

Title: Management of Orthopedic Injuries with the use of Red and Infrared Light Therapy: Three Case Reports

Authors: Anjali Malhotra, MPH, Kevin Setter, MD, SUNY Upstate Medical University, Department of Orthopedic Surgery

Abstract

Background

Red and infrared light therapy (RILT) has been used for various musculoskeletal conditions to improve inflammation and pain for decades. Other management options such as physical therapy and injections may not provide much change in pain. The benefit of using RILT in orthopedic related patients is that it provides a low-risk treatment option for patients while also drastically reducing symptoms.

Case Report

Details of the presentation and management strategies in three individuals including a 50-year-old male with symptomatic discoid meniscus, a 46-year-old male with symptomatic L3 disc herniation, and an 18-year-old collegiate baseball player with disabling right shoulder pain are all included in this report. Due to various reasons, surgical interventions were considered, but chosen against. RILT seemed to be a viable option since all other alternatives failed. In each patient, RILT from an OnLux device was used for approximately 15 minutes, two times per day. Within 4-6 weeks, pain and functionality was significantly improved in the three patients described.

Conclusion

These three cases suggest that RILT has considerable clinical benefit to reduce pain and improve musculoskeletal injuries. We are not insinuating that RILT can heal injuries completely; however, RILT is designed to decrease inflammation and pain, which is important when surgical options are not possible. Further investigation regarding the potential use of RILT should be considered with the goal being to eventually add RILT to existing treatment.

INTRODUCTION

Nonoperative treatment can play a pivotal role in various musculoskeletal injuries. This management option is often the choice of many patients that have orthopedic related issues. It has been found that about 79% of patients who visit orthopedic surgeons do not have surgery within a year and a half of the initial visit (Badley et al., 2013). During this period, it is improbable that the pain has subsided, necessitating the exploration of alternative methods. Some options include non-steroidal anti-inflammatory (NSAIDs) drugs, medicated injections, and physical therapy (Günther et al., 2021). Although these options may work for some duration, some patients do not see improvement from these options. Chronic use of such options has also been shown to have negative health benefits from long-term use (Yasir et al., 2024). A newer alternative that has shown promising results is RILT.

RILT can be described as the use of non-ionizing electromagnetic energy in the form of infrared waves to deliver heat. Electromagnetic energy triggers photochemical changes within cellular structures receptive to photons, which lead to stimulation or inhibition of cellular and biological processes. RILT is carried out with either low-level LASER (light amplification by stimulated emission of radiation) or light-emitting diodes (LEDs) that can modulate cellular functions, resulting in tissue regeneration (Yu et al., 2019), in wound healing, in reduction of pain and inflammation (Cidral-Filho et al., 2013, 2014; Martins et al., 2016), as well as for many neurological benefits like neuroprotection and improved neuroplasticity (Caldieraro & Cassano, 2019).

RILT has been used for a variety of musculoskeletal conditions to improve inflammation and pain for decades. The benefit of using RILT in orthopedic related patients is that it provides a low-risk treatment option for patients while also drastically reducing symptoms. This case study demonstrates these benefits and provides knowledge about RILT by presenting the effectiveness and outcomes of the OnLux device which is a RILT. In the patients discussed, multiple nonoperative treatment options were utilized with little to no success. However, there was a significant improvement in pain and function after using the RILT from the OnLux device.

Case Presentation

Case 1: 50-year-old male with symptomatic discoid meniscus

A 50-year-old male with previous asymptomatic left knee presented with a new onset of pain and “clicking.” The patient endorsed walking at a rest stop, feeling a pop and pain in the lateral aspect of the knee. There was no specific traumatic event, however, the pain started acutely. The patient drove three hours further to their destination and had a difficult time walking secondary to mechanical symptoms and pain lateral aspect of the left knee. Over the next 7- 10 days the pain and mechanical symptoms continued and slightly progressed. Upon returning home, the patient sought treatment with his orthopedist. Examination revealed a mild effusion, mechanical symptoms with full flexion, negative McMurray’s, negative Lachman, pivot shift. Radiographs were interpreted as mild patellofemoral arthritis, squaring of the condyle. (Figure 1). Physical therapy and an MRI were ordered.



The patient participated in 3 months of knee dedicated physical therapy without improvement. The MRI revealed a discoid meniscus with likely longitudinal disruption (Figure 2).



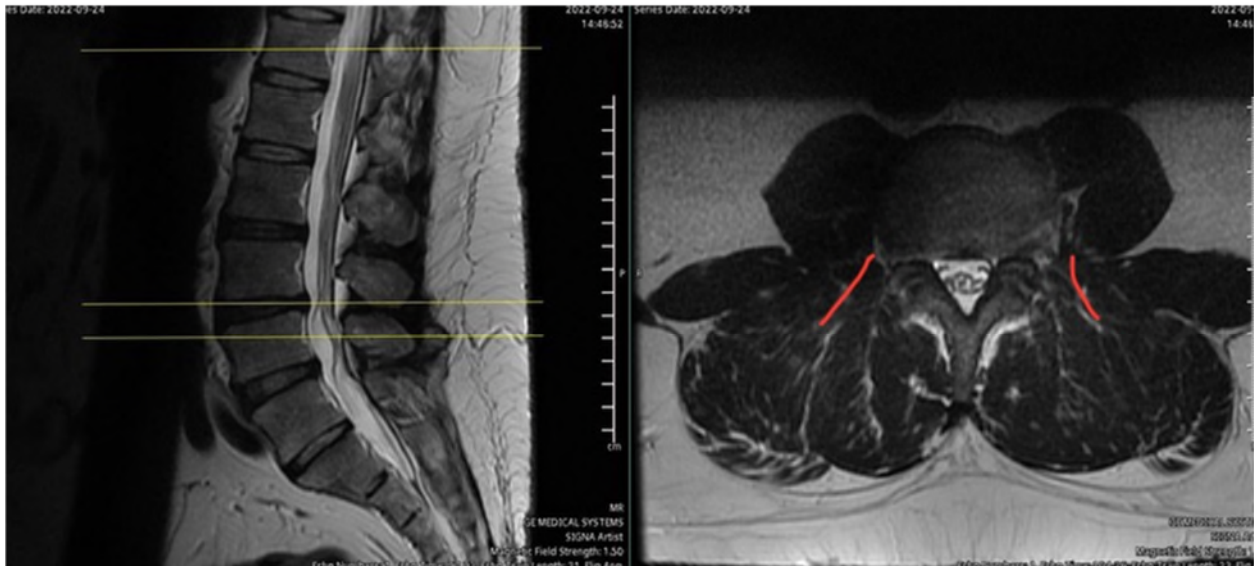
The patient's pain and dysfunction persisted. The decision was made to perform an intra articular knee injection with 80 mg of depo-medrol and lidocaine. Within 4 days the patient reported approximately 50% pain relief with continued occasional mechanical symptoms. This continued for several weeks, however the pain returned to pre injection level. The patient was offered a viscoelastic injection which was approved but he declined. Surgical intervention was discussed and considered. Over the next month the pain increased, mechanical symptoms were still minimal. The patient was offered a trial of OnLux knee device. The pain would wax and wane but would range from 0 at rest, to 3-6 pain with walking. The patient was unable to squat secondary to pain and had difficulty rising from a seated position.

The OnLux LED unit was applied as per instructions. The patient used the unit for 15-minute intervals twice a per day. No complaints during usage were reported. The unit was used for 4 weeks. The patient noted an incremental decrease in symptoms such that by 3 weeks the pain was reported as 0/10. Presently, one year out from the incident the patient reports zero knee pain and a return to normal function without restrictions.

Case 2: 46-year-old male with symptomatic L3 disc herniation.

46-year-old male who presented with severe low back pain with ambulation and paresthesias in L3 distribution left thigh. History included initiation of low back pain 2 years prior to presentation. While walking approximately one mile on vacation, the patient had to take breaks secondary to significant low back pain, no leg pain noted. These symptoms abated in severity but would return in a mild form with ambulating more than approximately one mile.

Approximately 3 months before presentation, the pain increased in severity and distance leading to pain decreased. At presentation to the clinic the patient was unable to walk more than several hundred feet before he needed to bend at the waist to ameliorate the pain. At this time, he was also complaining of numbness and paresthesia in the anterior thigh. Radiographs revealed mild lumbar degenerative changes. Physical therapy and activity modification were prescribed. A six-week course of physical therapy was not helpful. The patient then did 2 courses of a Medrol dose pack with concomitant NSAID. Unfortunately, this did not relieve the symptoms. An MRI of the lumbar spine revealed a large herniated left sided disc at L3 (Figure 3).



The patient was prescribed gabapentin which did reduce the pain fairly significantly, however, the patient had adverse effects to the medication. These effects included somnolence and mild confusion. The patient is a practicing orthopedic surgeon and needed to discontinue this medication secondary to side effects. At this time the patient was offered an OnLux LED unit for the lumbar spine.

The OnLux LED unit was worn at 15-minute intervals twice a per day. The patient noted an incremental improvement in both pain and paresthesias over the first 6 weeks. By week 6 he was walking greater than a mile pain free without leg symptoms. Upon discontinuing the LED treatments, the pain returned in a moderate fashion. The LED treatments were resumed, and pain once again resolved. The patient is now 2 years from presentation with occasional, if any, low back symptoms.

Case 3: 18-year-old collegiate baseball player with right disabling shoulder pain.

This patient reported to the clinic with classic signs and symptoms for an unstable superior labrum anterior and posterior (SLAP) tear. The patient is a collegiate pitcher at a division school. He had been experiencing increasing pain while and after throwing, feelings of “dead arm,” as well as decreased velocity and issues with location. Prior to seeing me, he had participated in extensive physical therapy, and had mechanics evaluated by a pitching coach and trainer.

He was unable to pitch at game level secondary to his symptoms. An MRI was ordered and revealed a large SLAP type 2 tear (Figure 4).



The patient was offered an intra articular injection. He did quite well from this and was able to pitch his freshman year with moderate to occasion severe symptoms. The patient had aspirations of going to medical school and did not want to delay his participation in his athletics. After the season, we discussed surgical intervention, but decided against surgery. He was introduced to LED therapy. He continued to rehab between his freshman and sophomore year and included use of the OnLux Shoulder LED unit 15 minutes, two times a per day. Again after approximately 6 weeks of usage his symptoms markedly improved. He has had a successful sophomore and junior year pitching in college. He is presently gearing up for his senior year. Although he no longer uses the LED daily, he will use it after a bullpen session or game. Anecdotally. his teammates request some after pitching as well.

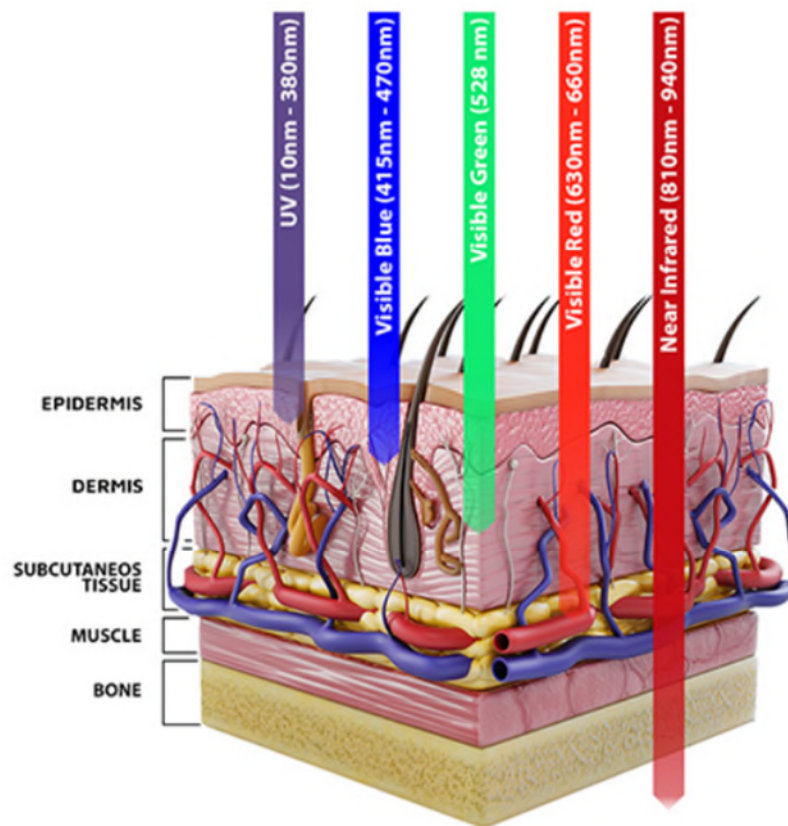
DISCUSSION

Musculoskeletal orthopedic conditions are one of the leading causes of disability within the United States (Carvalho et al., 2017). As a result of this, nonoperative management has been utilized by patients to relieve pain and gain functionality. Surgery may not always be an option for patients due to the cost and long recovery time. Options such as physical therapy (PT) have been utilized and shown to provide benefit in patients. However, it has been found that there are many perceived barriers in access due to long travel, being unable to leave work and not having childcare coverage (Hanney et al., 2022). Medications such as NSAIDs and joint interventions including corticosteroid injections have been shown to relieve inflammation and reduce pain. Long term use of NSAIDs, however, has been shown to decrease the effectiveness of the gastrointestinal mucosal barrier and limit the about of submucosal blood flow leading to a higher risk of poor health outcomes (Rockwell et al., 2023). It has further been found that repeated steroid injections can be associated with osteoporosis, adrenal insufficiency, gastrointestinal effects, and hyperlipidemia among many other adverse effects. Repeated steroid injections are mostly effective in the short term and over two years have brought no significant long-term improvement in reducing pain (McAlindon et al., 2017). Based on these findings, new alternatives are needed for patients with a lower chance of adverse health effects. Among the newer options for pain treatment, RILT is an upcoming modality for non-operative management in orthopedic injuries that has shown to have low risks.

RILT dates back to medicine and physiotherapy practice as early as the 19th century. Treatment with light has especially been used in dermatological settings since the 1950s. It was not until the late 20th century that there has been a more widely practiced global use of light in the treatment of orthopedic and rheumatological conditions (Liebert & Kiat, 2021). RILT has been shown to promote and enhance healing while also treating the symptoms. Infrared light irritation activates

the natural repair mechanisms within the body, alleviating pain. These same mechanisms that allow the reduction in pain have played a major role in the steps of tissue healing and bone healing through the increase of osteoblast formation. As a result, light therapy can directly reduce pain by combining these local and systemic actions. RILT also releases nitric oxide which has a critical role in increasing vasodilation and promoting blood flow to tissues. The increased blood flow allows to reduce the discomfort of symptoms while also increasing tissue repair (R Hamblin, 2017)

In the patients presented, the OnLux device was used to provide specific wavelengths to contribute to increased healing and pain relief. The only requirement to utilize this device is to press the controller and then the device turns off after fifteen minutes of treatment. The OnLux device specifically uses wavelengths 470nm, 660nm, 830nm, 950nm. (Figure 5.)



There have been multiple cases of RILT therapy leading to improvement in pain among patients. Oliveria et al found that there was a 50% improvement in non-specific knee pain using RILT therapy alongside physical or chiropractic therapy (DE OLIVEIRA et al., 2022). The results in this study and many other studies were limited, however, since the quality of evidence was low, urging future research to investigate the effects on RILT and pain management. We believe this

case report is the first instance of the use of the OnLux device leading to improvements in orthopedic injuries.

CONCLUSION

Our three cases show that RILT therapy has considerable clinical benefit to reduce pain and improve musculoskeletal injuries. Unlike previously reported patients, our 3 cases specifically utilized OnLux devices. In no way are we suggesting that RILT has the capability of healing a torn meniscus or reducing a herniated disc. However, RILT therapy is engineered to increase blood flow to an injured area, decrease inflammation, and decrease pain. This is specifically important in cases where surgical options are not viable. Future clinical applications of a randomized control trial can be beneficial to eventually add RILT therapy to existing treatment. More studies should be done to provide definitive evidence of this management option.

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