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LASER THERAPY AND MANUAL THERAPY AS TREATMENT FOR TEMPOROMANDIBULAR DISORDERS: A LITERATURE REVIEW

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Abstract: Temporomandibular dysfunction is a condition involving the temporomandibular joints, masticatory muscles and associated tissues. One of its main symptoms is pain in these regions. Furthermore, this disease has a multifactorial etiology, so its diagnosis and treatment involves various modalities. The aim of this study is to report on the combination of laser therapy and manual therapy as a form of treatment for this condition. Both treatments will act directly on the patient's painful symptoms. Although manual therapy, combined with specific exercises for this region, has been shown to be more effective than laser therapy, the combination of these two techniques may be promising in the rehabilitation of patients with temporomandibular disorders.

Keywords: Temporomandibular joint. Temporomandibular Joint Dysfunction Syndrome. Temporomandibular Joint Disorders. Laser Therapy. Manual Therapy. Laser therapy.

INTRODUCTION

According to the American Academy of Orofacial Pain, temporomandibular disorders (TMD) are recognized as a musculoskeletal, neuromuscular condition involving the temporomandibular joints, masticatory muscles and associated tissues.¹ We can divide them into specific subgroups, among them the subgroups of muscle and joint disorders. These conditions can negatively influence the patient's lifestyle, such as their normal daily activities and psychosocial relationships, especially in patients with these two conditions.² One of the most frequent symptoms in patients with temporomandibular disorders is pain. This pain is most common in the periauricular region and in the masticatory muscles, and patients' main complaints are headache, earache, pain in the jaw region and facial pain.³

Various therapeutic modalities can be used to treat TMD, including non-invasive ones, such as the use of occlusal plates, physiotherapy, acupuncture, psychological support, low-intensity laser therapy, ultrasound, transcutaneous electrical nerve stimulation (TENS); minimally invasive, through medication, sodium hyaluronate injections, corticosteroid injections, arthrocentesis, arthroscopy; and invasive, through occlusal adjustment, discectomy and disc repositioning, reconstruction of parts of the joint and total reconstruction of the joint.^{4,5}

The low-intensity laser (LLLT) has been used in other areas of health besides dentistry for various therapeutic purposes. This is due to the ability of the wavelengths to penetrate tissues and promote the release of analgesic substances,⁶ generating a reduction in the inflammatory nature of TMD and the perception of pain, due to its photobiochemical reactions.^{7,8}

Physiotherapy is an ally in the treatment of TMD and according to the American Massage Therapy Association, targeted manual therapy aims to promote health and comfort.⁹ It works through massages that mobilize the TMJ and the soft tissues of the muscles that are associated with pain. This is done through active or passive muscle stretching exercises, which relieve pain in this area and by mouth opening and closing movements, which help to alter jaw opening patterns that are often reduced due to dysfunction. They also act on the coordination of the masticatory muscles, improving the functional movements of the muscles involved, as well as providing relief from tension headaches, one of the symptoms closely related to TMD.^{9,10}

The aim of this study is to review the mechanisms, protocols and results of low-intensity laser and manual therapy as a treatment for TMD symptoms in isolation and in combination.¹

LITERATURE REVIEW

Temporomandibular dysfunction can be described as a clinical condition involving the temporomandibular joint (TMJ) as well as the muscles of mastication and associated tissues¹¹. Therefore, in order to better understand its symptoms, diagnosis and treatment, it is of the utmost importance to understand how the temporomandibular joint works physiologically, so that we can then approach the two forms of treatment that will be reported in this study.

TEMPOROMANDIBULAR JOINT

The temporomandibular joint plays an important role in dental occlusion and the neuromuscular system¹². The temporomandibular joint is classified as composite and ginglymoarthral, whose components are the condyle, mandibular cavity, articular tubercle, articular disc (which is inside the joint capsule), retrodiscal tissue, synovial membrane and joint capsule^{13,14}. It is located anteriorly to the external surface of the auditory meatus, superiorly to the temporal bone and inferiorly to the mandible.¹⁴

The TMJ performs a number of movements, including rotation and translation. Rotational movement occurs between the condyle and the lower part of the disc, in the translational movement occurs in the space between the upper part of the disc and the fossa, also at the moment of opening the mouth.¹²

Symptomatology of temporomandibular joint dysfunction

Although pain is one of the most common symptoms, intra-articular disorders, dislocations of the articular disc and degenerative joint diseases are also prevalent features of TMD.¹⁵ The pain caused by TMD can radiating to the temples, ears, cervical spine and dental arch. In addition, in most cases, it is a reason for tension in the masticatory muscles

and parafunctional habits that can cause intraoral damage. For example, tooth sensitivity due to cervical lesions of non-carious origin, pathological attrition, gingival recessions, abnormal occlusal wear, tooth mobility and loss of bone support. In this case, treating TMD from a dental point of view alone may not be enough.¹⁶ Another common symptom of TMD is limited range of jaw movement and TMJ sounds.³

Epidemiology

TMD has a higher prevalence in women than in men, which can probably be explained by the higher level of estrogen present.¹⁷ This is because estrogen plays an important role in pain sensitivity. However, although estrogen plays this role and also modulates pain and biological processes in the TMJ region, it is not enough to fully explain why TMD is more prevalent in women.¹

Furthermore, although some studies such as Mohlin and Kopp's show a relationship between occlusal interferences (posterior crossbite, class II malocclusion and open bite) and dysfunctional pain, we cannot use this relationship as a determining factor for the cause of this disorder, since it is known to have a multifactorial cause.¹⁷

Although temporomandibular disorders are divided into articular and muscular, around 50% of which are of muscular origin (not articular, excluding chronic conditions such as fibromyalgia). Disorders of this origin trigger myofascial pain in the muscles of mastication due to teeth clenching, bruxism and other parafunctional habits. Another factor that can contribute to this pain is emotional stress, which can predispose to these habits. The pain is not exclusive to the muscles of the face, as it can radiate to the ears, neck and head.¹⁷

Diagnosis

As a multifactorial disorder, TMD has a variety of diagnostic approaches, such as amplitude testing, passive accessory movement testing, manual muscle testing, quantitative sensory testing, examining the cervical spine (postural deficits), adjacent muscles, relative prominence of the facial and neck muscles, size and shape of the mandible, regional symmetry, mandible in a resting position and palpation of the TMJ region. However, a good and complete anamnesis is essential for this diagnosis.¹⁴ In addition, there are more precise diagnostic methods that will act on the diagnosis by means of images, assessing the integrity of the TMJ components. In this way, we can analyze the extent or even the progression of the disease and thus draw up the best treatment plan. However, it's worth pointing out that this diagnostic method is indicated in cases where trauma, changes in the patient's occlusion, limitation of mobility, etc. have been reported and/or observed during the physical examination mouth opening and joint noises.¹³

Diagnostic imaging methods that are used for this purpose are TMJ X-rays, panoramic X-rays, planigraphy (a panorama that covers the TMJ region), transcranial X-rays, arthrography, magnetic resonance imaging (MRI), computed tomography, as well as other imaging techniques such as ultrasound and nuclear medicine (to assess metabolic and growth alterations, such as tumors and metastases).¹³

Among the techniques mentioned, radiographs are indicated for the early assessment of less complex symptoms and the differential diagnosis between TMD and inflammatory dentomaxillofacial conditions. Computed tomography, on the other hand, is considered the gold standard for assessing the structures of hard tissues, teeth and bone (with the exception of soft tissues and the articular disc, since few details are provided), its indication is to identify and measure morphological and

degenerative bone abnormalities and fractures. Arthrography, which is an invasive intra-articular examination, is indicated to visualize articular disc alterations, but because it has iatrogenic risks such as disc perforation, facial nerve damage, pain, limited movement after injection and the risk of radiation to radiosensitive structures such as the lens and thyroid, this diagnostic method has been replaced.

By nuclear magnetic resonance (NMR). This in turn will identify and assess inflammatory changes, the position of the articular disc and other soft tissue structures. With ultrasound, we can see the articular disc precisely and make a differential diagnosis between TMD and other conditions that cause pain, such as the major salivary glands, as well as assessing pre- and post-infiltrative therapies.¹³

The most reliable diagnostic imaging methods for this purpose are computed tomography and nuclear magnetic resonance when compared to conventional radiography. Cone beam computed tomography is considered the gold standard for assessing bone structures, while MRI has limitations in this regard, being the best choice for assessing soft tissue. However, for the assessment of the TMJ and adjoining areas, both imaging techniques complement each other.¹³

Treatment

Because the etiology of TMD is multifactorial, with trauma, systemic and iatrogenic factors, occlusal and psychological disorders as causes, treating TMD from a dental point of view alone is not enough. However, the association between the various treatment approaches for Temporomandibular Dysfunctions has proved beneficial.¹⁶

Among the treatment approaches mentioned above, two non-invasive ones will be studied in this review, as well as the combination of both with the aim of helping with the painful symptoms of the disease.

LASER THERAPY

Laser therapy is a type of light therapy and is used as a non-invasive treatment. In addition to the use of laser, LED light² can also be used to treat TMD. However, there is a critical difference between light therapies (laser and LED) which is the wavelength and optical power that determines the amount of energy that will be deposited in the tissue and the depth of penetration of the light.¹⁸

Types of lasers

There are various types of laser on the market, classified into three categories: high-power lasers, which act by increasing the kinetic energy of tissue with a power of more than 500 mW, intermediate-power lasers, which use a power of 250-500 mW, and low-power lasers, which have no thermal effect on tissue and use a power of less than 250 mW. In addition, various lasers are used in the fields of medicine and health in general, with visible (red lasers) or invisible (infrared) wavelengths. Today, arsenide (GaAs) and gallium-aluminum-arsenide (GaAlAs) lasers are also used, while the helium-neon laser has fallen into disuse. The ones used today are diode semiconductors and are compact, as well as having a high efficiency in converting electrical energy to laser energy.⁵

Low-intensity lasers have been studied since 1905, when Albert Einstein proposed the stimulated emission theory. In 1960, this study was continued by Theodore Maiman, who developed the first emitter with the function of emitting light with coherence, monochromaticity and a low degree of divergence.⁶

Mechanism of action

Therapeutic lasers act through photostimulation or biostimulation and also bioinhibition.

The effects of light therapy depend on the level at which the light is absorbed.⁵

The laser that will be discussed in this study is the low power laser (LBP). It works by emitting monochromatic infrared rays which, when irradiated into inflamed tissues, act to increase pain tolerance. This is due to the fact that they reduce the concentration of chemical agents such as histamine, acetylcholine, serotonin, H⁺ and K⁺, and promote vasodilation, generating increased blood flow to the tissues, aiding blood circulation, consequently reducing swelling in the tissue and promoting muscle relaxation involving analgesia. In addition, it increases cellular metabolism and can trigger photochemical reactions at mitochondrial level so that cellular metabolism is altered, as well as protein synthesis. It also accelerates the speed of healing, in other words, it plays an anti-inflammatory, analgesic, biostimulating and regenerative role.^{7,8,18}

Furthermore, there is evidence that LBP has neuro-pharmacological effects that lead to a reduction in C-fiber activity.⁶ However, the LLLT laser has limitations due to the lack of consensus in the literature regarding its dosage, but its analgesic, anti-inflammatory and stimulating effects have been confirmed.¹⁹

LBP is applied to selected points in the periarticular region where there are nociceptors, such as in the tissues of the disc, capsular and retrodiscal ligaments, since these structures surround the TMJ, the region where the patient feels pain.¹⁹

MANUAL THERAPY

According to El Hage Y, et al. changes in the muscles of mastication, neck muscles and occlusal muscles are causal factors of imbalances in postural muscle chains, leading to changes in the center of pressure of the feet. Thus, therapies aimed at restoring occlusion, such as muscle relaxation techniques, can lead to a restructuring of the overall balance of the system and an improvement in body posture.²⁰

Several studies have shown the effectiveness of manual therapy for the treatment of TMD.²¹ This review will therefore look at different types of manual therapy, including physiotherapy, exercise therapy and intraoral manual therapy. Manual therapy seems to be effective in treating TMD symptoms in the medium term. And its practice associated with exercise therapy can increase the effect and be maintained in the long term.²²

The aim of exercise therapy in the treatment of TMD symptoms is to balance the muscles of the orofacial region and help perform the functions of the stomatognathic system.²³ It consists of exercises focused on improving the motor control and endurance of the masticatory muscles, including stretching the tongue and masticatory muscles, focusing on relaxation and better coordination of this region. However, there is no standard dosage in relation to the intensity, duration and frequency of these exercises due to the low methodological quality of randomized controlled studies on this subject.²⁴

Physiotherapy has also been shown to be effective in treating TMD, being applied directly to the TMJ structure and/or directly or indirectly to the cervical region, which is directly related to this joint and can be explained by neuroanatomy through nociceptive nerve stimuli. This manual therapy approach has been shown to be beneficial for pain, also helping to increase the range of mouth opening. One of the manual therapy techniques that can help with TMD symptoms is the La Touche et al protocol, which consists of 10 sessions of therapeutic muscle manipulation in the cervical region, with approximately 35 minutes of manual manipulation, 10 minutes of muscle conditioning exercises and 5 minutes of muscle stretching.²⁵

Manual therapy has been applied to patients with TMD and consists of applying digital pressure to the trigger points of the masticatory muscles at their origins and insertions, i.e. the intra- and extra-oral soft tissues of the masticatory muscles, the articular tissues related to the TMJ (joint region) and the cervical spine. This pressure can be firm and enhanced by the combination of other techniques, thus facilitating the condition of the patient.

Proprioceptive neuromuscular and promoting relaxation and myofascial release of the jaw and surrounding regions. It can trigger neurophysiological mechanisms that are responsible for relieving pain and reducing muscle hyperactivity,^{24,26,27} as well as improving muscle coordination, helping to recover the range of motion of the muscles movement and increased muscle strength. In addition, passive and active muscle stretching exercises will help with mouth opening movements and reduce pain in the area.²⁷

There are different modalities of manual therapy and they consist of massage, TMJ mobilization and manipulation, cervical mobilization and manipulation. In addition, its association with exercises carried out at home by the patient themselves has proved beneficial according to Arribas-Pascual M, et al (2023).²⁸

Exercise therapy includes various exercises, including range of motion exercises for the temporomandibular joint. Its aim is to increase the range of movement of the mandible by means of traction in an antero-inferior direction. In the study carried out by Sakuma S, et al (2017) we see the association between this exercise performed by the therapist and the patient's own care therapy. In the technique performed by the therapist, the patient's head is positioned firmly in the palm of the left hand and the middle finger is used to palpate the impaired mandibular joint. The professional then applies pressure with the thumb

of the right hand to the occlusal surface of the left molar and holds the mandible with the other free fingers. After this, a force to rotate the mandible in an anteroposterior direction is applied for 15 seconds and repeated 5 times.²⁹

As mentioned earlier, the patient can perform self-care therapy. The patient sits upright and begins to lean their torso forward and holds the anterior teeth of the mandible with their index and middle fingers and the chin area with their thumbs, thus performing the traction movement, which in this case consists of rotating the mandible in an antero-inferior direction. The recommendation according to the aforementioned study is that patients should do one session, 10 repetitions of 10 seconds of traction, in the morning and another daily while in the shower.²⁹

In view of the analysis of the association of these exercise therapies, it was concluded, based on the results obtained in the study proposed by Sakuma S, et al (2017), that it can cause an increase in TMJ mobility, a decrease in the pain and a favorable impact on the individual's ability to carry out their daily activities since they do not have major painful symptoms.²⁹

COMBINING LASER THERAPY AND MANUAL THERAPY

A randomized, controlled and blinded clinical trial was carried out with 34 volunteers divided into 2 groups. The first group received treatment with the first group was treated with Orofacial Myofunctional Therapy (OMT) associated with photobiomodulation and the second was treated with OMT associated with inactive laser. There was an improvement in the patient's quality of life related to oral health in both groups 1 and 2, meaning that myofunctional therapy, whether or not associated with laser, has proved effective in improving TMD symptoms.³⁰

The study by Machado B, et al (2016) found that the combination of LBP and exercise therapy was more effective than treatment with LBP alone. However, this result did not prove to be any better in rehabilitation treatment than the complete exercise protocol, which consists of instructing patients about TMD, myofunctional disorders and the care needed to avoid muscle overload, as well as pain relief strategies (thermotherapy, massage and relaxation techniques) and exercise therapy, which consists of exercises for the tongue, lips, cheeks and jaw muscles to improve mobility, endurance and muscle strength.³¹

CONCLUSION

Because temporomandibular disorders are multifactorial in origin, their diagnosis and treatment requires a lot of study. Two treatment modalities for TMD were studied in this review: low-intensity laser and manual therapy. As a result, we can see that although laser therapy acts to modulate pain, it does not outperform the full therapeutic exercise protocol.

It can therefore be concluded that the combination of laser and manual therapies with a complete therapeutic protocol may be promising in the rehabilitation of patients with temporomandibular disorders.

In view of this, new randomized clinical studies are needed that associate only the use of these techniques. In addition, it is of the utmost importance that these studies do not involve other treatment therapies, such as the use of medication, dry needling, corticosteroid injections and others reported at the beginning of this study. In this way, it will be possible to assess whether the combination of these two therapies enhances the treatment effect of these dysfunctions.

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