COMPARATIVE EVALUATION OF EFFICACY OF TENS AND US THERAPY IN THE MANAGEMENT OF PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

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ABSTRACT

BACKGROUND - The temporomandibular joint(TMJ)) is a bilateral synovial articulation between the temporal bone of the skull above and the mandible bone below. Any disruption in maintaining the harmonious relationship between the two can lead to Temporomandibular disorders (TMDs). Treatment therapy of TMDs include various surgical and non surgical methods. Non-surgical methods are proved to be very effective for TMDs.

AIM AND OBJECTIVE-The purpose for this study is to evaluate the efficacies of TENS and US techniques as these are highly recommended due to minimal or no side effects and immediate relief causing by them.

MATERIAL AND METHOD -Total 60 patients were divided in Group A and B -TENS and Ultrasound therapy. The therapy was given for 10 minutes 2-3 times in week for one month and evaluation was done at 1st, 2nd ,3rd and 4th week.

RESULTS- Both of the modalities were effective in management of TMDs .Ultrasound was more effective in improving pain (statistically significant at $p < 0.05$) while TENS and US were equally effective in reducing muscle tenderness in both groups (statistically significant at $p < 0.05$). No significant results were seen in mouth opening and deviation in patients of both groups.

CONCLUSION- Both the modalities are effective in treating TMD symptoms but US proved to be more efficient in improving overall symptoms with statistically significant results ($p<0.05$)

KEYWORDS- Temporomandibular disorders, Temporo m ndibular joint,Tens therapy, Ultrasound therapy.

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INTRODUCTION- TMJ is described as one of the most complex joints in the body. It is a bilateral, diarthrodial, joint (TMJ) and its associated structures play an essential role in guiding mandibular motion and distributing stresses produced by everyday tasks such as chewing, swallowing, and speaking.[1]

TMDs are described as a "group of orofacial conditions affecting TMJ and its associated structures". [2-3] The etiology of TMD is complex and multifactorial which can include occlusal abnormalities, orthodontic treatment, para-functional habits and orthopedic instability, macrotrauma and microtrauma, joint laxity and exogenous estrogen.[4-5]

Patients with TMDs most frequently exhibit pain, limited or asymmetric mandibular motion, and TMJ clicking sounds.[2-3]

A variety of therapeutic modalities have been proposed for the management of individuals with the TMDs, such as orthopaedic stabilisation, intraoral appliances, behavioural therapy, interarticular injections, low level laser, TENS, Therapeutic US, physical therapy and pharmacological modalities. [6]

TENS is one of the safest and most inexpensive modality which is used to reduce and control both chronic and acute pain. [7-8]. According to the gate control theory, the change of pain perception is induced by TENS is allocated to the recruitment of Aβ afferent fibers situated in the posterior horn of the spinal cord which can prevent the activation of the pain conducted in thin fiber.[9-10] It is safe, noninvasive, inexpensive, and an effective method of providing analgesia, with reduced potential adverse reactions related to other methods.[11-12]

Therapeutic US is a noninvasive therapeutic modality which includes vibrations above 16,000 vibrations/s or 16 Hz (range audible to the human ear). The frequency frequently used is between 1.0 and 3.0 MHz.[13-14], to speed up healing, reducing joint stiffness, relieve pain, increase the extendibility of collagen fibers, and reduce muscle spasm.[15-16]

MATERIALS AND METHODS

A comparative study was carried out in our Dept.of Oral medicine and Radiology. In this study, those patients who reported with signs and symptoms of TMDs were randomly selected.

Inclusion criteria- Patients suffering from TMDs and those who did not respond to pharmacological treatment were included.

Exclusion criteria- Patients with any neurological problem , musculoskeletal, congenital anomalies, disturbed occlusion, severe attrition, complete loss of teeth and habit of severe bruxism and those who were suffering from severe odontogenic pain were not included.

Total 60 Number of patients were randomly selected within age group of 18-60 years. There was equal distribution of all patients into two study groups (30 in each)- Group A and Group B. Group A received TENS therapy and Group B received US therapy. No drug or any other therapy was given. Both A and B groups received treatment twice to thrice in a week for 4 weeks.

GROUP A

Group A received TENS therapy for 10 min . It is the application of pulse duration of 50–200 μs and frequency of 50 mA–100 mA applied through surface electrodes .

GROUP B

Group B received US therapy at continuous mode at frequency of 1.0 and 3.0 MHz for 10 minutes.

The patients were evaluated at 1st,2nd ,3rd and 4th week of treatment for following parameters- pain, muscle tenderness, maximum mouth opening without pain and deviation.

Pain was calculated on VAS score where 0 means no pain, 1 means mild pain, 2 means moderate pain and 3 means severe pain.

Muscle tenderness was calculated in VAS score where 0 means no muscle tenderness and 1 means presence of muscle tenderness.

Deviation was described as 0 i.e absence of deviation and 1 i.e. presence of deviation.

Maximum mouth opening without pain was calculated in mm.

STATISTICAL ANALYSIS

The data was collected and analysed using Mean, Standard deviation and Anova test was applied.

RESULTS

		Frequency	Percent	p value
Group A- Pain at 1st week	Mild Pain	6	20	0.116
	Moderate Pain	16	55	
	Severe Pain	8	25	
Group A- Pain at 2nd week	No pain	3	10	**0.022***
	Mild Pain	18	60	
	Moderate PAin	9	30	
Group A- Pain at 3rd week	No pain	16	55	0.655
	Mild Pain	14	45	
Group A- Pain at 4th week	No pain	30	100	---
	Total	30	100	

Table I Pain perceptions at 1st week,2nd week,3rd week and 4th week in Group A.

		Frequency	Percent	p value
Group B- Pain at 1st week	Mild Pain	4	15	**0.011***
	Moderate Pain	20	65	
	Severe Pain	6	20	
Group B- Pain at 2nd week	Mild Pain	23	75	**0.025***
	Moderate Pain	7	25	
Group B- Pain at 3rd week	No pain	18	60	0.371
	Mild Pain	12	40	
Group B- Pain at 4th week	No pain	30	100	----
	Total	30	100	

TableII Pain perceptions at 1st week,2nd week,3rd week and 4th week in Group B.

		Frequency	Percent	p value
Group A- Muscle Tenderness at 1st week	Absent	5	15	**0.002***
	Present	25	85	
Group A- Muscle Tenderness at 2nd week	Absent	11	35	0.180
	Present	19	65	
Group A- Muscle Tenderness at 3rd week	Absent	30	100	-----
Group A- Muscle Tenderness at 4th week	Absent	30	100	----
	Total	20	100	

Table III Muscle Tenderness at 1st week,2nd week,3rd week and 4th week in Group A.

		Frequency	Percent	p value
Group B- Muscle Tenderness at 1st week	Absent	1	5	**<0.001***
	Present	29	95	
Group B- Muscle Tenderness at 2nd week	Absent	3	10	**<0.001***
	Present	27	90	
Group B- Muscle Tenderness at 3rd week	Absent	15	50	1.000
	Present	15	50	
Group B- Muscle Tenderness at 4th week	Absent	30	100	1.000
	Total	20	100	

Table IV Muscle Tenderness at 1st week,2nd week,3rd week and 4th week in Group B.

	N	Minimum	Maximum	Mean	Std. Deviation
Mouth Opening- 1st week - Group A	30	32	40	37.13	2.02
Mouth Opening- 2nd week - Group A	30	33	40	37.13	1.94
Mouth Opening- 3rd week - Group A	30	34	41	38.06	1.91
Mouth Opening- 4th week- Group A	30	34	42	38.60	2.11

Table V Mean Mouth Opening at 1st week, 2nd week,3rd week and 4th week in Group A

	N	Minimum	Maximum	Mean	Std. Deviation
Mouth Opening- 1st week - Group B	30	34	42	37.56	2.31
Mouth Opening- 2nd week - Group B	30	35	42	37.53	2.27
Mouth Opening- 3rd week - Group B	30	35	42	37.9	2.21
Mouth Opening- 4th week- Group B	30	35	42	38.36	2.31

Table VI Mean Mouth Opening at 1st week, 2nd week,3rd week and 4th week in Group B

Table VII- Comparisonof Mouth opening between Group A and Group B.

Group	Mean	Std. Deviation	t value	p value
Group A	38.10	2.08	0.917	0.360
Group B	37.84	2.27		

Weeks		Mean Difference (I-J)	p value	F value	p value
1st Week	2nd Week	-0.05	1.000	1.834	0.148
	3rd Week	-0.85	0.6		
	4th Week	-1.35	0.205		
2nd Week	1st Week	0.05	1.000		
	3rd Week	-0.8	0.646		
	4th Week	-1.3	0.235		
3rd Week	1st Week	0.85	0.6		
	2nd Week	0.8	0.646		
	4th Week	-0.5	0.884		
4th Week	1st Week	1.35	0.205		
	2nd Week	1.3	0.235		
	3rd Week	0.5	0.884		

Table VIII ANOVA with post hoc Tukey's test showing Comparison of Mouth opening between 1st, 2nd ,3rd and 4th weak in Group A

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Weeks		Mean Difference (I-J)	p value	F value	p value
1st Week	2nd Week	-0.1	0.999	0.614	0.608
	3rd Week	-0.4	0.947		
	4th Week	-0.9	0.608		
2nd Week	1st Week	0.1	0.999		
	3rd Week	-0.3	0.976		
	4th Week	-0.8	0.693		
3rd Week	1st Week	0.4	0.947		
	2nd Week	0.3	0.976		
	4th Week	-0.5	0.902		
4th Week	1st Week	0.9	0.608		
	2nd Week	0.8	0.693		
	3rd Week	0.5	0.902		

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Table IX ANOVA with post hoc Tukey's test showing Comparison of Mouth opening between 1st, 2nd ,3rd and 4th weak in Group B

		Frequency	Percent	p value
Group A- Deviation at 1st week	Absent	15	50	1.000
	Present	15	50	
Group A- Deviation at 2nd week	Absent	15	50	1.000
	Present	15	50	

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Group A- Deviation at 3rd week	Absent	30	100	-----
Group A- Deviation at 4th week	Absent	30	100	-----
	Total	30	100	

Table X: Deviation at 1st week,2nd week,3rd week and 4th week in Group A.

		Frequency	Percent	p value
Group B- Deviation at 1st week	Absent	17	55	0.655
	Present	13	45	
Group B- Deviation at 2nd week	Absent	17	55	0.655
	Present	13	45	
Group B- Deviation at 3rd week	Absent	20	65	0.180
	Present	10	35	
Group B- Deviation at 4th week	Absent	27	90	**<0.001***
	Present	3	10	
	Total	30	100	

Table XI: Deviation at 1st week,2nd week,3rd week and 4th week in Group B.

There was significant difference observed in pain at first second week in Group B and in Group A statistical significant difference was seen at first week only.($p < 0.05$)

The statistical difference in muscle tenderness in Group B was at first and second week while in Group A it was statistically significant at first week only. ($p < 0.05$)

Mean mouth opening of the participants in Group A was 37.00±2.22 at 1st week, 37.05±2.11 at 2nd week ;37.85±2.08 at 3rd week and 38.35 ±2.20 respectively at 4th week.

In Group B Mouth opening was 37.5±2.37 at 1st week ;37.6±2.32 at 2nd week ;37.9±2.24 at 3rd week and 38.4±2.28 respectively at 4th week.

There was no statistical difference was seen in mouth opening.

Significant difference in Deviation was seen in Group B at fourth week.

DISCUSSION

TMD is very common disorder with approximately 75% of people showing some signs, while more than quarter (33%) having at least one symptom.

TMD patients present with a number of signs and symptoms, including pain, malocclusion, altered joint function with or without deviation, clicking and/or restricted movement. [17]

Treatment for TMDs are wide ranging and are directed primarily toward relief from persistent

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orofacial pain.[18,19,20] Due to difficulty in determining the etiology and the possibility that the symptoms are secondary to some other disorders of the TMJ or muscles of mastication initial treatment given should be reversible.[21]

Mean age of the patients in group A and Group B was 31.50±10.80 and 27.80±9.60 respectively. TMD is the most common joint disease among younger individuals. Possible reasons for this are the limitations of the disease itself, as well as the higher rates of anxiety and number of stressful situations encountered by younger individuals.

In our study no significant difference seen in parameters according to age groups of patients although most of the patients in our study were belonging to younger age group . There were studies done to evaluate the incidence peak of TMDs with increasing age. **Luca et al** found prevalence in patients with mean age 37 and 52 seeking for diagnosis and treatment of TMD and arthritis. risk factors such as psychological stress, anxiety/depression, sleep disturbances, tension type of headache, occlusal characteristics like malocclusion, posterior cross bite, anterior open bite, deep bite, parafunctional habits, adverse habits, missing posterior teeth, preferred chewing side have a significant role in establishing progressive TMDs.[22] **Guarda Nandini** et al have shown an increasing prevalence of TMJ degeneration with advancing age.[23]

Maixner et al in their study showed peak prevalence in 45-70 years..[24]There was no significant difference in genders in our study.There are some studies reporting no significant difference in TMDs between gender. However, some studies have reported that the high incidence of TMDs regarding gender.

Oral K et al [25] stated that trauma, occlusal discrepancies, stress, parafunctions, hypermobility, age, gender, and heredity have been implicated in the etiology of temporomandibular disorder pain.

Joseph et al stated the prevalence of tmds in females is four times more than males.

These higher prevalence rates for women indicate that possible biological, psychological, and/or social factors associated with the female gender, increases the risk of TMDs. One hypothesized reason for women suffering from high chances of TMDs is the physiological variances of the female, including hormonal variations, different characteristics of the connective tissue, and brain structure and function.[26,27,,28]

While Velly et al. reported that females had approximately three times the risk of myofascial pain than males due to presence of psychological symptoms like anxiety and more amount of clenching.[29]

PAIN

About 55% participants had moderate pain in first week .25% had severe and 20% had mild pain in Group A while in Group B 65% had moderate pain, 15% had mild pain and 20% had severe pain respectively. There was clinical difference in pain symptoms in both groups but this difference was statistically significant in Group B.(**p=0.01**).

In second week there were 10% population who had no pain while 60% had Mild pain and 30% had moderate pain in group A. In group B at second week 75% had mild pain while 25% had moderate pain respectively. There was clinical difference in pain symptoms in both groups. The difference was statistically significant in both the groups.**(p=0.02).**

AT third week55% participants in Group A had no pain while 45% had only mild pain whereas in Group B 60% had no pain and 40% had mild pain respectively. There was clinical difference in pain in majority of patients.This difference was not statistically significant. (p>0.05)**..** In fourth week patient had no pain in both the groups. On comparison between both the groups US proved to be more effective.**Table I and II.**

Wright et al [30] stated that as most TMD symptoms have a high incidence of remission over time, usually within 3 months due to adaptive and behavioural changes.

Gewandter JS [31] stated the most commonly used drugs in TMDs for clinical symptoms include NSAIDs corticoids, analgesics, muscle relaxants, anxiolytics, opiates, TCAs, gabapentin, and lidocaine patches.

Rai et al [14] in their study comparatively evaluated the efficacy of TENS and US therapy in pain management of TMDs and concluded that US therapy is more effective in the management of pain associated with TMDs as it decreases muscle thickness .

Harneet et al [32] stated that there was increased improvement in muscle pain in patients receiving TENS at different visits as it inhibits the pain perception by working at trigger pain points.

Fatima et al [33] concluded that TENS and LLLT therapy showed improvement in pain and muscle tenderness in patient with TMDs.

Kamran [34] studied the effect of TENS in managing pain related TMDs.

Kirupa et al performed a study for comparative evaluation of TENS and US therapy in reducing pain in TMDs and found US to be more effective.

Akansha et al [35] found reduction pain in patients receiving US and TENS therapy.

Richa et al [36] compared the efficacy of laser and US therapy in the management of TMDs and found .

MUSCLE TENDERNESS

Muscle tenderness at 1st week was seen in 85% participants in Group A and in 95% participants in Group B. This difference was statistically significant in both the groups**(p<0.001). A**t second week muscle tenderness was observed in 65% participants in Group A and 90% participants in group B. This was found to be statistically significant in group B**. (p<0.001).** In third week muscle tenderness was present 50% in Group B. In Group A participants there was no muscle tenderness present at 3rd and 4th week while in Group B muscle tenderness was absent at 4th week. **Table III and IV.** On comparison of both the groups both were found equally effective but statistical significance was observed in Group B.

Richa et al [36] performed a study to compare the effectiveness of US and LLLT in reducing muscle tenderness in patients with TMDs and found US effective as US has deeper effect on tissues and reduces tenderness effectively.

Akansha et al [35] found performed a study between LLLT,US and TENS and found LLLT to be most effective in decrease in muscle tender points when given for consecutive 4 weeks as LLLT reduces muscle hyperactivity.

Santosh R[37] found significant reduction in muscle tenderness at 3rd and 4th visits in patients treated with TENS .

Fahimeh et al[33] compared the effects of TENS and LLTT in reduction of muscle tenderness and found both of the modalities effective . There was no significant difference between both groups.

Harneet [32] in their study concluded that TENS therapy has significant difference in reducing muscle tenderness at first, second, third visit but it was not significant at third visit.

MOUTH OPENING

Mean mouth opening of the participants in Group A was 37.00±2.22 at 1st week, 37.05±2.11 at 2nd week ;37.85±2.08 at 3rd week and 38.35 ±2.20 respectively at 4th week. **Table V**

In Group B Mouth opening was 37.5±2.37 at 1st week ;37.6±2.32 at 2nd week ;37.9±2.24 at 3rd week and 38.4±2.28 respectively at 4th week. .Clinically there was significant improvement seen after weeks. in patients of Group A and Group B due to decrease in pain intensity while opening mouth after receiving therapies. **Table VI**

ANOVA with post hoc Tukey's test showed no statistically significant difference between four weeks in mouth opening in Group A.**Table VIII**.In group B there was no statistically significant difference observed in Mouth opening. (p>0.05) **Table IX**

Unpaired t test between Group A and B showed no statistically significant difference in Mouth opening. (p >0.05) as the patients in our study had already sufficient mouth opening but there were some studies in the support of increased mouth opening in patients who were treated with TENS and US.

Silvia [38] performed a study in which it was concluded that patients receiving TENS therapy show higher improvement in mouth opening in a study done to study the management of mouth opening in patients with TMDs through low-level laser therapy and TENS.

Harneet [32]found increased mouth opening in patients at different visits who received TENS therapy for one month.

Santosh [37] also found TENS therapy effective in increasing mouth opening of patients with TMDs.

Fouda [39] concluded that there was increase in mouth opening in patients at 2nd or 3rd visit in US therapy when given for continuous 15 minutes.

Sanyukta et al [40] also stated there is increased in mouth opening post treatment of ultrasound therapy.

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DEVIATION

In group A mouth deviation was present in 50% participants at first and second week respectively further mouth deviation was absent in 3rd and 4th week respectively. Mouth deviation was present in 55% participants in Group B at first week and second week respectively. In third week mouth deviation absent in 65% participants while in 4th week it was absent in 90% participants. There was statistically significant difference observed in Group B in week 4**.(p<0.001). Table X and XI.** The reason for improved deviation in Group B at 4th week is that US slowly improves the muscle function and mainly encounters for reducing muscle tenderness rather than improving muscle dysfunction.

Clinically there was improvement in deviation in Group A in comparison Group B although not statistical difference was found, the reason could be the adaptive changes after reduction in pain intensity after receiving treatment and US slowly reduces the muscle hyperactivity .

Richa et al [36]conducted a study between LLLT and US therapy to study the effect on jaw deviation and they concluded that there was no significant reduction in jaw deviation but was improved after 60 days of therapy.

CONCLUSION

In our study both US and Tens therapy were found helpful in management of TMDs but US proved to be more efficient in improving overall symptoms.

In our study both US and Tens were effective in reducing pain . US was found more effective in reducing pain at 1st and 2nd visits and was found clinically as well as statistically significant
($p < 0.05$) , the resason can be thermal effect of US and penetration of waves deeper into tissues thereby reducing pain perception.

TENS was also helpful in reduction of pain clinically at all visits but the result was statistically significant at 2nd week only ($p < 0.05$) . On comparison of both modalities based upon the treatment outcome US proved to be more effective.

There was reduced muscle tenderness seen in both the modalities. Improved muscle tenderness was present clinically in TENS at 1st and 2nd week although the statistical difference was present at 1st week only. ($p < 0.05$) In US muscle tenderness was improved clinically in all visits and was found statistically significant at1st and 2nd week ($p < 0.05$) only ,the reason behind this can be that US reduces edema and inflammation deep on the tissues.

Clinical improvement in mouth opening of patients was found in both the therapies but no statistically significant results were seen , the reason can be that the patients included were already have sufficient mouth opening and the follow-up time was short.

Both the modalities were helpful in reducing the deviation . Patients showed clinical improvement in TENS therapy although there was no statistical difference . In Us therapy clinically reduction in deviation as a symptom of TMD was not appreciable and the significant result was also obtained at 4th week only. The reason could be short term follow-up as this sign of TMD heals with time .

But the mouth opening was still not improved that much , due to patient's sufficient mouth opening before the treatment or gender difference. , insufficient sample size. More clinical trials can be done to study the effects of techniques on reducing symptoms of TMD as there was less number of severely affected patients and there is long term follow-up required at least 3-6 months.

CONFLICTS OF INTEREST- NIL

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