



Case Report

Radial Pressure Wave Therapy Demonstrated Healing in Three Soft Tissue Structures

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Abstract

Radial pressure wave therapy (RPW) has been effective in many soft tissue injuries. It is believed to function through activation of the repair process of soft tissue. There is more research needed in different anatomical structures to determine the role of RPW in healing. RPW has not been used on superficial abdominal fascia tear, medial collateral ligament sprains, or ankle sprains. Therefore, these three case reports analyse the healing effect of RPW can have on ligaments and fascial tissue. Three patients were referred to physical therapy for various soft tissue injuries. Diagnostic ultrasound revealed a disruption of various soft tissue injuries to include, the anterior talofibular ligament, the medial collateral ligament at the knee and the superficial abdominal fascial. In all three cases, RPW was initiated directly to the injured areas, along with eccentric exercises. Ultrasound imaging was taken at the end of treatment, showing significant healing of all three soft tissue structures. Additionally, the patients reported pain and function including strength and stability were greatly improved. Although these were case reports in three individuals with soft tissue injuries, the result indicated that RPW may offer a solution to heal soft tissue disruption.

Keywords: Radial pressure wave; Extracorporeal shockwave therapy

Introduction

In recent years there has been a significant global uptake in the clinical use of extracorporeal shockwave therapy (ESWT) [1]. This has been largely due to the quality and quantity of contemporaneous evidence supporting this modality in the management of musculoskeletal conditions [1]. There are two different methods that provide extracorporeal shockwave therapy (ESWT): focused shockwave therapy (FSW) and radial pressure wave therapy (RPW). FSW produces true shockwaves that penetrate deep into tissue [1]. RPW produces pressure waves that reach a lower peak pressure over a longer period [1,2]. Consequently, the maximum energy is applied to the skin, as opposed to deep in the tissue with FSW, and then attenuates as it travels through the

tissue [1]. While there is limited literature on RPW use, studies have concluded that there is not a major clinical difference for outcomes between the two [1,3]. RPW may be beneficial because ultrasound guidance and anesthesia are not necessary [2]. RPW has been studied in plantar fasciopathy, Achilles tendinopathies, calcific rotator cuff tendinopathies, and wound healing [4,5]. However, more research needs to be done regarding this treatment method, including utilizing the modality in other pathologies. RPW is not entirely understood, but is believed to activate repair processes of connective tissue [6]. Animal research showed that ESWT can promote acute muscle healing in rats [7]. During this intervention, mechanical transduction is induced, which is the mechanism by which cells sense mechanical signals, adapt their biological activity, influencing cell migration, proliferation, differentiation, and apoptosis [8]. More recent research has shown that mechanical transduction can influence Mesenchymal Stromal Cell (MSC) activity [9]. Mesenchymal stromal cells have been

used for cell-based therapy in regenerative medicine due to their propensity to home towards damaged tissue and act as a repository of regenerative molecules that can promote tissue repair and exert immunomodulatory effects [7,9]. As previously mentioned, there is now a high volume of publications on ESWT with fewer studies focusing on RPW as compared to FSW. There have been significant positive outcomes indicating its use both mechanistically and clinically. However, research on different structures is needed to expand the uses of RPW, moving beyond its current uses. Therefore, the purpose of this study was to consider the effects of using RPW in the management of structures that have not been utilized in the current literature. Three case studies are reported on: an abdominal fascia tear, a medial collateral ligament sprain, and anterior talofibular ligament sprain.

Case 1: Medial Collateral Ligament Sprain

A 34-year-old woman presented with a medial collateral ligament partial tear. The patient described falling on her left knee and feeling pain immediately. After resting for several days, the patient reported instability and pain, resulting in an inability to walk. She was referred to physical therapy. The initial evaluation included a positive valgus stress test for pain and instability of the medial collateral ligament. Patient's initial Lower Extremity Functional Scoring (LEFS) was 1.3%, showing disability. An ultrasound was performed and grade 2 strain was diagnosed (Figure 1). Patient was started on RPW with a bar of 2.5. The Pressure wave was applied 3 times per week for 4 weeks for a total of 12 sessions. Exercises included eccentric loading to the quadriceps and the lower limb. The ligament demonstrated significant healing. The valgus stress test was performed again after the treatment. After the 12 sessions the valgus stress test was negative, and the soft tissue healing was noted in the ultrasound (Figure 2). The final LEFS score was 98.8%. The overall difference on LEFS was 97.5%.

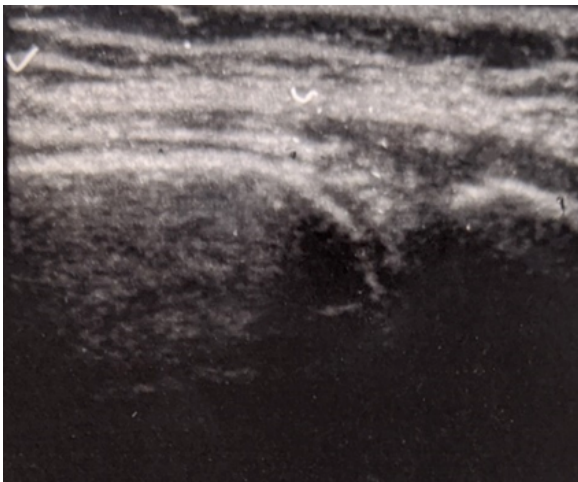


Figure 1: Initial Ultrasound after injury demonstrating a medial collateral ligament grade 2 sprain.

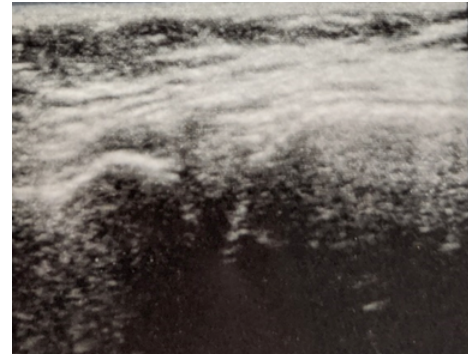


Figure 2: Medial Collateral Tear after 12 sessions of RPW.

Case 2: Camper's Fascia Tear

An 11-year-old gymnast performed a kip up on the uneven bars and complained of pain in the left abdominal area. The gymnast was in severe abdominal pain and was unable to continue in the gymnastic meet. After several days rest the patient was feeling less pain with daily activities, however she was unable to before any gymnastic activities without significant pain. The ultrasound demonstrated a strain to the superficial fascia or Camper's fascia (Figure 3). Patients initially was unable to perform activities of daily living without severe pain. The patient was started on RPW treatments with a Bar of 2.5. After 15 treatments with the (RPW) radial pressure wave the tear was no longer visible on ultrasound (Figure 4). The gymnast returned to performing pain free skills.

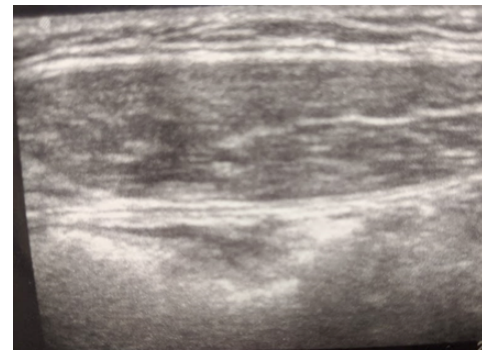


Figure 3: Initial ultrasound demonstrating the deficit in the left fascial tissue.

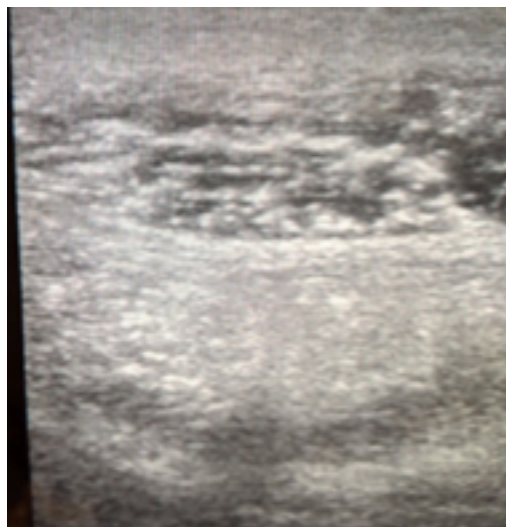


Figure 4: After 15 pressure wave treatments, the left abdominal fascial tissue was resolved.

Case 3: Anterior Talofibular Ligament Sprain

A young volleyball player demonstrating a severe ankle sprain tear of the anterior talofibular ligament. The patient jumped and landed on her fellow player's ankle. The patient was in immediate pain and the patient noticed significant swelling. Ice and compression were initiated, and the patient was taken to an emergency room at the nearby hospital. She was referred to an orthopaedic surgeon. The surgeon diagnosed a 3rd degree ankle sprain with detachment of the anterior talofibular ligament from the talus (Figure 5). The surgeon elected not to go to surgery because of the patient's young age and he referred her to physical therapy. Patient's initial LEFS was 0%, showing full disability. The patient was started on RPW treatments. After 12 treatments, the anterior talofibular ligament reattached to the talus (Figure 6). The patient started proprioception training using the Balance Shuttle. After two months of rehabilitation the patient returned to volleyball. The final LEFS score was 96.3%. The overall difference on LEFS was 96.33%.

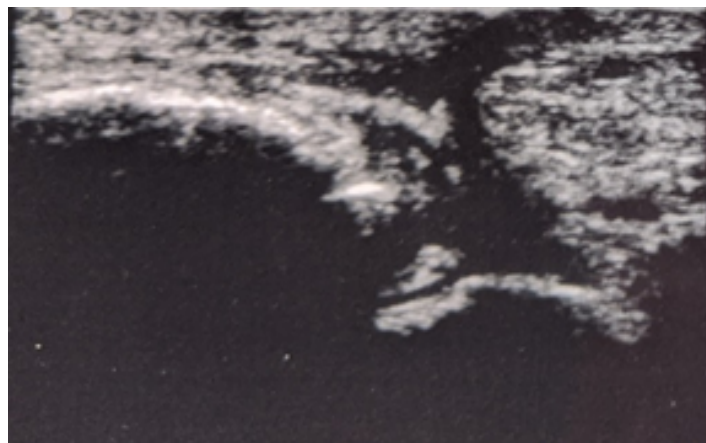


Figure 5: Initial ultrasound demonstrating tear of the anterior talofibular ligament.

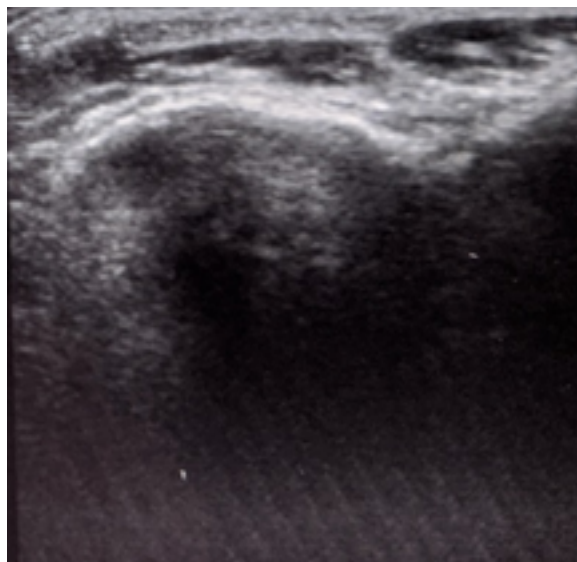


Figure 6: Ultrasound after 12 treatments demonstrating significant healing of the ligament.

Discussion

In these three case reports, RPW was applied to the skin above various soft tissue injuries including medial collateral ligament, superficial abdominal fascia, and anterior talofibular ligament. The use of RPW along with eccentric loading exercises showed healing of all three of the structures as demonstrated through ultrasound findings of improvement of the tears. Additionally, LEFS scores, patient pain, and patient activity level including strength and stability all were significantly improved using RPW. This is significant as RPW has not been used in these structure to our knowledge. With recent uptake of this treatment, is it important to analyse what structure RPW demonstrates success in treating. This further defines the use of this technology and widens the scope for future utilization. Additionally, the treatment of the studied injuries has not been set. The findings in this initial study demonstrate the potential benefit of using RPW for soft tissue healing. To our knowledge, RPW has never been used in these three structures. However, this is a case study and thus the healing of these structures cannot be compared to other treatment methods. This demonstrates the need for more studies on the use of RPW in soft tissue injuries including placebo-controlled trials.

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