



The Efficacy of Low Intensity Laser Therapy in Reducing Pain in Osteo Arthritis Patients- A Review study

Dr. Anchit Gugnani, Associate Professor, H.O.D ,Department of Physiotherapy, Jayotividyapeeth women's university, Jaipur

Abstract- Osteoarthritis is a very common occurrence in old age majorly affecting the knee joint leading to chronic pain, loss of function and finally disability. Being said so, it requires timely treatment and if treatment is not taken, it leads to a definite onset of symptoms leading to structural damage. Low Intensity Laser Therapy (LLLT) that uses a light source and a single wavelength for pain relief and faster healing in many musculo-skeletal conditions including OA. Many evidences published effectiveness of the LLLT treatment while some suggested that it is not very useful. There was a need to review all the studies. This study examined the various guidelines published, for physical therapy and rehabilitation. The PubMed data bases and the Web of Science were used for randomised clinical trials, systematic reviews and guidance. There have been investigations into specific journals and referral lists. Some good articles on the treatment of knee arthritis were included in the review.

Key words: Knee Osteoarthritis, PhysicalTherapy, LLLT

I. INTRODUCTION

Osteoarthritis (OA) is the world's most common degenerative articular disorder leading to daily living disability^{11,14}. It is very prevalent in the elderly and is diagnosed in around 10% of males and 18% of females over the age of 60^{3,14,27}. OA is most common in the hip and knee articulation^{15,27}. The medial tibiofemoral section is most often affected in the knee joint. Both clinical symptoms and radiography can define OA¹⁴. Pain, loss of function, joint stiffness, and sometimes crepitus and outflow can be the most common clinical signs of OA^{15,20,27}. OA is characterized by the gradual degeneration of the joint cartilage on the basis of radiography^{6,8,27}. This degeneration of the cartilage includes the formation of osteophytes, subchondrial cysts, joint reduction and subchondral bone sclerosis^{4,6}. If symptoms occur, OA can only be diagnosed clinically¹⁴. The drawback is that OA is already progressive and likely irreversible at this time.

Osteoarthritis

The most common form of arthritis is osteoarthritis, which affects millions of people around the world. Although osteoarthritis can damage any joint, your hands, knees, hips, and spine are most often affected by the disorder.

Symptoms of osteoarthritis usually can be managed, even if joint damage cannot be reversed. Staying active, maintaining a healthy weight and certain treatments may slow disease progression and contribute to better pain and joint function.

A large proportion of the population is affected by osteoarthritis (OA). As an alternative noninvasive treatment for OA, low levels of laser therapy (LLT) were introduced some years ago;

Symptoms

Symptoms of osteoarthritis often develop and deteriorate slowly over time. Osteoarthritis signs and symptoms are as follows:

Pain- During or after movement the affected joints may harm.

Rigidity- Joint rigidity can be most apparent when awakened or inactive.

Tenderness- If you apply light pressure to or near it, your joint may feel tender.

Flexibility loss- Perhaps you can't move the entire range of your joint.

Spurs of the bone- These extra pieces of bone can form around the affected joint, which feels as harsh lumps.

Swelling- This can be caused by inflammation of the soft tissue around the joint.

Causes

Osteoarthritis happens as a result of gradual deterioration of the cartilage that cushions bones in your joint ends. ¹⁴Cartilage is a firm, slippery tissue which makes joint motion almost friction-free. Finally, the bone rubs the bone if the cartilage wears down fully.

Osteoarthritis was frequently called the disease of wear and tear. However, osteoarthritis affects the entire joint beside the decomposition of cartilage. It causes bone changes and connective tissue deterioration, which holds the joint together and attaches muscle to the bone. It also causes the joint lining to swell.²⁵

Factors of risk

Earlier age- Age increases the risk of osteoarthritis.

Gender- Osteoarthritis is more common for women, but it is not clear why.

Obesity- The extra weight of the body in a number of ways contributes to osteoarthritis, and the larger your risk. Increased weight increases stress on weight-bearing joints like hips and knees. In addition, fat tissue produces proteins that can cause adverse inflammation in your joints and around them.

Injuries together- Injury, such as sporting or accident injuries, can increase the risk of arthritis. Your osteoarthritis risk can be increased also by wounds which have occurred years ago and which seemed healed.

Joint stressed repeatedly- When you play work or a sport, your joint is stressed over and over again, osteoarthritis may ultimately develop.

Genetic engineering- Some people are inheriting osteoarthritis.

Distortions of the bone- Some are born with defective cartilage or malformed joint.

Some metabolic illnesses- These include diabetes and too much iron in your body (hemochromatosis).

Complexities

An arthritis is a long-lasting degenerative disease that leads to chronic pain. Joint pain and rigidity may be sufficient to make it difficult to perform everyday tasks.²⁷

Low Level Laser Therapy for Knee Arthritis

It seems a farfetched concept that light energy from a laser can reduce pain and inflammation, accelerate tissue healing, relax muscles and stimulate nerve regeneration. However, science tells us that these effects happen. The question is to how much wavelength and power are based on this?

"The laser is capable of penetrating the body through the wavelength and power. After being within the infrared spectrum and wavelengths higher than 800 nanometres, laser energy penetrates like ray x, but for depth, a considerable power or energy is required," Dr. Bruce Coren told SpineUniverse.

"A greater power and a higher dose, as determined by power output and time, is the best response in the majority of neuro-muscles. "A laser with a capacity of 30 watts or more will be the best result.^{24,27,28} A 10-minute laser treatment of 18,000 joules will produce an anti-inflammatory and healing effect on the pain."²⁸

Laser Therapy Characteristics

Laser reduces nerve sensitivity by decreasing bradykinin, which causes chemical pain.² Pain relief: It normalises ion channels and releases endorphins [natural pain reliever] and enkephalins [cellular gatekeepers] which produce an analgesic effect. It also affects some nerve fibres by blocking pain.

Laser increases the ATP energy which has been stored [ATP is an adenosine triphosphate acronym]. anti-inflammatory/Healing: This increased energy speeds up the cell's repairs. Laser also causes an increase in arteries and veins to remove damaged cellular debris and increase nutrients and oxygen. ^{9,28}The laser also leads to damage. Increased white blood cell activity leads to faster repair. Some molecules, like superoxide dismutase, are reduced, and beneficial antioxidants are increased.

Light photons are penetrating into the tissues deeply and accelerate cell reproduction and growth. Accelerated Tissue Repair and Cell Growth: The cells of tendons, ligaments, nerves and muscles are quicker to repair as a result of exposure to laser light.^{7,9,13}

Enhanced vascular action: Laser light increases the development of new capillaries in damaged tissue, accelerating the healing process and quickly closing wounds.

Laser is particularly effective when exhausting painful trigger points. Laser therapy reduces the formation of scar tissue following repetitive tissue damage caused by movement injuries, cutting, scratches, burning or operations.

Faster Wound Cure: Laser light stimulates collagen building blocks which are important to cure damaging tissue wounds.^{9,29} Collagen is the key protein necessary to replace or remedy old tissue injuries. The laser thus works on open wounds and burns.

Activation of stem cell: Laser increases the number of stem cells that heal²².

Lasers are also very effective in peripheral neuropathy, tendonite, bursitis and capsulitis for inflammatory conditions. Strokes, sprains and repetitive movement injuries are all inflammatory and can be treated with laser success. There is no special condition which responds to the laser more rapidly.^{13,27,28} Some patients will respond more quickly than others, however, for the same condition as individual cures vary.

Precautions for laser therapy

Laser therapy needs some of the precautions. The patient and the therapist need eye protection and the laser should not be used in malignancies, pacemakers, spinal stimulators or the mid-section of pregnant women.

II. DISCUSSION ON THE BASIS OF LITERATURE REVIEW

Due to chronic musculoskeletal disorders, pain is the most common reason to seek medical help. LLLT has been introduced non-invasively to control symptoms, with virtually no adverse and cost-effective effects. The results of the experimental and clinical trials, including for KOA, however, are contradictory.²³ in 1992.

There were soon several further studies to evaluate the efficacy of LLLT in KOA patients.⁷ found that there were no significant LLLT results for pain, strength, or joint activity outcome measurements. Subsequently, the advantages of LLLT were also disregarded by ²⁴. The efficacy of LLLT in KOA patients was called into question by these studies. As no study had synthesized meta-analytical results³¹, including nine studies with 518 patients, performed the current analytical analysis. The meta-analyzed pain relief or functional improvement did not show any LLLT therapeutic benefit for KOA patients even immediately after or week 12 following therapy.

Potential mechanisms for laser therapy pain reduction remain unknown. Various experimental studies show LLLT having anti-inflammatory and/or analgesic effects. Some argue that LLLT may inhibit peripheral nerve harmful signals ³². Others believe that LLLT could increase tissue oxygenation to alleviate and eliminate swelling that could lead to decreased pain². Some studies⁵ have reported improved regeneration of joint cartilage following LLLT. The results of the laser light interaction with the tissue,

however, depend on a number of factors including energy density, wavelength, output, number and time of treatment and the tissue's optical properties.

Several studies using LLLT for musculoskeletal pain have demonstrated General information from reciprocal studies showing that higher irradiation (energy density) protocols as well as a larger number of sessions and frequency of application appear to be associated with maximum laser photobiomodulation effectiveness. Compared to several previous clinical trials,^{2,13} found that LLLT energy density applications of more than 3 J/point could only work. The optimal energy density for KOA is to be at least 4 J per points, based on the WALT^{28,29} table of the recommended doses. These WALT recommendations were complied with in five studies^{13,24,33} We couldn't even see a statistically significant difference in LLLT when these four studies were combined.

All the studies included provided or exceeded the session number recommended. Although ²⁴ delivered as many sessions as possible they still had no difference from LLLT.

Wavelength is also an essential parameter for LLLT's positive results. It determines the capacity of a laser to penetrate tissue biophysically. Light with an infrared and invisible wavelength range of 700e1000 nm, is better than red wavelength and is therefore common for clinical therapy in this range³⁵. A clinical study in skin flapping of laser irradiation showed that penetration increases from 450 nm linearly to 1030 nm³⁴ wavelengths. Another research has shown that rabbit skin with a wavelength of 904 nm has entered a larger amount of energy than wavelength 632.8 nm³⁴. The WALT guidelines therefore recommend LLLT in KOA patients with wavelengths of 780 nme860 nm¹⁶ or 904 nm. All of the studies included used this range of wavelengths.

In addition to the wavelength, the tissue's optical characteristics are considered essential for LLLT treatment response as well. In different tissues, the penetrability of some wave lengths varies. The penetrating light energy is 20 per cent for a wavelength of 810 nm and 58 percent for a wavelength of 904 nm, according to Joenson & King^{17,18} found that laser irradiation is only a few mm into the skin. This could explain why some studies found LLLT in large joints not effective, while the results for small joints appear promising¹⁸.

The severity of the disease is a typical host factor, which could affect the outcomes of the treatment²⁰. Conti et al.⁹ reported a better outcome in the less severe group in a study evaluating the efficacy of LLLT for temp rom and fibula joint arthritis. But no such study of KOA patients has yet been conducted. A variety of factors could be associated with a variation in the effectiveness of LLLT in KOA patients. The optimum dosing, treatment schedule, energy density, output and wavelength are currently still difficult to determine. This could explain why several outcomes have shown a high level of heterogeneity.

III. CONCLUSION

The results of the different systemic review and meta-analysis of LLLT in the treatment of KOA have provided best current evidence.

The studies showed that LLLT has no advantage in pain reduction and/or function improvements for patients with KOA either early or later.

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