Effectiveness of ultrasound therapy to reduce pain and help in mouth opening in TM Joint dysfunction- A review

Dr Rajvi. B. Shah

Assistant Professor, College of Physiotherapy, Sumandeep Vidyapeeth Deemed to be University, Vadodara
Corresponding author email: shahrajvi9493@gmail.com

Abstract

Background and objective Temporomandibular joint is a complex joint. which connects the mandible to the skull. Temporomandibular disorders (TMD) are a group of pathologies that affect the masticatory muscles, the temporomandibular joint, and related structures and affect more than 25% of the general population. The objectives of current review are to report effects of the Ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions.

Methods: A literature search for current study was performed in electronic databases of PubMed and Google scholar. Many articles were assessed, articles assessing TENS, Laser therapy, splint and any type of therapeutic interventions were eliminated.

Conclusion: The present article provides an overview of the effects of ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions.

Keywords: Temporomandibular disorder, Ultrasound therapy, Pain, Mouth opening.

INTRODUCTION

Temporomandibular disorder is the one type of musculoskeletal disorder which affected in the masticatory system. In India around 27.7% of the populations are affected.[1]This joint is one of the most complex and dynamic joint in the body.TMD is a pathological conditions which involve TM Joint, its associated structures and its functions.[1] Most common signs and /or symptoms of this disorders are pain, joint sounds, limitation in jaw movement, muscle tenderness, and joint tenderness. Other symptoms are headache, ear-related symptoms &cervical pain, if patient having chronic TMD Also report symptoms of depression, poor sleep and low energy. [2] There are many Risk factors include age, sex (Female prominence), ethnicity (more common in Caucasians),Parafunctional habits (tics, chewing gum), bruxism, Hyper laxity and malocclusion.[3]

The first time study was done in 1934 by otolaryngologist James Costen, after that there was another epidemiological studies concerning TMD are in the Scandinavian school in 1974.after that In 1990, studies conducted by Dworkin et al. showed some difficulties in obtaining similar methodologies among the studies to validate TMD treatments. These authors developed a Research Diagnostic Criteria for Temporomandibular Disorders (RDC/ TMD) to standardize and, therefore ensure more reliability to TMD studies.[4] The Research Diagnostic Criteria for TMD classifies patients into three groups: (a) myogenous (sustained by muscular

dysfunction, bruxism, abnormal posture, and myofascial conditions); (b) disk displacement or articular disk derangement; (c) articular causes (arthralgia, inflammatory arthritis, osteoarthritis, and less commonly ankylosis and neoplastic conditions).[5]

There are various type of treatment options available like surgical and non surgical. Most commonly non surgical treatments are occlusal splints of temporomandibular joints (TMJs) and the muscles of mastication, Exercises therapy, phototherapy, transcutaneous electrical nerve stimulation (TENS), ultrasound, dry needling, biofeedback therapy, pharmacotherapy and psychological treatment.[4] Ultrasound mainly work as a mechanical vibration at frequencies above the limit of human sound detection, which can be transmitted into the body as high-frequency acoustic pressure waves. [6] Therapeutic ultrasound has an output between 20 to 60 kHz. It produces deep heat at joints and treats joint contracture by increasing the stretch of the extra capsular soft tissue. It also decreases non-acute pain, muscle spasms, and inflammation of the tendon, facilitating the stretch of soft tissue by reducing the viscosity of collagen, thereby decreasing the firing Capacity of type II muscle-spindles. [7] The objectives of current review are to report effects of the Ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions.

MATERIALS & METHODS

This is a review of literature related to the acknowledgement of the effect of the Ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions. Electronic databases of Pubmed and Google scholar were used for searching the articles. All types of the studies like Systematic reviews, Meta-analysis, Randomized control trials, Cohort studies, Narrative reviews and Case series are included. The articles published in English language and irrespective of the year of publication were included in the study. Synthesis of reviewed articles was carried out in four steps:

Step 1: Introduction about TM joint dysfunctions.

Step2: Importance of the physiotherapy in TM joint dysfunction

Step 3: Various techniques of physiotherapy treatment in TM joint dysfunction.

Step 4: The effects of ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions.

Introduction about TM joint dysfunctions:

There are Various signs and symptoms of TM joint dysfunctions like pain, impaired jaw function, malocclusion, deviation or deflection, limited range of motion, joint noise, and locking. Also Headache, tinnitus, visual changes, and other neurologic complaints.TM joint dysfunctions or disorders having many classifications. TM can be divided into two parts muscular and articular categories. Myogenic disorders include myalgia (myofascial pain, fibromyalgia), myospasm, splinting, and fibrosis/contracture. articular disorders include synovitis/capsulitis, joint effusion, trauma/fracture, internal derangement, arthritis, and neoplasm. Articular disorders include synovitis/Capsulitis, joint effusion, trauma/fracture, internal derangement,

arthritis, and neoplasm. There are various treatment options are available Conservative, Physiotherapy, Medical and surgical .but surgical treatment is the last option in this case. [8]

In medical and dental field most commonly used TM joint dysfunction criteria is Research diagnostic criteria for Temporomandibular disorders (RDC/TMD). The primary purpose was to evaluate the reliability of the 8 RDC/TMD Axis I diagnoses that include.[9]

- Group I Muscle Disorders: (Ia) myofascial pain; (Ib) myofascial pain with limited opening.
- Group II Disc Displacements: (IIa) disc displacement with reduction; (IIb) disc displacement without reduction with limited opening; (IIc) disc displacement without reduction without limited opening.
- Group III Arthralgia, Arthritis, Arthrosis: (IIIa) arthralgia; (IIIb) osteoarthritis; (IIIc) osteoarthrosis. [9]

Importance of the physiotherapy in TM joint dysfunction

Generally exercise therapy uses to reduce clinical symptoms like pain in the muscles and joints. mainly exercise therapy divided into two parts self exercise and Manual therapy that passively applied by the physiotherapist. In the exercise therapy includes mobilizations, stretching, Muscle strengthening exercise etc.[10]

Generally we divided exercise therapy for TM joint in 4 parts: Mobilization, Muscle strengthening exercise, Coordination exercise and Postural exercise. In the mobilization exercise includes Passive jaw Mobilization and voluntary jaw opening exercise. all the different exercises main purposes are to improve flexibility and extensibility of muscles,Fascia,tendons and ligament of masticatory muscles and facial muscles around the mouth so as to result in pain relief. [10]

Strengthening exercise used to strengthen the targeted muscles. For TM joint isotonic jaw opening exercise and isotonic jaw closing exercises are used to train aw opening and closing muscles with resistance. Mainly used to improvement of limited range of mouth. Isotonic jaw closing exercise releases tension in the masseter and temporalis,which yields relief of muscle related pain. [10]

Coordination exercise refers to rhythmical movement that activates both agonist and antagonist muscles. For TM joint open, close and lateral movements of the mandibular are effective to obtain coordination of muscle activity in masticatory muscles.[10]

Postural exercise is also used for TM Joint region because it is believed that wrong head position can cause muscle pain due to acceleration of muscle activity in the neck and jaw muscles, as well as postural reflex. Exercises including mainly head posture correction, correction of mandibular position including tongue postural exercise and myofascial release. [10]

Various techniques of physiotherapy treatment in TM joint dysfunction

There are various treatment options in the physiotherapy for various goals like pain relief, muscle strengthening, improve range of motion and improve functional mobility.

also various electrical modality used for the same. For TM Joint dysfunction various treatment options like mobilization, manipulation, Massages, Muscle release techniques, Laser therapy, dry needling, taping therapy used and many others options are available.

In this study we included 3articles of dry needling, 3articles of Taping, 3 articles of low Laser therapy and 2 articles of Mobilization techniques. There are many articles available regarding effects of different techniques in the cases of TM joint dysfunctions regarding pain relief, reduce muscle spasm, improve mouth opening and improve functional mobility. Here I have included three articles, Total 120 patients treated by deep dry needling included in the review. In the first and second study deep dry needling of trigger points in the lateral Pterygoid muscle shows good efficacy in reducing pain and mouth opening ,laterality and protrusion movement compared with methocarbamol/Paracetamol treatment. No adverse events were observed with respect to deep dry needling of trigger points. The mechanism of inactivation of a trigger points by dry needling is unknown[11,13]. According second articles there are mainly two types of dry needling technique exist, based on the depth to which the needle is inserted up to the subcutaneous tissue overlying the myofascial trigger point. Deep needling in which the needle is inserted in to the muscle with the intention of reaching the myofacial triggerPoint.[12]This minimally invasive technique is based on the insertion of a needle, without any additional substances, into myofascial trigger points, which are irritable nodules of a tensed band composed of hypertonic muscle fibers.[12]

Here I have included three articles with total 148 Patients treated by Kinesio taping included in this review. kinesio taping treatment is effective in TM joint dysfunctions in terms of pain relief, improve in the Range of motion and improve functional mobility. In kinesio taping had minor effects on neuromuscular level. Skirven et al suggested that the analgesic action is local, and its main goal is to enlarge the space between the skin and soft tissues in order to expand the movement space, facilitate the circulation of blood and lymph, and increase the rate of tissue healing[15]. Also low level laser therapy is also effective in terms of reduce pain , improve mouth opening and improve finctional mobility in the case of TM joint dysfunctions. and all are work in the different mechanisms.

The effects of ultrasound therapy to reduce pain and help in mouth opening in individuals with TM Joint dysfunctions.

Here I have included 9 articles in this review. According to research by Shalu Rai et.al they included in them study around 90 patients who were assigned in three different groups each having 30 patients. Group I was healthy control patients, Group II was receiving The US therapy, and Group III was receiving TENS therapy. The frequency used is between 1.0 and 3.0 MHz. It is known to accelerate healing, decrease joint stiffness, alleviate pain, increase the extendibility of collagen fibers, and reduce muscle spasm.[17]

According to research by Dr. Smita Kamtane and Dr. D. M. Sable they included in them study around 15 patients Out of fifteen patients thirteen were female and two were male. Patients are assigned to therapeutic ultrasound therapy and received the treatment for 10 days (5 times a week for 2 weeks). In this study All the patients were evaluated for the following parameters before, and after every treatment session: mouth opening (mm) and subjective evaluation of muscle pain on VAS scale. In the end of study they concluded Ultrasound therapy is promising with little or no complications and can be used for pain relief in TMJ dysfunction.

Another 7 studies which I have included all the give positive result after giving ultrasound treatment in the case of TM Joint dysfunctions.

Study ID	Objective	Study design	No. of participants	Diagnosis	Interventions	Outcomes
2016 European Journal of Dentistry	To compare the results of two treatment modalities(TENS and U.S)	A comparative study	90	TM Joint dysfunction	Group I was healthy control patients, Group II was receiving Th US therapy, and Group III was receiving TENS therapy	Pain (VAS)
World Journal of Pharmaceutical Research, Vol 6, Issue 15, 2017.	Effect of ultrasound therapy over temperomandibular joint	Experimental study	15	TM Joint dysfunction	15 patients were taken in this study, The pre-post experimental study is carried out on 15 patients of either sex between 20 years and 50 years. Patients are assigned to therapeutic ultrasound therapy and received the treatment for 10 days (5 times a week for 2 weeks).	Pain (VAS),Mouth opening
2018 Ann Rehabil Med.	Effects of Ultrasound, Laser and	A RCT	60	TM Joint pain and Trismus	Sixty participants following, who had experienced HNC,	visual analog scale

	Exercises on Temporomandibular Joint Pain and Trismus Following Head and Neck Cancer			following Head and neck cancer	were randomly allocated to three groups of 20 people each. Each group received different therapy. Group A received LIUS and TET; group B received LLLT and TET; while group C received TET.	(VAS), the University of Washington Quality of Life questionnaire (UW-QOL) and the Vernier caliper scale (VCS)
Drug Invention Today |Vol 12 • Issue 3 • 2019	A comparative study of ultrasound therapy and transcutaneous electrical nerve stimulation in reducing pain for temporomandibular joint disorder	A Comparative	30	Temporomandibular joint disorder	A total of 30 subjects are taken according to the inclusion criteria, The subjects are divided into two groups. *Group A* Subjects receive TENS for the duration of 15 min TENS is a simple, non-invasive analgesic technique. *Group B* Subjects receive continuous mode ultrasound at frequency of 1.0 and 3.0 MHz to TMJ duration of 5 min.	visual analog scale
Indian Acad Oral Med Radiol 2022;34:242	Comparative Evaluation of Efficacy of Therapeutic	Comparative	30	Myofascial pain dysfunction	Thirty patients with MPDS were randomly assigned into two groups.	Pain (VAS),Mouth opening

-5.	Ultrasound and Phonophoresis in Myofascial Pain Dysfunction Syndrome			syndrome	Group 1 (*n* = 15), therapeutic ultrasound was applied with ultrasound gel without any therapeutic ingredient for 10 min and five sessions. Group 2 (*n* = 15), ultrasound was applied with ultrasound gel with diclofenac and thiocolchicoside gel for 10 minutes and five sessions.	
Journal of Pain Research	Ultrasound is Effective to Treat Temporomandibular Joint Disorder	A RCT	160 Patients	TM Joint dysfunction	A total of 160 patients with TMD were enrolled in this study. The subjects were randomized into two groups to receive US therapy or no therapy. Patients in the US group were given US therapy once a day for 5 days per week for 2 consecutive weeks. Before and 4 weeks and 6 months after the treatments, the patients were assessed for pain using visual analog scale (VAS) and the maximum pain-free inter-incisal distance	visual analog scale (VAS) ,The maximum pain-free inter-incisal distance (IID),mandibular,movement (MM), jaw noise (JN), disability index (DI) and craniomandibular index (CMI) .

					(IID).	
Middle East J Rehabil Health Stud. 2020 July; 7(3):e102928.	Effect of Diclofenac Gel Phonophoresis on Temporomandibular Joint Disorders: A Prospective QuasiExperimental Study	Quasi-Experimental Study	50 Patients	Temporomandibular joint disorder	Twenty sessions (1 session per day) of continuous Ultrasound to intensity of 1 W/cm2/1 MHz/5 minutes over the affected joint, with Ultrasound gel (5 mL) and 10% diclofenac gel (5 mL) in a proportion of 1:1 as transducer medium.	Pain (VAS),Mouth opening
OHDM-Vol. 17-No.2-April, 2018	Treatment of Temporomandibular Disorder Using Synergistic Laser and Ultrasound Application	Case report	----------	TM Joint dysfunction	In this study, two therapeutic sessions were carried out per week for 4 weeks, followed by an assessment of the initial pain: (t=0), at the end of 8 clinical sessions (t=1) and 30 days after the end of the treatment (t=2). During the clinical assessments, data was collected, using the analogue scale for pain and oral quality of life questionnaire [Oral Health Impact Profile (OHIP-14)] in the pre- and post-treatment periods.	Pain (VAS), oral quality of life questionnaire

J. Phys. Ther. Sci. 26: 1847–1849, 2014	Effectiveness of a Home Exercise Program in Combination with Ultrasound Therapy for Temporomandibular Joint Disorders	RCT	38 Patients	TM Joint dysfunction	This study enrolled 23 female and 15 male patients who were divided randomly into two groups. The home exercise group performed a home exercise program consisting of an exercise program and patient education, and the home exercise combined with ultrasound group received ultrasound therapy in addition to the home exercise program.	Pain (VAS),Mouth opening

CONCLUSION

The results of this review support the use of Ultrasound therapy to reduce pain, improve in mouth opening and improve functional mobility. according to all the included studies 's conclusion have positive results in terms of reduce pain, mouth opening and improve functional mobility. The main effects of ultrasound is associated with the effect of micro-destruction which is responsible for micro-tears of non-vascularized or scantily vascularized tissues, and thus stimulate revascularization by the local release of growth factors and mobilization of stem cells, leading to increased blood supply to the tissue and ultimately reduce pain.[23]

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