



## THE EFFECT OF THERAPEUTIC ULTRASOUND AND PHONOPHORESIS ON TMJ PAIN

### Dental Science

**Dr Joyce Sequeira\*** BDS, MDS Professor & HOD Department of Oral & Maxillofacial Surgery Yenepoya Dental College Mangalore – 575018. \*Corresponding Author

**Dr Thejas Girishan** BDS Postgraduate Department of Oral & Maxillofacial surgery Yenepoya Dental College Mangalore – 575018

### ABSTRACT

Temporomandibular disorders (TMD) relate to discomfort of the temporomandibular joint (TMJ). The disorder is multifactorial with a degree of psychogenic influence varying throughout an individual's life with phases of symptoms affecting the quality of life. Taking into consideration the application of different physical therapies for the reduction of this pain, this study is to compare the effect of ultrasonic therapy and phonophoresis on TMJ pain. **MATERIAL AND METHODS:** The study Sample consist of twenty clinically confirmed cases of TMJ pain, visiting the dental clinic of the Department of oral and maxillofacial surgery, Yenepoya Dental College, Mangalore. They were divided into two groups- Group A patients (n=10) received Hydrocortisone Phonophoresis therapy and Group B patients (n=10) received only Ultrasound, daily for a period of 7 days. The outcome were measured by Pain Status & mouth opening, measured using VAS and vernier calliper. **RESULTS:** After the treatment period score of the Group-A who received Hydrocortisone Phonophoresis is significantly higher than Group-B on the Pain Intensity and Improvement in mouth opening when analysed using independent 't' test at  $p < 0.05$  **CONCLUSION:** The data suggest that phonophoresis therapy can be used as an treatment modality in controlling pain associated with TMDs. However, further studies on larger sample size with longer follow up periods are required.

### KEYWORDS

Phonophoresis Therapy, Vernier Calliper, Hydrocortisone.

### INTRODUCTION

The temporomandibular articulation consists of a complex synovial system composed of two TemporoMandibular Joints(TMJ) together with their articular ligaments and masticatory muscles.<sup>1</sup> The bony elements of this articulation are the mandibular condyle below and the squamous temporal bone above. An articular disc is interposed between the glenoid fossa and condyle, dividing the articular space into upper and lower compartments. Gliding or translatory movements occur primarily in the upper compartment, while the lower compartment functions as a hinge or rotary joint. So it is classified as ginglymodiarthrodial joint, namely, a joint that is capable of hinge-type movements (ginglymos) and gliding movements.<sup>2,3</sup>

Temporomandibular disorders (TMDs) is a collective term embracing a number of clinical problems that involve the temporomandibular joints and associated structures, or both. These disorders are characterized by facial pain in the region of the TMJs and muscles of mastication, limitation or deviation in mandibular movements, clicking sounds during jaw movement and function, ear symptoms like tinnitus, sensation of variable bite changes.<sup>4,5</sup> Though aetiology remains as a controversy, multiple factors influence the evolution of TMD, like Para functional habits, emotional distress, acute trauma from blows or impacts, trauma from hyperextension, instability of maxillomandibular relationships, laxity of the joint, co-morbidity of other rheumatic or musculoskeletal disorders, poor general health and an unhealthy lifestyle.<sup>6</sup>

The goals for management of TMD includes: Pain reduction, restoration of normal jaw function, reduction in the need for future health care and restoration of normal lifestyle functioning. A wide variety of therapies proposed for TMD are orthopaedic stabilization, intraoral appliances, behavioural therapy, placebo and pharmacotherapy with analgesics, muscle relaxants, antidepressants and an alternative management using ultrasound therapy.<sup>7,8</sup>

There has been an increasing incidence of Temporomandibular joint pain in adults due to unbalanced activity, spasm on over use of jaw muscle, and stress.<sup>9</sup> Taking into consideration the application of different physical therapies for the reduction of this pain, This study was designed to compare the effect of ultrasonic therapy and Hydrocortisone phonophoresis on patient with painful TMJ.<sup>10</sup>

### AIM:

Aim of the study was to determine the efficacy of therapeutic ultrasound and phonophoresis on TMJ pain.

### MATERIALS AND METHODS

This prospective randomized clinical study was performed at the Department of Oral and Maxillofacial Surgery Yenepoya dental college, Mangalore. The study was conducted with approval from the Ethics Committee. (Research Ethics Committee of yenepoya university) and written consents were obtained from patients before the study

The sample comprises of twenty (one male and nineteen females) clinically confirmed cases of TMJ pain meeting the inclusion criteria are Patients with TMJ pain with age group of 20-50 years and patients who are medically compromised are excluded from the study .

Randomly patients received and divided into two groups, Group A and Group B

**Group A** (n=10) received phonophoresis (ultrasonic therapy with 1% hydrocortisone cream). Application of 1% (W/W) hydrocortisone cream with ultrasound therapy on the skin and receiving 3MHz frequency with pulse mode and 1.5 to 2.0 W/cm<sup>2</sup> of intensity for 7 to 10 min for 7 subsequent days. (fig-1)(fig-2)



Figure 1: Armamentarium For Ultrasound Therapy



Figure 2: Patient During Phonophoresis Therapy

**Group B** (n=10) received ultrasonic therapy with 1MHz frequency and continuous mode with intensity of 0.25to 0.75 W/cm<sup>2</sup> for 7 to 10min for 7 subsequent days.(fig-3)

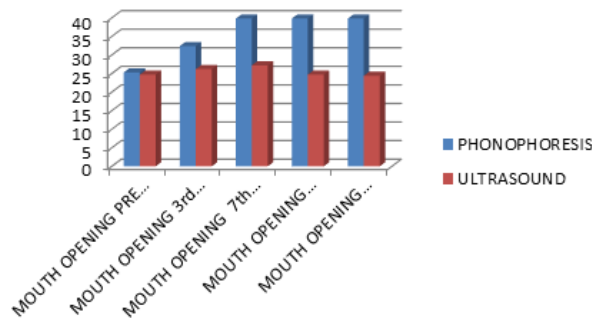


**Figure 3 : Patient During Ultrasound Therapy**

**RESULTS**

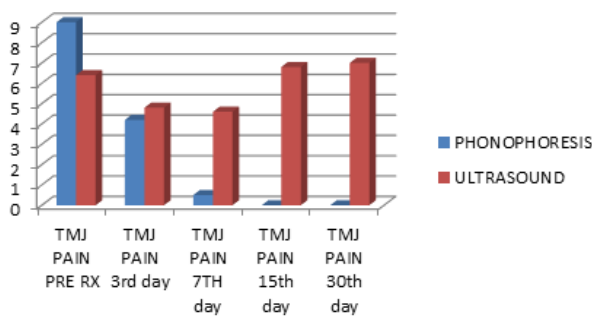
The study showed, significant reduction in pain in all the 20 patients after the two sessions of treatment. Hydrocortisone Phonophoresis had an effective reduction in the pain status as well as improved mouth opening in Group-A subjects as compared to Group-B with ultrasound therapy. The reduction in the mean of pain status and mouth opening values of Group-A subjects is depicted very clearly in the graphs. Which shows that adjuvant phonophoresis therapy can effectively used as pain control modalities in TMJ pain.(table-1) (graph-1)(graph-2)

**Independent 'T' Test Performed With Pre & Post Values Of Mouth Opening For Significance Between Groups**



**Graph: 01**

**Independent 'T' Test Performed With Pre & Post Values Of Pain Intensity For Significance Between Groups**



**Graph: 02**

**Table-1 Comparison Of The Two Groups In Each Category : 'T' Test**

GROUP	MODALITIES	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
MOUTH OPENING PRE RX	PHONOPHORESIS	10	25.3	5.143	0.269	18	0.791
	ULTRASOUND	10	24.7	4.809			
MOUTH OPENING 3rd day	PHONOPHORESIS	10	32.4	3.806	3.58	18	0.002

	ULTRASOUND	10	26.2	3.938			
MOUTH OPENING 7th day	PHONOPHORESIS	10	39.8	0.632	7.93	9	<0.001
	ULTRASOUND	10	27.2	4.984			
MOUTH OPENING 15th day	PHONOPHORESIS	10	39.8	0.632	9.845	11	<0.001
	ULTRASOUND	10	24.7	4.809			
MOUTH OPENING 30th day	PHONOPHORESIS	10	39.8	0.632	10.65	51	<0.001
	ULTRASOUND	10	24.4	4.526			
TMJ PAIN PRE RX	PHONOPHORESIS	10	9	1.054	3.702	13	0.002
	ULTRASOUND	10	6.4	1.955			
TMJ PAIN 3rd day	PHONOPHORESIS	10	4.2	1.135	-0.88	7	0.387
	ULTRASOUND	10	4.8	1.814			
TMJ PAIN 7TH day	PHONOPHORESIS	10	0.5	0.707	-6.78	1	<0.001
	ULTRASOUND	10	4.6	1.776			
TMJ PAIN 15th day	PHONOPHORESIS	10	0	0	-12.7	5	<0.001
	ULTRASOUND	10	6.8	1.687			
TMJ PAIN 30th day	PHONOPHORESIS	10	0	0	-12.1	24	<0.001
	ULTRASOUND	10	7	1.826			

**DISCUSSION**

The term temporomandibular joint disorders (TMDs) are used to describe a wide range of symptoms manifested by disruption of normal temporomandibular joint function. Although the term TMD is not a disease entity, rather a range of manifestations of altered structure or performance of articular and periarticular tissues that may arise from a variety of causes.<sup>11</sup> Pain can be present at any stage of TMDs and is a significant part of the symptoms that prompt patients to seek treatment. Treatments for TMDs are wide-ranging and directed primarily toward relief from persistent orofacial pain.<sup>12</sup> The variety of therapies proposed for TMD are orthopaedic stabilization, intraoral appliances, behavioural therapy, placebo and pharmacotherapy with analgesics, muscle relaxants and antidepressants. An alternative mode of management is ultrasound therapy.<sup>8,13</sup>

Transdermal drug delivery through the use of topically applied agents has been used in the treatment of systemic conditions such as motion sickness, hypertension, and angina, as well as for the local treatment of musculoskeletal injuries. The use of physical modalities such as ultrasound enhances the delivery of topically applied compounds. The potential advantage of this technique is that it is noninvasive, minimizes the risk of hepatic and renal injury from drug elimination, and is well tolerated by the patients.<sup>14</sup> Hydrocortisone phonophoresis is a therapeutic treatment method that uses ultrasound to drive hydrocortisone into subcutaneous tissues in order to produce an anti-inflammatory effect. The treatment is used for conservative management of numerous musculoskeletal disorders that affect the military readiness of the patient.<sup>15</sup>

Ultrasound, a form of acoustic energy (sound waves that are above the audible limit : >20 KHz) is one of the most widely and frequently used electro physical agents. Therapy dosage can be varied by lowering the frequency of the ultrasound beam: lower the frequency, deeper the penetration of the waves. A typical treatment session would last between 3 and 10 minutes depending on the injury.<sup>5</sup>

S, Doğan SK, Evcik D, Başer OC( 2011) compare the effect of phonophoresis, ultrasound and placebo ultrasound therapies in the treatment of myofascial pain syndrome (MPS). They concluded both diclofenac phonophoresis and ultrasound therapy were effective in the treatment of patients with MPS, and phonophoresis was not found to be superior over ultrasound therapy. In this study proposed that, marked improvements in clinical parameters were obtained with phonophoresis or therapeutic ultrasound in patients with TMJ pain, and phonophoresis therapy was found to be superior to the other<sup>16</sup>.

Pottenger et al (1989) studied the utilization of hydrocortisone phonophoresis in United States Army Physical Therapy Clinics. It was

surveyed by a questionnaire and demonstrated that a majority of Army clinics used hydrocortisone phonophoresis for the management of various musculoskeletal disorders that affect the military readiness of the patient.<sup>15</sup> Goraj-Szczybiorowska and colleagues (2007) noted that although phonophoresis is commonly used among physical therapists, doubts persist as to the relevance and effectiveness of this method.<sup>17</sup>

The ultrasound which was used as an enhancer of transcutaneously applied steroidal transcutaneous drugs, would have had some systemic effects on reducing pain and improving mouth opening.<sup>18</sup> In the phonophoresis group, overall improvement can be due to the improved internal muscle mechanics. Another possible mechanism of action is due to its neurophysiological effects on the nervous system, on the basis of nociceptive system. The phonophoresis would have exerted an effect on mouth opening; by altering pain perception locally at the joint by inhibiting nociceptors, facilitating the large afferent fibers input into spinal cord and possibly by endogenous processes of pain inhibition. Thus the study implies that phonophoresis with proper regime of exercises, various musculo-skeletal discomforts can be overcome and also eradicated, if all these measures are incorporated from the beginning. Limitations of the study (1) This study couldn't be generalized to everyone as the sample size was small.(3) The study was limited with an age group of 20-50 years.(3) The study was limited to only TMJ pain patients.(4) The study was limited to assess only the Pain Status and improving mouth opening.

## CONCLUSION

In this study, an attempt was made to evaluate the efficacy of ultrasound and phonophoresis therapy as an adjuvant modality in reducing pain and increase in mouth opening among 20 TMJ pain patients. But in this study it clearly emphasizes that phonophoresis therapy is more effective, and used as an adjuvant modality in controlling pain and mouth opening associated with temporomandibular disorders. Hence forth sample size in this study is very less, further studies on larger sample size with longer follow up periods are required to affirm the results obtained from this study.

## REFERENCE

- Alomar X, Medrano J, Cabratosa J, Clavero JA, Lorente M, Serra I, Monill JM, Salvador A. Anatomy of the temporomandibular joint. In *Seminars in Ultrasound, CT and MRI* 2007 Jun 1 (Vol. 28, No. 3, pp. 170-183). WB Saunders.
- Gage JP. Mechanisms of disc displacement in the temporomandibular joint. *Australian dental journal*. 1989 Oct;34(5):427-36.
- Hyllander WL. Functional anatomy and biomechanics of the masticatory apparatus. *Temporomandibular disorders: an evidenced approach to diagnosis and treatment*. New York: Quintessence Pub Co. 2006.
- Rossetti LM, Rossetti PH, Conti PC, Araujo CD. Association between sleep bruxism and temporomandibular disorders: a polysomnographic pilot study. *CRANIO®*. 2008 Jan 1;26(1):16-24.
- Conti PC, Pinto-Fiamengui LM, Cunha CO, Conti AC. Orofacial pain and temporomandibular disorders: the impact on oral health and quality of life. *Brazilian oral research*. 2012;26(SPE1):120-3.
- Howard JA. Disorders, Facial Pain, and Dental Problems in Performing Artists.
- Michelotti A, Iodice G. The role of orthodontics in temporomandibular disorders. *Journal of oral rehabilitation*. 2010 Jun;37(6):411-29.
- Gil-Martínez A, Paris-Alemán A, López-de-Uralde-Villanueva I, La Touche R. Management of pain in patients with temporomandibular disorder (TMD): challenges and solutions. *Journal of pain research*. 2018;11:571.
- Buranastidpom B, Hisano M, Soma K. Effect of biomechanical disturbance of the temporomandibular joint on the prevalence of internal derangement in mandibular asymmetry. *The European Journal of Orthodontics*. 2006 Jun 1;28(3):199-205.
- Ciccone CD, Leggin BG, Callamaro JJ. Effects of ultrasound and trolamine salicylate phonophoresis on delayed-onset muscle soreness. *Physical therapy*. 1991 Sep 1;71(9):666-75.
- Singh RK. Temporomandibular joint disorders. *National Journal of Maxillofacial Surgery*. 2016 Jan;7(1):1.
- Manfredini D, Piccotti F, Ferronato G, Guarda-Nardini L. Age peaks of different RDC/TMD diagnoses in a patient population. *Journal of dentistry*. 2010 May 1;38(5):392-9.
- Shanavas M, Chatra L, Shenai P, Rao PK, Jagathish V, Kumar SP, Naduvakkattu B. Transcutaneous electrical nerve stimulation therapy: An adjuvant pain controlling modality in TMD patients—A clinical study. *Dental research journal*. 2014 Nov;11(6):676.
- Klaiman MD, Shrader JA, Danoff JV, Hicks JE, Pesce WJ, Ferland J. Phonophoresis vs Ultrasound in the treatment of common musculoskeletal conditions. *Med Sci Sports Exerc* 1998;30:1349-55.
- Pottenger FJ, Karalfa BL. Utilization of hydrocortisone phonophoresis in United States Army physical therapy clinics. *Military Medicine*. 1989 Jul 1;154(7):355-8.
- S, Doğan SK, Evcik D, Başer OC ( 2011 ) compare the effect of phonophoresis, ultrasound and placebo ultrasound therapies in the treatment of myofascial pain syndrome (MPS).
- Muktamath U, Muktamath V, Maniazhagu D. Effects of phonophoresis on supraspinatus tendinitis in abducted position and adducted and internally rotated position of college men. *Journal of Exercise Science and Physiotherapy*. 2009 Jun;5(1):42.
- Byl NN. The use of ultrasound as an enhancer for transcutaneous drug delivery: phonophoresis. *Physical therapy*. 1995 Jun 1;75(6):539-53.