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LASERS : A BOON IN THE MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS

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Abstract

Temporomandibular disorders have been identified as the most important cause of pain in the facial region. Pain relief and reestablishment of normal masticatory function are the main goals of conservative management of Temporomandibular Disorders (TMD). Laser therapy is a part of the treatment modality that have demonstrated to have an analgesic, anti-inflammatory and biostimulating effect. The LLLT is a non invasive , quick and safe, non pharmacological intervention that may be beneficial for patient with TMDs. This review article projects the use of LLLT for management of temporomandibular disorders ,its mode of action and also gives a review on various studies conducted to assess its efficacy on pain management.

Introduction

Temporomandibular disorders (TMD) is a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both. TMD have been identified as a major cause of nondental pain in the orofacial region and are considered to be a sub-classification of musculoskeletal disorders. Failure of one component of these structures may impair the function of the system as a whole.

Temporomandibular Joint

The TMJ is structurally unique, consisting of only two joint in the body with vascularised tissue within the capsular ligament. Since the disc is avascular and not innervated, pain from within the joint is in all probability due to inflammation or injury of the highly vascularised and innervated retrodiscal tissue or inflammation of the synovial tissues. It is a ginglymoarthrodial synovial joint. The joint is encapsulated and immersed in synovial fluid, and is stress bearing and capable of both rotational and translator movements. The mandibular condyle can move in a variety of directions within the mandibular fossa. Condylar movements are protected from direct contact with the bony architecture of the fossa through an intricate system of fibrocartilage and synovial structures. [1]

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Functioning Of Tmj

When the TMJ is in motion, the interarticular disc is always positioned between the fossa/eminence and condyle by the action of the superior lateral pterygoid muscle and the uppermost elastic portion of the posterior attachment known as the postero-superior retrodiscal lamina of the retrodiscal tissue. During function, the lateral and medial discal collateral ligaments attach the disc to the condyle on the inferior surface of the disc The superior surface of the disc translates or slides along the posterior aspect of the articular eminence during full mouth opening. Translation of the condyle occurs as a result of the action of the inferior lateral pterygoid muscle, which protrudes from the mandible, in concert with other mandibular depressors the infra- and suprahyoid musculature. The posterosuperior retrodiscal lamina acts passively to pull the disc posteriorly during opening as the condyle translates anteriorly. The superior lateral pterygoid muscle contracts eccentrically during closure, stabilizing the disc against the distal slope of the articular eminence. The two synovial membrane layers line the joint capsule and disc, except on the articulating surface, and produce synovial fluid, fulfilling the nutritional needs of the joint. Laser treatment uses light photons (energy) to penetrate deep into the tissues surrounding the temporomandibular joint as well as the joint itself[2].

The Etiology Of Tmd

The aetiology of the most common types of temporomandibular disorders is complex and is still largely unresolved. Malocclusion and trauma—whether acute, such as after an assault, or chronic and repetitive, such as tooth grinding or clenching—are often cited as possible causes.However, there is a clear lack of substantial evidence. Psychogenic factors have also been implicated, but, like trauma and malocclusion, these are often considered as exacerbating factors rather than the primary cause of temporomandibular disorders. It is well established that very few patients with malocclusion, mandibular trauma, or psychogenic related illnesses actually go on to develop temporomandibular pain and dysfunction.8 Hence, there is speculation that only some patients who are vulnerable to temporomandibular disorders will develop pain and dysfunction after an exacerbating event such as trauma [3].

De Boever (1979) reported five different etiologic theories of TMD, i.e. mechanical displacement theory, neuromuscular theory, psychophysiological theory, muscular theory and psychological theory. At present, TMD are considered not as a single entity but as comprising several diseases of varying etiology and pathology, and controversy still exists because of limited knowledge regarding the etiology and natural history of the course of TMD.

Based on the multifactorial etiology of such problems, the treatment usually involves more than one modality in order to maximize any complementary effects, including counseling, drug therapy and physical therapy. Physical therapy aims to

- increase the awareness of the patient about the cause of the symptoms;
- achieve muscle relaxation;
- reduce muscular hyperactivity and reestablish muscle and joint movement;
- relieve pain, spasm, and edema;
- allow for recovering of normal function.

Among such treatments, acupuncture, exercises, massages, thermal therapy, electric stimulation (TENS), ultrasound, and low level laser have been used.

Low level laser therapy has a role in pain control and healing . Recent studies suggest that LLLT (application of 10 j/cm^2 and 15 cm^2) can be useful method for treatment of TMD – related pain.[2,3]

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Low Level Laser Therapy

Low level light/laser therapy (LLLT) is the application of light (usually delivered via a low power laser or light-emitting diode; LED) to promote tissue repair, reduce inflammation or induce analgesia. Low-level laser therapy (LLLT) is considered a viable noninvasive and nonpharmacological alternative.

Classification Of Lasers

Based on power, lasers can be classified as follows:

- High power lasers(hard or hot or surgical lasers): they have output more than 500mW.they produce heat. They cause necrosis,carbonization, vaporization, coagulation and denaturation.
- Intermediate power lasers(soft or cold): they have output power ranging from 250-500mW. They do not produce significant heat.
- Low power lasers: output power is less than 250mW. They do not cause change in tissue temperature and the chemical reactions are dependent on light. They act through photobiostimulation. They are widely used for therapeutic and biostimulating purposesand act as accelerators of healing process. [3]

Unlike many other laser treatments LLLT is not an ablating or heating based therapy but is more analogous to photosynthesis in its mode of action. LLLT also differs from photodynamic therapy (PDT), which utilizes light indirectly to trigger photosensitive dyes to produce bactericidal molecules that kill infecting microbes that cause disease. Indeed, current data indicates that PDT appears to be a useful adjunctive tool for treating oral infections in the dental specialties of oral surgery, endodontics and periodontitis .[4]

LLLT uses the action of light and light alone to directly stimulate host cells in order to reduce inflammation, relieve pain and/or promote wound healing. Dental applications for LLLT are not well documented in comparison with musculoskeletal applications; however, more studies are now being reported. Indeed, there is now encouraging data for LLLT application in a wide range of oral hard and soft tissues and covering a number of key dental specialties including endodontics, periodontics, orthodontics and maxillofacial surgery . LLLT has also been shown to have efficacy in managing chronic pain and non-healing bone and soft tissue lesions in the maxillofacial region.[4]

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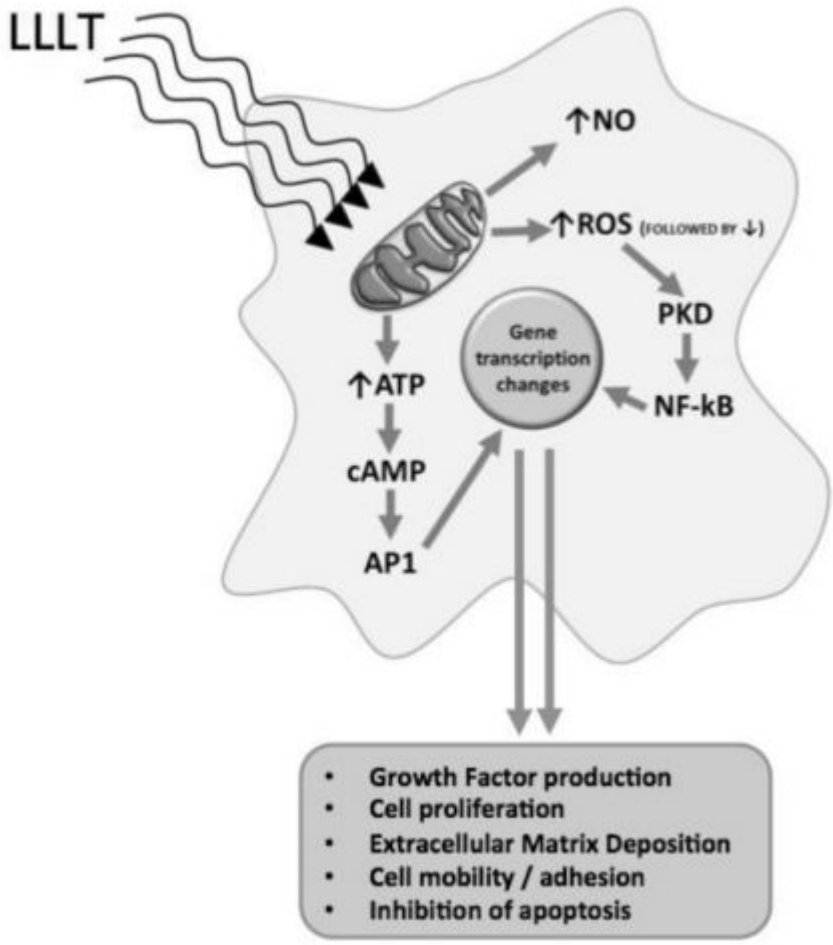

The cellular effect of low level light therapy (LLLT) on cellular metabolism. LLLT is proposed to act via mitochondria displacing nitric oxide (NO) from the respiratory chain and increasing levels of adenosine triphosphate (ATP) and reactive oxygen species (ROS). These changes act via intermediaries cyclic adenosine monophosphate (cAMP) and protein kinase D (PKD) to activate transcription factors AP-1 and NF-!B resulting in changes in gene expression and subsequent downstream production of chemical messengers implicated in the cellular changes seen following LLLT exposure.[5]

Laser As A Mode Of Managing Tmd

Therapeautic LLLT application is achieved through light, static and direct contact of pobe on the skin. The LLLT should be applied on the selected points considering the presence of nociceptors in the periarticular tissues(discal ligaments, capsular ligaments and retrodiscal tissues), because these structures are involved in the TMJ pain.[6]

The probe should be placed perpendicular directly on the skin at the centre of the upper joint space, approximately 1cm in front of the tragus. The laser beam is delivered through a laser probe. Treatment can be applied for 2 minutes at both the closed mouth and maximum mouth opening position. Repeated appointments for atleast 8 weeks and three times a week are desired. The laser should be caliberated before use, and the laser probe wiped with a alcohol before each treatment. The subjects and the clinician should wear protective glasses. Also the state of laser instrument should be monitored and reviewed regularly to prevent untoward hazards.[7]

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Considerable work has focussed on determining the effects of laser on pain management. In 1998, a study on the subject of the effect of low level laser therapy with wavelength of 632.8nm, 670nm, and 830nm on 24 TMD patients was done by Pinhero et al ; the recovery from pain and clicking was significant.Nunez evaluated the effectiveness of LLLT and TENS on the iimprovement of mouth opening in patients with TMD and found a significant improvement in the range of motion for both therapies immedietly after treatment. Comparing the two methods LLLT was stated to be more effective than TENS. In an experimental study, Plano et al assessed the effectiveness of 670 nm lasers on 32 TMD patients. The duration of application was 10 min. His study showed that clicking and pain were significantly reduced.[8]

Kitchen and Partridge showed that a variety of conditions, like rheumatoid arthritis, chronic neuralgias, and muscle pain, can be treated with low intensity laser. Some studies, like those of Simunovic and Eckerdal and Bastian presented a reduction of the tissue inflammation or a direct effect on nerve tissues. Other studies, like those of Conti, believe in pain relief, but not in physical improvement. The doses used in these studies are different, making comparisons difficult and limiting conclusions. It is still unclear if the effect of laser is dependent upon the wavelength of the light, irradiance or dose . [9,10]

Conclusion

There is still a lack of scientific explanations in literature for the apparent effectiveness of laser in the treatment of pain. Although many authors present opposite results, the majority of the studies (about 85%) demonstrated that the reduction of pain is effective. Based on the non-invasive aspect of this treatment modality, it is suggest that studies in this area should continue, to define effective energy doses, as well as the effect of its interaction with other treatment modalities, using a higher number of applications for a longer period of treatment.

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