Physiotherapeutical modalities in the treatment of temporomandibular disorders- a review

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ABSTRACT
Temporomandibular disorders (TMD) occur as a result of problems with the jaw, TM joint, and surrounding facial muscles that control chewing and the movement of the jaw. Patients affected by TMD’s present an array of symptoms which include jaw or neck pain, headache, and clicking or grating within the joint. The objective of comprehensive TMD management is not only relief of pain, but the rehabilitation or return of the entire masticatory apparatus to optimum physiologic function. The rationale for such an approach is to minimize the likelihood of exacerbations & chronicity, which are common in TMD. As our dental curricula provide nominal training in TMD management, most dentists have limited understanding of these disorders and its management. Similarly therapists also have little understanding of the importance of the dental role in management of these disorders. Hence treatment of TMD requires an interdisciplinary approach of appropriate and effective dental therapy combined with well executed physiotherapy. Physiotherapy includes modalities (e.g., Iontophoresis, Phonophoresis), relaxation techniques, and complementary therapies (e.g., Acupuncture, Hypnosis) which are used for the treatment of temporomandibular joint disorders and have proven to provide good results.

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Introduction
The temporomandibular joint is a hinge joint that connects the lower jaw to the temporal bone of the skull. It is one of the most frequently used joints in the human body. It is not only used while talking, chewing, yawning, swallowing and other normal activities, but even during sleep. The frequency of movement is assessed as approximately 1500–2000 times a day.¹

A Temporomandibular disorder (TMD) is a musculoskeletal disorder within the masticatory system. TMDs are defined by the American Academy of Orofacial Pain as “a collective term that embraces a number of clinical problems that involve the masticatory muscles, the TMJ(temporomandibular joint), and the associated structures.”² TMD’s occur as a result of problems with the jaw, jaw joint, and surrounding facial muscles that control chewing and moving the jaw. According to epidemiological studies, 70% of the population suffers from at least one symptom or sign of TMD, but only one 1/4th of this number is aware of it and only 5% seek medical treatment.¹ The complex array of symptoms and disability a person suffers often can lead them to feel that their condition is too difficult, frustrating, and elusive to treat.

Common signs and symptoms of TMD’s include:
1. Pain or tenderness in the temporomandibular joint, muscles of mastication, facial areas, ear region, shoulder and neck.
2. A clicking, popping or grating sound when opening or closing the mouth or while chewing.
3. Catching or locking or limitations of the joint with deviations or deflections of the mandible when opening or closing the mouth.
4. Difficulty or discomfort while chewing.
5. Sensation of an uncomfortable bite.²,³

It is essential to start treatment at the stage of mere dysfunction, i.e., at the stage when the changes are still reversible, in order to prevent irreversible structural changes. Physical therapy comprises a group of supportive actions that is performed in conjunction with definitive treatment.²,⁵-⁶ They can be broadly grouped into physical modalities and manual techniques though they work best in combination.

Physical therapy represents the physical treatment that can be applied to the patient.² It includes modalities like thermotherapy, coolant therapy, ultrasound, electrogalvanic stimulation, transcutaneous electrical nerve stimulation, iontophoresis, phonophoresis, acupuncture, and laser therapy. Manual therapy comprises of various techniques like stretching, mobilizations, and manipulations of the TMJ and cervical spine, exercise instruction (i.e., self-stretching and mobility strategies for the TMJ and cervical spine); patient education (i.e., postural instruction, relaxation techniques, and parafunctional awareness); and other modalities that improve tissue health. Katsoulis J and Richter M demonstrated that TMD patients who undertook specific physical therapy and regularly practiced self-physical therapy succeeded in relaxing their masticatory muscles and in decreasing the level of pain. Another clinical trial conducted by Madani and Mirmortazavi on patients with TMD highlighted the importance of physical therapy in pain relief.²

Treatment Modalities
Thermotherapy/Heat treatment: It is one of the most commonly used modalities to treat pain related to TMD. The basic mechanism behind thermotherapy is that it causes vasodilatation in the compromised tissues thereby improving the circulation and relieving the myalgia and muscles soreness. It also helps in increasing the extensibility of periarticular tissue. A hot water bottle wrapped in a hot, moist towel or an electric heating pad placed over the offending area for 10-15 minutes will provide the required amount of surface heat.² Moist heat penetrates to depths of 1-2cm. It is better than dry heat because
water transfers heat more quickly. Studies have shown that this modality is capable of improving active joint range of motion. Heat has also been shown to decrease muscle spindle sensitivity. This procedure should not be attempted more than 30 minutes. Risks include burn injuries if left unattended for a long time.

**Coolant therapy:** It is a mild stimulator of cutaneous nociceptor (counter irritation) as well as the thicker A-beta fibers, thus stimulating pain inhibitory mechanism. It can be given in the form of ice packs (ice in Styrofoam cup or bag of frozen vegetables), elastogel packs or vapocoolant sprays like ethyl chloride, fluoromethane etc. An instrument called ‘Cryostim probe’ is also used in a similar way and uses the combination of both cryotherapy and acupressure. It has been suggested that cold encourages the relaxation of muscles that are in spasm and thus relieves the associated pain. It also decreases the blood flow (by increasing viscosity of blood), edema and inflammation. Amin and Keith demonstrated that cryotherapy reduces nerve conduction and increases pain threshold and tolerance. Ice, when applied over the affected area for about 5-7 minutes is found to relieve pain (decreases peripheral nerve conduction). Arterial and venular vasoconstriction results if applied for a longer time (less than 15 min). It should be applied over the offending area in circular motion without applying any pressure on the tissues. A series of sensations starting from an unpleasant sensation, burning sensation and mild aching occur followed by numbness after which the ice should be removed. There is risk of frost bite if applied for longer duration. Vapocoolant sprays are applied to the desired area from a distance of 1-2 feet for approximately 5 seconds. Ethyl chloride spray was introduced by Schwartz in 1954 in a painful mandibular movement case. As it is a cardiac depressant and highly inflammable, it has been replaced by fluoromethane nowadays. A technique called spray and stretch is used in case of myofacial pain, which involves spraying the tissue over a mandibular movement case. As it is a cardiac depressant and highly inflammable, it has been replaced by fluoromethane etc. An instrument called ‘Cryostim probe’ is also used in a similar way and uses the combination of both cryotherapy and acupressure. It has been suggested that cold encourages the relaxation of muscles that are in spasm and thus relieves the associated pain. Information on areas of numb skin/decreased sensation TENS should be used with caution because it’s likely less effective due to nerve damage. It may also cause skin irritation due to the inability to feel currents until they are too high. TENS should not be used across an artificial cardiac pacemaker (or other indwelling stimulator, including across its leads) due to risk of interference and failure of the implanted device. It should also not be used during pregnancy as it can induce labour.

**Micro Current Electrical Nerve Stimulation (MENS):** It is a recent addition and works similar to TENS, but at a sub threshold level making it very appealing to use in facial and intraoral areas. It uses a signal amplitude of 1 millionth of an ampere. Gentle massage of the affected muscles can be done with one probe of the device intraorally and the other extraorally. Various studies have been conducted to compare TENS with MENS and to determine its effectiveness on muscle pain in TMD’s. Results suggest that MENS can be used as a means of adjunct physiotherapeutical modality in pain relief.

**Ultrasound (US):** It is a method of producing an increase in the temperature at the interface of the tissue and therefore affects deeper tissues rather than causing surface heat. Therapeutic ultrasound can serve as either a superficial or a deep heating modality depending on the frequency used. While 3 MHz US provides superficial heating, 1 MHz US heats tissues at depths of 3-5 cm and is considered to be a deep heating agent. US produces heat through high frequency acoustic vibrations. It is absorbed specifically in tissues with high collagen content (skin & fat absorb less heat whereas muscle and joint capsule absorbs more heat). It has been shown that because tendon tissue is less vascularized than muscle tissue, tendons will retain heat for longer periods of time. It stimulates the blood flow in deep tissues and separates collagen fibers, thus improving the flexibility and extensibility of connective tissues. Average treatment times range from 5 to 8 minutes. As the intensity is increased, the duration of the treatment should be decreased accordingly. Strickler et al found that an increase in temperature of 4 degrees for a brief period increased the amount of elongation a tissue could sustain without rupture. It can be used along with surface heat, especially in treating post trauma patients. Ultrasound along with deep heat are used in treatment of inflamed joints.

**Phonophoresis:** Ultrasound has also been used for drug delivery through the skin and this is called phonophoresis. Salicylates, topical anesthetics, anti-inflammatory agents, steroids etc can be Transdermally delivered to deeper tissues by this manner and helps in enhancing their actions.

**Iontophoresis:** It is similar to phonophoresis except that it utilizes a low voltage electrical current to drive the medications into the tissues. It is basically an injection without needle. Movement of the medicines are measured in units of chemical
flux i.e. μmol /cm²h. Medicines are usually placed in a pad or patch and placed over the offending area and driven into the desired tissues using electricity. The ion solution of a pharmacologic agent is placed under the electrode of the same polarity. The site of application must be free of cuts, abrasions and skin eruptions. Local anesthetics, corticosteroids and anti-inflammatory agents are usually delivered by this method. Electro-acupuncture has emerged as a promising modality and has been successfully used with some TMD symptoms. It stimulates muscle nociceptors which in turn activate the endogenous antinociceptive mechanism. Stimulation of certain specific points (acupuncture points) release endorphins that in turn reduce painful sensations by flooding the afferent interneurons with sub threshold stimuli. In the treatment of TMJ dysfunction acupuncturists often find a deficiency of qi (energy flow in Chinese) in the liver meridian and an excess of qi in the gall bladder meridian. According to studies by Rosted P, Acupuncture proved effective in the treatment of TMD’s and as analgesia. The effect of acupuncture in treating TMD and facial pain seems real and acupuncture could be a valuable alternative to orthodox treatment.

Electro-acupuncture: Utilizes a flow frequency (2 Hz) but high intensity electric current and is applied at specific cutaneous sites called as acupoints.Electro acupuncture is quite similar to traditional acupuncture in that the same points are stimulated during treatment. As with traditional acupuncture, needles are inserted on specific points along the body. The needles are then attached to a device that generates continuous electric pulses using small clips. These devices are used to adjust the frequency and intensity of the impulse being delivered, depending on the condition being treated. Electro acupuncture uses two needles at time so that the impulses can pass from one needle to the other. Several pairs of needles can be stimulated simultaneously, usually for no more than 30 minutes at a time.

Cold Lasers: A cold laser is thought to accelerate collagen synthesis, increase vascularity of healing tissues, decrease the number of microorganisms and decrease pain. It also increases capillary permeability. It is generally applied for a time period of 3 minutes and gives an output of 4 joules/cm².

In many cases cold lasers have been used on persistent TMJ pain. Low-level therapy(LLLT) is suggested to have bio stimulating and analgesic effects through direct irradiation without causing thermal response.

Hydrotherapy: It involves the use of water for pain relief and treatment. The term encompasses a broad range of approaches and therapeutic methods that take advantage of the physical properties of water, such as temperature and pressure for therapeutic purposes, to stimulate blood circulation and treat symptoms of certain diseases. It is useful, especially for neck and back pains of muscular origin. Usually agitated circulating water and a brisk stream of shower water is used to provide therapeutic effect. Hydrotherapy can be used with heat, cold or combination approaches.

Muscle Exercises: Various muscle exercises have been advocated for the treatment of TMD’s. All muscle exercises basically aim at relaxing the muscles, improving its strength and stretch ability and increasing arthokinematics. For e.g. postural exercises by Rozabado help to improve jaw motion, head and neck posture, induce muscle relaxation and proper joint resting position in patients. Similarly there are various TMJ rotation exercises, shoulder and head posture exercises, jaw opening exercises extra that provide similar effects.

Biofeedback: This technique is useful for treating stress related Temporomandibular disorders and should be a part of comprehensive treatment plan. One can always use biofeedback to analyze the effectiveness of exercises. Sensors are placed on the jaw and muscles and shows the amount of tension in your muscles. It amplifies minute muscle action potentials or skin temperature to provide immediate feedback on muscle tension or circulation through visual or auditory means. This is called as electromyography feedback. Patients can be taught how to reduce muscle tension and relax their muscles. It reduces heart rate, respiratory rate, and blood pressure and lactic acid levels in blood. It can be used for self-regulation and motivation.

Conclusion

Although dentistry has undergone a sea change over the years, the management and treatment of TMD still remains an enigma. The unknown but true rationale behind the particular TMD problem should be recognized and treated appropriately. TMD management requires a multidisciplinary approach. As dentists, we must understand the importance of diagnosing and treating the underlying cause and the role of physiotherapy in reducing the pain related to TMD. The practitioner managing the patient’s therapy should decide which therapies are most cost-effective and evidence-based, and which have the greatest potential to provide the patient with long-term relief.

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