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Use of Class IV, High Intensity Laser Therapy as an Adjunct in Treating a Patient with an Acute Shoulder injury: A Case Report

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Abstract

Background: The use of high intensity laser therapy (HILT) in treating musculoskeletal conditions is used in some physical therapy clinics but is not widespread. The purpose of this case report is to present a case in which class IV, high intensity laser therapy was used successfully to treat a patient with acute shoulder pain. Furthermore, the author aims to present evidence supporting the use of high intensity laser therapy as a supplement to conservative interventions in patients with musculoskeletal injuries. **Case Description:** A 25-year-old female presented to physical therapy by referral from a work compensation physician with shoulder pain after a fall approximately 2 weeks prior to the initial visit. **Intervention:** Treatment consisted of education, upper extremity range of motion (ROM) techniques, strengthening, soft tissue mobilization, stretching, and various modalities – primarily class IV, high intensity therapeutic laser. **Outcomes:** Following the interventions, the patient demonstrated an increase of 20 points on the Focus on Therapeutic Outcomes (FOTO) questionnaire representing improved functional status. The patient also demonstrated improved pain free active ROM, raised her perceived level of improvement score by 60%, and had a notable decrease in pain levels. **Discussion:** A literature review using PubMed and UpToDate on the efficacy of class IV, high intensity therapeutic laser for treating musculoskeletal injuries was performed. Further research is needed to determine the optimal parameters of high intensity laser in treating musculoskeletal conditions; however, the randomized controlled trials (RCTs) mentioned in this case report show HILT as an effective treatment modality. This case report supports the use of high intensity laser therapy in conjunction with physical therapy intervention to improve ROM, pain levels, and overall functional status.

Background

Low level laser therapy (LLLT) or class III 'cold lasers' are a modality that have been available to physical therapy providers since the early 1980s. Laser therapy is a non-invasive modality used to generate a photochemical response in dysfunctional tissue. The therapeutic component of laser therapy involves photobiomodulation, which aims to stimulate cell proliferation and decrease inflammation. Infrared wavelengths (600-1000 nanometers) emit photons which are scattered, reflected, absorbed and can often times be felt as a heat during treatment. With mitochondria stimulated, downstream effects of increased adenosine triphosphate (ATP) for energy and nitric oxide (NO) for vasodilation are produced. Anti-inflammatory effects include changes in biochemical markers, altered distribution of inflammatory cells, and reduced formation of edema, hemorrhage, and necrosis. In total, the primary aim of laser therapy is to reduce inflammation and accelerate the recovery of damaged tissue.¹

Parameters involved in therapeutic laser dosage are power output, wavelength and time. Power units for a laser are watts (W), which is a measure of the number of photons emitted from the laser each second. Simply stated as power increases, the amount of photons penetrating the tissue surface increases for a given amount of time. Energy density is measured in Joules/centimeters² (J/cm²), while total energy = W x Time. Higher power output, at longer wavelength, over a longer period of time results in greater therapeutic dosage to tissue. A clinician may use this to their advantage to treat multiple areas or larger surrounding areas in a time efficient manner. The World Association of Laser Therapy (WALT), along with other institutions, have established that target tissues need a therapeutic dose of 5-7 J/cm² to elicit a biological cellular response. Factors which can reduce the dose reaching the tissue include what's absorbed in the skin and fat layers prior. Since it's impossible to directly measure what's delivered to the target tissue, instead it's measured by dose delivered to the treatment area. Parameters for calculating the laser therapy dose or total energy, involve the size of the area in cm² and the target dosage (5-7 J/cm²). Total energy = target dosage (5-7 J/cm²) x Treatment Area (cm²).

There are two types of lasers which are being used in physical therapy today: class III or low level laser therapy (LLLT) and class IV or high intensity laser therapy (HILT). Class III lasers can only deliver up to .5 W, whereas Class IV lasers have a higher output power of .5 W and greater. Therefore, class IV lasers have the advantage over class III because they can deliver larger therapeutic dosages in less time. The use of class IV lasers were developed more recently, cleared by the Food and Drug Administration (FDA) in 2003, and its use in practice has since grown.

As class IV, high intensity laser therapy remains a relatively new treatment option for physical therapists, the purpose of this case report was to describe the examination procedures and clinical decision making process for incorporating class IV laser therapy as a supplemental modality in treatment in a young woman with acute shoulder pain. Furthermore, a review of the evidence supporting the use of class IV, high intensity laser therapy for musculoskeletal injuries was performed.

Case Description

History

A 25-year-old female presented to physical therapy two weeks after suffering a fall after slipping on some water in the restroom at work. She worked as a project manager supervising engineers and was referred to physical therapy by the worker's compensation physician, with a diagnosis of left shoulder pain and decreased range of motion. Her physician authorized 2-3 visits per week until her follow-up medical appointment (2 weeks later). Furthermore, she was given no restrictions for her work status.

At the initial evaluation, the patient reported she slipped on some water while in the restroom causing her to land directly on the front of her left shoulder. She stated that she did not have immediate pain, but the following few days her pain grew worse and she had increasing difficulty with movement. She explained her pain to be deep inside the shoulder and on the anterior aspect when

touched. She rated her pain both at rest and at best a 3/10, and at worst a 9-10/10 over the previous 24 hours. She reported her pain increased to 9-10/10 levels while reaching overhead and lifting items. At times her pain would increase to 9-10/10 at night when sleeping on her left side, which would wake her up. The pain was typically dull and achy in nature, but on occasion when her pain was high she would experience shooting pain down into the elbow. She denied any numbness or tingling.

The patient denied a previous history of injury or trauma to the left shoulder, neck or back. She had no previous limitations in her functional and work related activities prior to injury. She felt she was severely limited in lifting and functional reaching, and described herself as moderately limited in her ability to reach behind her back. She continued to work with no restrictions, though she found many required work tasks challenging. She could modify her unilateral tasks to her right side, as she is right hand dominant. Radiograph imaging confirmed no fracture at the shoulder area. Her medical history of asthma, obsessive-compulsive disorder, and obesity were remarkable components to take into consideration with physical therapy. The patient had never received physical therapy prior to her first visit.

Clinical Impression #1

The patient reported high pain levels, displayed non-verbal signs of anxiety and lack of confidence in physical therapy. We felt laser would be appropriate because it was a non-invasive approach which could help build the patient's trust and facilitate the relationship as it was a non-invasive and potentially a pain-relieving modality.

Examination and Evaluation

The patient completed a FOTO questionnaire prior to the initial evaluation. This is a self-report assessment generated by a computer-based software. The patient first completed a short assessment about the functional level of the body part (shoulder) that needed treatment, and using those answers the software calculated the initial functional status measure on a scale of 0-100 (higher number = greater % of function). The questionnaire also includes risk adjustment questions (age, acuity, severity, co-morbidities), and these risk factors influence the change in functional status and the predicted outcome. The predicted outcome is the average amount of change in function similar patients in the FOTO database have achieved after treatment at discharge. According to the FOTO website², the FOTO database can identify large sets of patients with similar risk adjustment profiles to the patient at hand. The patient episodes in the FOTO system are categorized by care type, the body part, and/or impairment. Functional status (FS) is the primary measure for patients but a clinician. Per FOTO guidelines, the patient completes the questionnaire/assessment every 5 visits and at discharge to track progress in functional ability during treatment. The patient's actual change in functional status measure, is the subtraction of the score at admission from the score at discharge, representing the change in function during the entirety of treatment. The FOTO also composes comparative benchmark reports at the clinician/clinic level of the number of patients per impairment treated, the final scores at discharge per clinician/clinic, and the amount of visits it took to do so. It has shown good internal consistency (person reliability) and response to a change in functional status, as 94% of the patient population had FS scores where measurement error was least.³ The patient's initial functional status score was a 54, and her risk adjusted score was 51. The number of visits predicted to successfully treat this patient's episode was 12, and the number of days for treatment duration predicted was 53. The FOTO suggested a minimal detectable change (MDC) of 4 points, and a minimal clinically important improvement (MCII) of 5 points.

Upon evaluation, the patient appeared to be anxious about coming to physical therapy and her shoulder injury. She held her left arm pressed to her abdomen with her right upper extremity as she cautiously walked through the clinic into the treatment room. She displayed both verbal and non-verbal signs of pain and uneasiness. For example, the patient would say phrases such as, "give me a couple seconds to prepare" and "I don't like to be touched, but do what you have to." There was no observable bruising, discoloration, or edema of the left shoulder.

Table 1. Initial Examination Summary of Findings

	Left (involved)	Right (uninvolved)
Shoulder Active Range of Motion	Flexion: 105 degrees with pain Abduction: 105 degrees with pain IR at 90 degrees abduction: 10 degrees with a pull ER at 90 degrees abduction: 90 degrees	Flexion: WNL Abduction: WNL IR at 90 degrees abduction: WNL ER at 90 degrees abduction: WNL
Shoulder Passive Range of Motion	Flexion: 110 degrees with pain Abduction: 130 degrees with pain Internal rotation: 30 degrees with pain External rotation: 90 degrees	Not assessed.
Shoulder Gross Strength	Flexion: NA due to pain Abduction: 4/5 with pain Internal rotators: 4/5 with pain External rotators 4+/5	Flexion: 4/5 Abduction: 4+/5 Internal rotators: 5/5 External rotators: 5/5
Joint Mobility	Not assessed due to pain	
Special Testing	Yergason's – positive Speed's Test – positive Clark – negative Clunk Test – unable to fully assess due to pain	
Palpation	Patient was very tender along the bicep muscle belly and long head tendon, and along the surrounding area at the shoulder joint. Pain up to 9/10 with palpation. Very sensitive.	
Numeric Pain Rating Scale – last 24 hours	Current at rest: 2-3 Best: 2-3/10 Worst: 9-10/10	
Perceived level of improvement	30% of pre-injury level	

Clinical Impression #2

We determined from the evaluation that class IV, high intensity laser would be appropriate to try as an adjunct to treatment. Palpation revealed severe tenderness at the biceps and surrounding tissue at the shoulder joint. The aim of using the laser would be to decrease inflammation, pain levels, and improve ROM. After providing education on the intervention, the patient was agreeable to participating in the session. We cleared the patient for any red flags to performing class IV laser treatment, no precautions or contraindications were noted. Contraindications of laser therapy include applying light to abdominal or lumbosacral points in pregnant females, epiphyseal lines in children, thorax or pacemaker in those patients with pacemakers, thyroid gland, ovaries, testicals, over suspected tumors or cancer areas, and to those patients taking drugs causing heat or light sensitive contraindications. Protective eyewear must also be worn by the clinician and the patient in the presence of class IV laser radiation.

Diagnosis and Prognosis

Upon completion of the examination, we concluded the patient's pain was most likely derived from a biceps tendon and muscle pathology. The mechanism of injury suggests a quick stretch to the biceps unit as she fell anteriorly with a high force impact, resulting in tissue injury and remaining inflammation causing pain. Clinical examinations significant to this diagnosis: tenderness to palpation at the biceps structure, painful elbow and shoulder flexion MMTs, and pain with stretching of the muscle unit.

After the initial examination, it could not be ruled out whether a labral glenohumeral pathology was present. We were unable to perform clinical tests which could assess those pathologies, due to the patient's pain levels and anxious presentation.

Intervention

Treatment Session 1

The patient was educated on her physical therapy diagnosis, prognosis, the plan of care, and appropriate activity choices at work. She performed towel slides across the countertop in a pain free AAROM. We performed PROM in all shoulder planes, pain free range of motion on her in supine. The patient was educated on the importance of scapular stability at the shoulder joint and given a home exercise program consisting of scapular squeezes. Class IV laser therapy (980/810nm wavelength, continuous, 4200 J, 14 W, 5 minutes) was applied at the left proximal biceps and surrounding areas of the shoulder. The treatment area measured approximately 600 cm²: therefore, 4200 J (7 J/cm² x 600 cm²) was the required therapeutic dose. This treatment would take 5 minutes using 14 W (4200 J / 14 W = 5 minutes). A large non-contact cone attachment was used because she was sensitive to touch. The focus of this session was education in pain management and work activity modification. With her anxious presentation, it was important to keep interventions pain free to facilitate the therapist-patient relationship.

Treatment Session 2 – 1 day after evaluation

The patient reported her pain levels had not changed. However, she was less sensitive to touch and tolerated a light effleurage along the biceps, pectorals and deltoids. Continued AAROM and PROM exercises were performed in a pain free range to maintain her ROM. As another supplement to manage pain levels, the patient was educated in working up to cold pack tolerance by using wet washcloths stored in the fridge. Class IV laser therapy (980/810nm wavelength, continuous, 4200 J, 14 W, 5 minutes) was used once again, intended to decrease inflammation and pain.

Treatment Session 3 – 5 days after evaluation

The patient AAROM exercises were advanced to wall slides because she was pain free performing countertop slides with no difficulty. We included shoulder isometrics that were pain free, external and internal rotation, to facilitate shoulder stability. We continued with the scapular squeeze exercises to build a good foundation of scapular strength. Isometrics and wall walks were added to her HEP. The patient demonstrated improved PROM measurements: flexion at 140 degrees, abduction to 130 degrees, and internal rotation up to 45 degrees with mild pain. Class IV laser therapy (980/810nm wavelength, continuous, 4200 J, 14 W, 5 minutes) was implemented again.

Treatment Session 4 – 6 days after evaluation

The patient reported her shoulder felt less achy overall. Since the patient tolerated laser therapy, the same treatment parameters were performed again. Interventions consisted of the same as those given in treatment 3.

Treatment Session 5 – 8 days after evaluation

At this treatment patient stated her shoulder continued to feel less achy. She felt her scapular region was a little sore from the scapular squeezes. Since the patient appeared to be feeling better, we continued with the same treatment interventions.

Treatment Session 6 – 11 days after evaluation

The patient reported a perceived 80% improvement rating, as she comparing herself to pre-injury state. The treatment interventions consisted of AAROM wall slides, pain free PROM in all shoulder planes of motion, soft tissue massage of the shoulder structures, and pain free internal and external rotation isotonic exercises with yellow resistance tubing. We felt it was appropriate to advance to isotonic exercises because the patient was pain free in various ranges in isometric exercises. In order to increase scapular strength and stability, the patient was advanced to rows emphasizing scapular retraction using yellow tubing. Once again, class IV laser therapy (4200 J at 14 W for 5 minutes) was applied.

Treatment Session 7 – 13 days after evaluation

The patient reported a perceived improvement of 90% back to her pre-injury state. She reported she still felt a pull in the front of her shoulder as she reaches behind her back, and she still was tender to touching the front part of her shoulder. Differential diagnosis was important in this case, as labral instabilities were not ruled out in the initial evaluation. Though the patient reported a pain she felt deep in her shoulder suggesting a labral pathology, because the patient did not report any clicking or clunking we did not suspect this was the root of her injury. Furthermore, her overall pain and functional ROM levels were improving, and because of her anxious presentation in treatment the PT did not want to jeopardize her trust by performing a clunk test. This session we progressed shoulder exercises adding wall push-ups and diagonal pulls in D1/D2 patterns. She also demonstrated improved ROM, performing AROM in all planes of motion within a pain free range. The session concluded with class IV laser therapy at the same previous parameters (4200 J at 14 W for 5 minutes).

Treatment Session 8 – 15 days after evaluation

Subjective report had no significant differences from the previous. Treatment 8 was similar to treatment 7, with the exception of adding the SciFit Arm Ergometer bike to challenge upper extremity musculature endurance.

Treatment Session 9 – 19 days after evaluation

The patient reported she could perform more tasks at work using her left upper extremity pain free, such as reaching across her body for the stapler. Objective measures were documented to report to her physician, as noted in Table 2. Class IV laser was not performed at this treatment because the patient stated she and her husband recently decided to try and become pregnant: pregnancy is a contraindication to laser therapy. Shoulder perturbation exercises were added this session as another means to supplement shoulder stability and proprioception. The patient ended up being discharged from PT by her work compensation doctor a couple days later, and she did not choose to continue therapy by her own means.

Outcomes

The patient was seen for 9 visits over a 19 day period, 3 visits less and 34 days less than what the FOTO predicted for treatment duration. She did not demonstrate complete resolution of symptoms, but demonstrated an improvement in measures noted in (Table 2): AROM, gross strength, VAS levels, special tests, and perceived level of improvement. These measurements were recorded to submit a second progress note to her worker's compensation doctor for her scheduled visit later in the afternoon. The patient was discharged from physical therapy by the physician and documented she continue her home exercise program at home. On her final FOTO assessment, the patient scored a functional

status measure of 74 (compared to a predicted 68), showing 20 points of physical function change at discharge. Her 20 point improvement exceeds the suggested MCII (5) and MCD (4) points initially indicated, suggesting a meaningful improvement in function.

Table 2. Discharge Examination Summary of Findings

	Left (involved)	Right (uninvolved)
Shoulder Active Range of Motion	Flexion: 160 degrees Abduction: 155 degrees IR at 90 degrees abduction: WNL ER at 90 degrees abduction: WNL	Flexion: WNL Abduction: WNL IR at 90 degrees abduction: WNL ER at 90 degrees: WNL
Shoulder Passive Range of Motion	Not assessed.	Not assessed.
Shoulder Gross Strength	Flexion: 4+/5 with pain Abduction: 5-/5 Internal rotators: 5/5 External rotators: 5/5 Bicep: 5/5	Flexion: 4/5 Abduction: 4+/5 Internal rotators: 5/5 External rotators: 5/5
Joint Mobility	Not assessed.	
Special Testing	Yergason's – negative Speed's Test – positive Clark – negative	
Palpation	Patient slightly tender along bicep muscle belly and long head tendon. Less tone overall in pecs, serratus, and trapezius.	
Numeric Pain Rating scale – last 24 hours	Current at rest: 0 Best: 0/10 Worst: 3/10	
Perceived level of improvement	90% of pre-injury level	

Discussion

The purpose of this case report was to present an example of a positive outcome in a patient with acute shoulder pain in which Class IV, high intensity laser therapy was used as an adjunct treatment with traditional exercise and soft-tissue treatments. The use of class IV laser therapy was a significant component of treatment, as it was incorporated into each session but one. Initial purpose for using the laser was to decrease overall pain levels and increase active ROM by decreasing inflammation occurring at the damaged tissues. Once her reported pain levels were lower, it's intended role was to stimulate vasodilatory effects and cell proliferation to continue the healing process as her ROM improved. Outside of laser therapy, initial interventions involved pain free active assisted ROM and scapular stability exercises. As her reported pain levels decreased and ROM levels progressed, active ROM and shoulder strengthening exercises were incorporated appropriately.

Evidence-based Review

Multiple RCTs have concluded that class IV, HILT is a useful modality in treating musculoskeletal conditions with or without additional exercise. Currently there is literature supporting

the use of HILT in cases of osteoarthritis, low back pain, frozen shoulder, and sub-acromial impingement.

Knee Osteoarthritis

A RCT published in *Lasers in Medical Science* in 2014 analyzed HILT vs LLLT on knee osteoarthritis.⁴ Patient population included 53 male patients randomly assigned to three groups: HILT+exercise, LLLT+exercise, and placebo+exercise. For outcomes scales, they used visual analog scale (VAS) and the Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC). As a side note, the WOMAC measures pain, stiffness, and physical function. Each group received the same amount of therapeutic dose (1,250 J), but the delivery time was cut in half for HILT. The intervention period was six weeks, and the exercises included a 10-minute treadmill warm up, straight leg raises, and hamstring/calf stretching. Results showed that HILT and LLLT combined with exercise were effective treatment modalities in decreasing VAS and WOMAC scores after 6 weeks treatment. HILT combined with exercise was concluded to be more effective than LLLT+exercises. Both treatment modalities were better than just exercise.

Another RCT published in the *Journal of Physical Therapy Science* examined the effects of HILT on pain and function in patients with knee osteoarthritis.⁵ Twenty subjects were randomly divided into a control group who received conservative rehab (n=10), and the experimental group who received HILT after conservative rehab. Each intervention was received 3 times each week over a four-week period. Functional and pain outcome scales utilized were the Korean Western Ontario McMaster Universities Osteoarthritis Index (K-WOMAC) and VAS. The comparison of the two groups showed HILT group had statistically significant lower scores in both VAS and K-WOMAC than the conservative group.

Low Back Pain

A 2011 RCT published in the *European Journal of Physical and Rehabilitation Medicine* aimed to evaluate the short-term effectiveness of HILT vs ultrasound (US) in treating low back pain.⁶ Thirty patients were randomly assigned into two groups: HILT and US. Participants did not receive any other PT interventions. Outcome scales used were the VAS and Oswestry Low Back Pain Disability Questionnaire (ODI). Protocol for HILT included 2,600 J administered for 10 minutes. The US group received continuous US for 10 minutes at 2.0 W/cm² and 1MHz. Both modalities given at lumbar musculature in 150 cm² area, 5 days/week for 3 weeks in total. After 3 weeks of intervention, the HILT-therapy group demonstrated significantly greater decrease in VAS scales and improvement in Oswestry scores; therefore, concluding HILT was more effective than US in treating low back pain.

Another 2017 RCT published in the *Journal of Physical Therapy Science* examined the effects of HILT on pain in function of patients with chronic back pain.⁷ Twenty subjects were divided randomly into two groups: conservative rehab and HILT+conservative rehab. Treatment for respective therapies was received three times a week for four weeks. The ODI and VAS were used as outcome measures to evaluate functional status of the subjects. After the intervention, a statistical comparison between the two groups showed the HILT group scored significantly lower on the ODI and VAS.

A 2014 RCT published in *Lasers in Medical Science*, aimed to compare the effect of HILT alone or in combination with exercise in treating low back pain.⁸ Seventy-two subjects were randomly assigned into three groups and treated with HILT+exercise, placebo+exercise, and HILT alone. Outcome measures included lumbar ROM, VAS, functional disability by Roland Disability Questionnaire (RDI) and the Modified Oswestry Disability Questionnaire (MODI). The exercises included strengthening, stretching, mobilizing, coordinating, and stabilizing the abdominal, back, and pelvic muscles, and were personalized for each patient's clinical findings. Laser was performed three times weekly for four weeks, while exercises were performed two times daily. The main finding was that HILT combined with exercise was more effective and had a more prolonged effect (lasting up to 3 months) than placebo laser with exercise, or laser alone. There were larger significant differences in post-

treatment VAS, RDQ, and MODI scores compared with baseline in the HILT group compared to the other two groups (placebo+exercise and solely HILT) at both post-treatment and 12 weeks after.

Shoulder Impingement

A RCT published in 2009 in the *APTA Physical Therapy Journal*, evaluated the short-term effectiveness of HILT vs US in the treatment of subacromial impingement syndrome (SAIS).⁹ Seventy patients were randomly assigned to HILT or US, and received 10 treatment sessions of their respective therapies over two consecutive weeks. Outcomes measurements included the Constant-Murley Scale (CMS) which assesses subjective pain/function and quantitative ROM/strength, VAS, and Simple Shoulder Test (SST) which assesses shoulder function. HILT group received 2,050 J applied for 10 minutes and the US group received 100% duty cycle at 2 W/cm² for 10 minutes. The treatment site was the glenohumeral joint and surrounding tissue. Though there were significant improvements noted pre and post for both treatment groups, the HILT showed greater reduction in pain, more improvement in ROM, function, and muscle strength than those with US.

Frozen Shoulder

A 2015 study published in *Manual Therapy* evaluated the clinical efficacy of HILT in patients with frozen shoulder¹⁰. Sixty-six patients were randomly divided into two groups: HILT (n=33) and placebo laser (n=33). Protocol for the HILT included a therapeutic dose of 4000 J for 15 minutes. Treatments were given three times weekly for three weeks. VAS for pain, VAS for satisfaction, and passive ROM were measured at baseline, three, eight, and 12 weeks after treatment. Overall, the HILT group had significantly lower pain VAS score at three and 8 weeks. There was no significant difference in pain VAS at 12 weeks.

Case Studies

In a report published by LiteCure LLC, Brian Pryor presents a number of case reports showing positive outcomes when a class IV LiteCure laser was utilized to treat multiple clinical conditions.¹¹ These clinical conditions include knee osteoarthritis, lumbar spondylosis, cervical spondylosis, frozen shoulder, plantar fasciitis, leg sprains/strains and post traumatic residual pain. Of the 118 patients total patients, the majority of reported reduced pain following one or two laser sessions. Furthermore, no adverse effects were reported. Overall the author concludes class IV laser therapy provides clinical therapeutic benefits for these acute and chronic diseases.

Conclusion

This case report presents a scenario in which high intensity, class IV laser was used successfully to treat musculoskeletal-based shoulder pain. While a single case cannot prove efficacy of a treatment, this case demonstrates a positive outcome in one specific patient with initially severe pain and high levels of anxiety and distrust. Her outcomes suggest laser therapy may have facilitated the tissue healing process, contributing to her overall improvement. Further investigation is needed to evaluate the use of class IV, high intensity laser therapy in treating musculoskeletal injuries. Currently, the number of publications using class IV, high intensity laser is limited. Future research should focus on the use of this intervention in larger sample groups. Moreover, researchers should continue to study the efficacy of laser with or without conservative physical therapy treatment methods to establish its value as a modality in the clinical setting.

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