Per his report, the first occurrence was 15 years ago while playing in a football game. After he threw a football, he felt immediate pain and weakness in the right arm and left the game experiencing severe pain in his right shoulder. After several weeks he made an appointment with an orthopedic surgeon. The physician ordered an MRI which demonstrated a 1.4mm partial rotator cuff tear of the supraspinatus tendon. The patient elected not to have surgery to repair the rotator cuff tear.

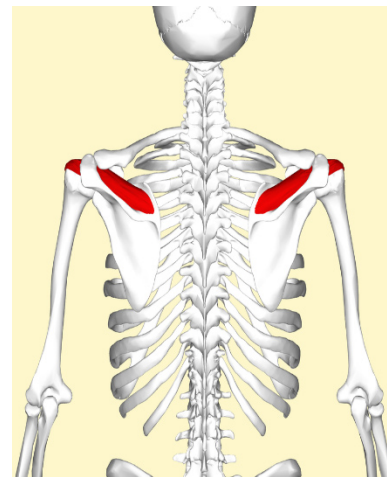
**Examination** The subject complained of a dull ache in the right shoulder at rest and noted severe sharp pain when reaching to the

right and back and attempting to get something out of the back seat of his car. He also complained of sharp pain when he raised his arm overhead in a throwing motion.

**Evaluation:** The subject demonstrated two positive Impingement tests, Neer and Hawkins/ Kennedy [27-30]. Manual muscle testing indicated weakness of the infraspinatus, teres minor, subscapularis manual muscle test grade of -3 and pain and weakness of the supraspinatus. Active Range of Motion (ROM) was measured to be 150 degrees of flexion and abduction. Passive ROM was limited by pain to 160 degrees of flexion and abduction.

Diagnostic ultrasound was used to determine the location and size of the rotator cuff tear. The ultrasound findings indicated a 1.4 cm partial thickness tear of the supraspinatus. Patient's DASH scores were 78.3/100 initially [31,32].

**Treatment:** The patient was requested to start physical therapy using extracorporeal shock wave or FOCUS wave therapy (Chattanooga electronics, Chattanooga Tennessee). The FOCUS was directed at the belly of the supraspinatus tendon. The supraspinatus tendon is difficult to reach. Based on anatomical landmarks the FOCUS was placed on the area of the shoulder between the clavicle and the spine of the scapula (Figure 1). The proximal portion of the acromion was palpated, the FOCUS was held on the soft tissue during each treatment session. To determine the exact area of dysfunction the patient reported a deep ache during the entire treatment session lasting 10 minutes. The FOCUS is an electromagnetic beam that can target tissues at varying depths, of 13 cm, 9 cm or 6 cm (Figures 2 and 3). For this treatment the depth of the electromagnetic beam was set on 13 cm with 35-40 jewels of energy. The patient was treated for 4 weeks, 2 times per week which included 8 treatments. At each treatment session the patient experienced a deep dull ache when the FOCUS was directly over the damaged supraspinatus tissue.



**Figure 1:** The location of the FOCUS beam during the treatment, between the spine of the scapula and the clavicle.



Figures 2 & 3: The central beam opening FOCUS on the proximal soft tissue just proximal to the acromion.

**Outcomes:** A second diagnostic ultrasound was performed demonstrating resolution of the 1.4 cm tear of the supraspinatus tendon (Figures 4 & 5). The subject regained full pain-free PROM, AROM, strength & stability throughout the right shoulder after eight treatment sessions over four weeks. He was able to return to full activities which included reaching behind and overhead activities such as throwing a football. Patient DASH scores after treatments 100/100.

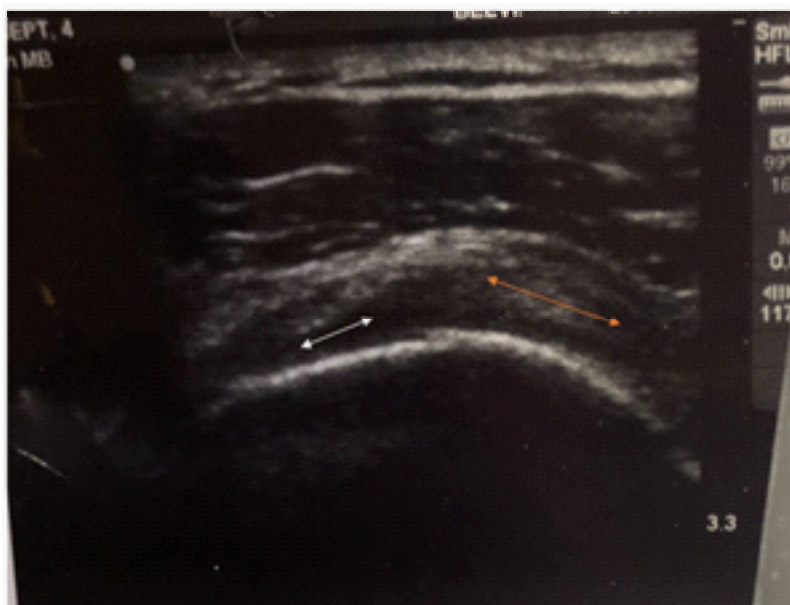


Figure 4: Illustrated here is the Supraspinatus showing a 1.4 cm tear as illustrated by the arrow.





Figure 5: healed supraspinatus tendon.

## Discussion

In this pilot study on one patient, a Focus beam was applied to the skin above the torn supraspinatus to induce an inflammatory response and tissue healing. High pressure shock waves (focused extracorporeal shock waves) have enough power to disrupt tissue and causes healing in response [19]. It has been shown to be helpful for a frozen shoulder [33]. It has been successfully used for lower back pain [34]. It has been shown to reduce tendinosis on calcified and non-calcified shoulders [35]. In dogs, it was shown to be effective in shoulder tendinitis and tears [36]. The majority of the papers on the shoulder show success between 65 and 91% in reducing pain and tendonitis [37] in human shoulders but no papers examined the effect of shock wave on healing torn tendons.

In the present investigation, while only a pilot study, we demonstrated significant healing of a torn supraspinatus tendon. Due to the chronic nature, and potentially devastating effects of rotator cuff tears, little has been written regarding comprehensive rehabilitation of the condition. With the healing effects of the FOCUS regaining full upper body range of motion, strength, and pain free movements in all body planes was possible. Since there had been no healing for years before this study, the rapid healing due to F-SW therapy makes it an interesting therapy and unique therapy. In other studies in lab animals and humans, some repair of tendons has been noted with shock wave therapy [38,39]. Shock wave has been shown to increase tenocyte proliferation and extracellular matrix metabolism in tendons [26]. The energy added to tissue is presumed to do minor damage which increases healing [40]. But these animal studies have not been replicated in humans. This pilot study may be the first study to do so and points to the need for more research.

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