ORIGINAL RESEARCH ARTICLE

Comparison and Evaluation of Efficacy of Soft Splint, Transcutaneous Electric Nerve Stimulation and Ultrasound in Temporomandibular Disorders

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Abstract

Introduction: Myalgia is easy to diagnose and difficult to treat. There are various treatment modalities which include use of analgesics, hard splint, surgery, etc.

Methodology: The present study aimed to compare and evaluate the efficacy of ultrasound, TENS, and splint in patients with myalgia. A total of 33 patients were included in the study. Three groups were made. Group I consisted of 11 patients of ultrasound, group II had 11 patients of TENS, and group III had 11 patients of soft splint. Pain, muscle tenderness, and mouth opening were the parameters for the study. Pain and muscle tenderness were measured on VAS and mouth opening was measured using vernier calliper. Patients coming with pain in facial area were randomly allocated into three groups. Ultrasound and TENS therapy were given for the period of 1 week and splint therapy for 1 month. Patients with splint were asked to wear splint at night to check for any parafunctional activity for a period of 1 month.

Results: Follow-up was done on 0th day, 7th day, 30th day, and 90th day. Results showed that 80% of patients in ultrasound group were relieved of pain when compared to TENS (45%) and splint (36%). The efficacy of ultrasound in alleviating pain is highest on 30th day when compared to TENS and splint.

Conclusion: Thus with the present study it can definitely be concluded that ultrasound, TENS, and splint can be the choice of treatment in treating patients with pain in facial muscles.

Keywords: Myofascial pain, Transcutaneous electric nerve stimulation, Ultrasound.

AMEI's Current Trends in Diagnosis & Treatment (2021): 10.5005/jp-journals-10055-0128

Introduction

Temporomandibular joint problems (TMD) are a heterogeneous gathering of conditions that can influence the supporting muscles of TMJ, plate as well as TMJ.[1] The temporomandibular joint (TMJ) is framed by the mandibular condyle being embedded into the mandibular fossa of the transient bone. The biting muscles are to a great extent liable for this present joint's development. Temporomandibular issues (TMD) are portrayed by craniofacial joint-related agony, masticator muscles, and head and neck muscle innervation. The TMJ is a skimming joint that is framed by the fossa of the mandibular condyle and fleeting bone.

Smooth joint movement is made possible by the ligament capsule, articular disk, and retrodiscal tissue.[2] Temporomandibular disorders (TMD) include clinical issues in the chewing muscles, auricular area, and related structures. Temporomandibular problems are generally classified into muscle-related TMD (myogenous) and joint-related TMD (arthrogenous) by the American Academy of Orofacial Pain (AAOP). Myofascial pain is the most common TMD. Trauma, parafunctional patterns, malocclusion, and stress are included in the multifactorial etiology. TMD is clinically characterized by temporomandibular or masticatory muscle pain, face, back, neck pain, head pain, discomfort in ear, jaw noises, locking of jaw, decreased opening of the jaw, and hypersensitivity of teeth.[3] Pain is the most widely recognized condition that patients seek medical treatment for. Several treatment approaches, including occlusal splints, physiotherapy, relaxation therapy, pharmacological therapies, and educational and behavioral counseling, have been used for TMD.[4]

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How to cite this article: Joshi C, Saleem A, Khare V, *et al*. Comparison and Evaluation of Efficacy of Soft Splint, Transcutaneous Electric Nerve Stimulation and Ultrasound in Temporomandibular Disorders. AMEI's Curr Trends Diagn Treat 2021;5(2):71–79.

Source of support: Nil

Conflict of interest: None

Soft diet, physical exercise, occlusal modification, analgesia, and medicine (NSAIDs, painkillers, tranquilizers) are included in conservative care. No reason shows why different treatments in different regions should be offered to patients with similar conditions. Nor is there any justification why various specialties should treat patients with similar problems differently. Commonly known masticatory muscle disorders are local myalgia, myofascial

pain, and myofascial pain with referral.[5] Of these myofascial pain is the most common TMD.[6] Few measures of managing pain in TMD include the use of analgesics, occlusal splints, physiotherapy, relaxation therapy, educational, and behavioral counselling.[6]

Various appliances are commonly used in myofascial pain. Soft occlusal splint is such type. It is relatively simple, reversible, and noninvasive method. It provides temporary ideal occlusion. They are easy to fabricate and therefore their use is promoted for TMD. Resilient nature of this splint allows even distribution of heavy occlusal load during parafunctional habit.[7] They allow muscle to function efficiently during contact and less active during postural function thereby, reducing abnormal muscle activity producing neuromuscular balance.[6] Noninvasive method includes transcutaneous electric nerve stimulation (TENS).

It works on:

- **Gate control theory**—TENS activates thick, myelinated, and sensory fibers (A-fibers) which in further obstruct the impulse of thin pain-modulating fibers and therefore at the stage of the spinal cord, it shuts the gate to pain signals.
- **Endogenous opioid mechanism**—TENS induces the release of morphine like substance which reduces pain.
- TENS can cause mellow, cadenced muscle constriction expanding neighborhood flow of blood and lymph consequently, diminishing edema and harmful tissue.[8]
- Other modality used in myalgia in TMD is therapeutic ultrasound. Ultrasound is characterized as sound wave wavering at a recurrence in excess of 20,000 cycles for every second (Hz). It has a frequency range 0.7–3.3 MHz for therapy. For TMD, thermal effect of therapeutic ultrasound is used and this effect is created by sound waves causing tissue vibrations creating heat thereby increasing blood flow to the tissue, delivering important nutrients and removing waste.[9]

Since ultrasound, TENS, and delicate occlusal splint permit patients to depend less on synthetic torment relievers which obviously have different results; our motive of this study is to analyze the impact of ultrasound, TENS, and delicate occlusal support in myalgic agony in TMD.

Aim

To evaluate and compare the efficacy of ultrasound, TENS, and soft occlusal splint in the management of myalgic pain in temporomandibular disorders (TMD).

Objectives

- To evaluate myalgic pain and muscle tenderness pre and post ultrasound therapy.
- To evaluate myalgic pain and muscle tenderness pre and post TENS therapy.
- To evaluate myalgic pain and muscle tenderness pre and post soft occlusal splint therapy.
- To evaluate mouth opening pre and post ultrasound, TENS, and soft occlusal splint therapy.
- To compare pain, mouth opening, and muscle tenderness in patients treated with ultrasound, TENS, and soft occlusal splints.

Methodology

Type of Study

In vivo interventional.

Place of Study

Tertiary dental care, Pune.

- Patients coming to Department of Oral Medicine and Radiology were included in the study after the approval of Research and Ethical Committee.
- Detailed case history was taken and patients clinically diagnosed with TMD were taken. A total of 33 patients both males and females above 18 years of age were included for the study. Double-blinding method was followed.
- Patients were randomly allocated into three groups and group I was treated with therapeutic ultrasound therapy, group II was given TENS therapy, and group III patients were given soft splint therapy. Patients were explained about all three modalities and the treatment of choice was left to the patients and then 11 patients from each group were enrolled for the study. Patients who were willing for treatment and ready to give written informed consent were selected for study.

Group I

Eleven patients of group A were given therapeutic ultrasound. Aquasonic gel was applied on the tender site. The US machine was turned on and the frequency was set to 3 MHz in pulse mode for 10 minutes. Ultrasonic probe was gently moved over the tender area in a circular motion. This was repeated for a total of 1 week on every alternate day. Follow-up was done at 0th day, 7th day, 30th day, and 90th day post treatment. Pain and muscle tenderness (on VAS) and mouth opening (vernier calliper) was done pre and post ultrasound therapy (Fig. 1).

Group II

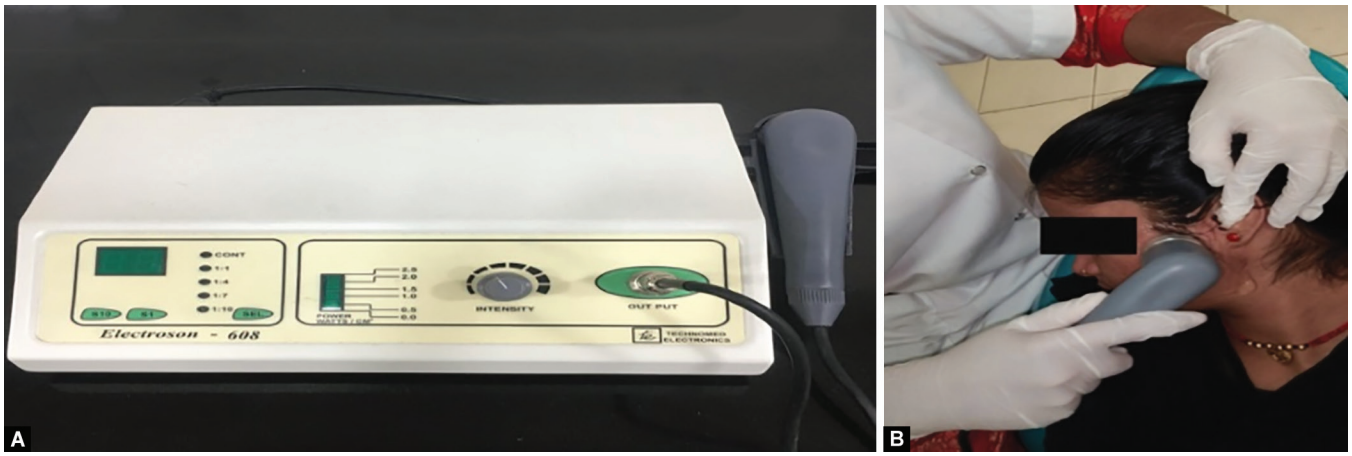
Eleven adult patients of group B were given TENS. Cardio Gel (Conducting Medium) was being applied to the tender sites. Electrodes placed over the gel were adhered to the tender sites with the help of leukoplast tape then the machine was switched on, beginning with low power was bit by bit expanded until the patient got mindful of the sensation with recurrence of 150 Hz in an ordinary mode. This was done for 15 minutes and was repeated every alternate day for a period of 1 week. Follow-up was done at 0th day, 7th day, 30th day, and 90th day post treatment. Pain and muscle tenderness (on VAS) and mouth opening (vernier calliper) were done pre and post TENS therapy (Fig. 2).

Group III

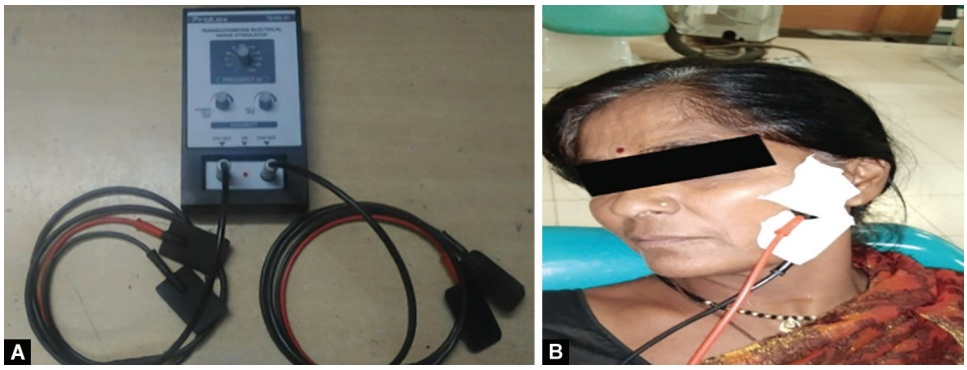
Eleven adult patients of group C were given soft splint. The impression of the maxillary and mandibular arch was made by using Alginate. Impressions were sent to private lab for fabrication. Splint was disinfected and placed in patient's mouth. Patients were recommended to put on the appliance while sleeping to take account of any parafunctional habits. Follow-up was done at 0th day, 7th day, 30th day, and 90th day. Patient was asked to discontinue the use of splint after 1 month. Pain muscle tenderness (on VAS) and mouth opening (vernier calliper) were done before and after soft occlusal therapy (Fig. 3).

Parameters

- Pain while chewing, sleeping, or any other function was recorded using the VAS scale which had the facial expression and the numerical grading, and patient was asked to give score



Figs 1A and B: (A) Ultrasound machine; (B) Ultrasound therapy



Figs 2A and B: (A) TENS machine; (B) TENS therapy

Fig. 3: Splint therapy

accordingly before and after the treatment (VAS—Visual Analog Scale)

- Mouth opening was recorded on vernier calliper before and after the therapy
- Muscle tenderness which is elicited as pain by the patients was also recorded on VAS scale before and after the treatment

Results

The present study was undertaken to evaluate and compare the efficacy of ultrasound therapy, TENS, and splint therapy in patients with temporomandibular disorders. The parameters assessed were pain intensity, mouth opening, and muscle tenderness pre and post therapy. The pain intensity and muscle tenderness were assessed using visual analog scale (VAS) having a reading from 0 to 10. One-way ANOVA test was used to find significant difference in between different groups, and Tukey's *post-hoc* test (SPSS version 22) was used to find significant difference within the groups. *p* value less than 0.05 were considered statistically significant.

Pain

On 30th day of follow-up ultrasound was seen to be most effective in alleviating pain compared to TENS and ultrasound. The mean value of VAS score reduced maximum in ultrasound when compared to TENS and splint.

Muscle Tenderness

Muscle tenderness which was also recorded on VAS reduced greatly with that of ultrasound when compared to TENS and splint on 30th day of therapy. Almost equal results were obtained for muscle tenderness when comparing TENS with the ultrasound therapy, although ultrasound was highly effective for muscle tenderness when compared to splint with a significant *p* value of 0.029.

Mouth Opening

There is increase in mouth opening with the use of splint as compared to TENS and ultrasound on 90th day, although the increase in mouth opening is statistically insignificant.

Sex Predilection

In the present study, of the 33 patients involved in the study, 22 patients were female and 11 male. Therefore, male:female ratio is 1:2. Females are affected two times more than female by TMDs. Commonly affected age group was 25–36 years. Females wearing splint were complaining of unpleasant odor and yellowish discoloration of splint. It was observed that male patients with robust personality were resistant to TENS therapy and therefore frequency had to be increased for them. From the above findings, it can be concluded that ultrasound, TENS, and splint can be given as the main line of treatment in myalgia.

The mean values of pain at on 0th day, 7th day, 30th day, and 90th day for ultrasound group were 7.45, 5.27, 4.3, and 3, respectively. For TENS group mean values of pain at 0th day, 7th day, 30th day, and 90th day were 7.36, 5, 5 and 4, respectively. The mean values of splint at 0th day, 7th day, 30th day, and 90th day were 8, 6, 6, and 5, respectively, as shown in Table 1.

The mean values of pain at on 0th day, 7th day, 30th day, and 90th day for ultrasound group were 7.45, 5.2, 4.3, and 3, respectively. For TENS group mean values of pain at 0th day, 7th day, 30th day, and 90th day were 7.36, 5, 5, and 4, respectively. The mean values of splint at 0th day, 7th day, 30th day, and 90th day were 8, 6, 6, and 5, respectively, as shown in Fig. 4.

The mean values of mouth opening at on 0th day, 7th day, 30th day, and 90th day for ultrasound group were 26, 27, 28, and 30 mm, respectively. For TENS group mean values of pain at 0th day, 7th day, 30th day, and 90th day were 28, 29, 29, and 29 mm, respectively. The mean values of splint at 0th day, 7th day, 30th day, and 90th day were 30, 30, 30, and 31 mm, respectively, as shown in Table 2.

The mean values of mouth opening at on 0th day, 7th day, 30th day, and 90th day for ultrasound group were 26, 27, 28, and 30 mm, respectively. For TENS group mean values of pain at 0th day, 7th day, 30th day, and 90th day were 28, 29, 29, and 29 mm, respectively. The mean values of splint at 0th day, 7th day, 30th day, and 90th day were 30, 30, 30, and 31 mm, respectively, as shown in Fig. 5.

The mean values of muscle tenderness at 0th day, 7th day, 30th day, and 90th day for ultrasound group were 6, 5, 4, and 3,

Table 1: Pain (VAS) at different time intervals with ultrasound, TENS and splint therapy

						95% confidence interval for mean			
Pain (VAS)		*N*	*Mean*	*Std. deviation*	*Std. error*	*Lower bound*	*Upper bound*	*Minimum*	*Maximum*
0th day	Ultrasound therapy	11	7.45	1.44	0.43	6.49	8.42	5.0	10.0
	TENS therapy	11	7.36	1.43	0.43	6.40	8.33	5.0	9.0
	Splint	11	8.18	1.25	0.38	7.34	9.02	6.0	10.0
7th day	Ultrasound therapy	11	5.27	1.27	0.38	4.42	6.13	4.0	8.0
	TENS therapy	11	5.00	1.41	0.43	4.05	5.95	3.0	7.0
	Splint	11	6.36	1.43	0.43	5.40	7.33	5.0	10.0
30th day	Ultrasound therapy	11	4.36	1.50	0.45	3.35	5.37	3.0	8.0
	TENS therapy	11	5.00	1.48	0.45	4.00	6.00	3.0	7.0
	Splint	11	6.00	1.18	0.36	5.21	6.79	4.0	8.0
90th day	Ultrasound therapy	11	3.91	1.76	0.53	2.73	5.09	2.0	8.0
	TENS therapy	11	4.64	1.86	0.56	3.39	5.89	1.0	7.0
	Splint	11	5.64	1.69	0.51	4.50	6.77	2.0	8.0

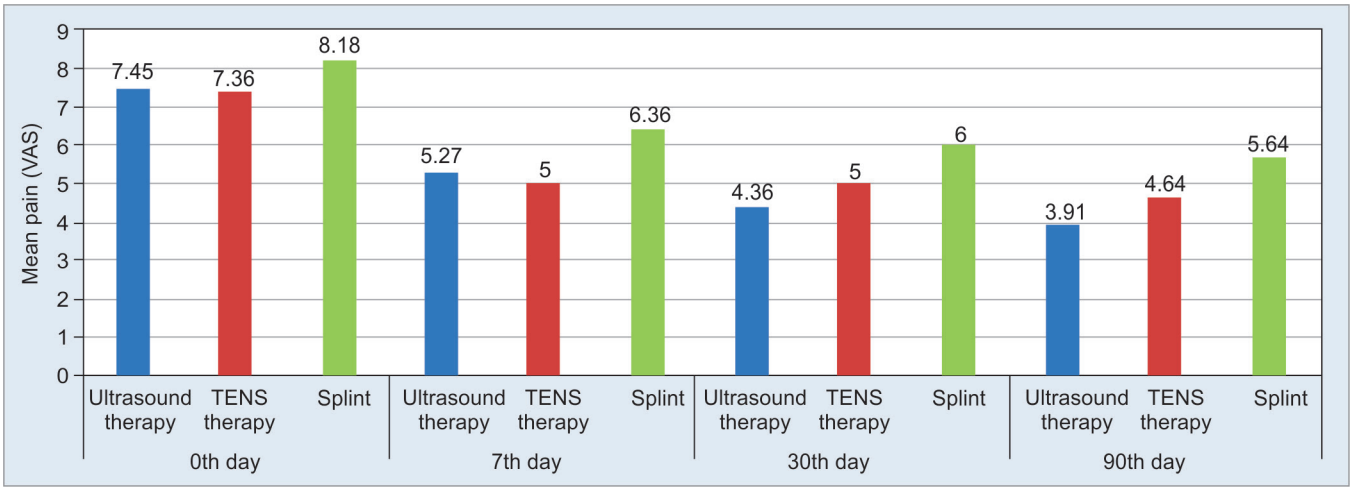


Fig. 4: Comparison of mean pain (VAS) at different time intervals between ultrasound therapy, TENS therapy, and splint group

Table 2: Mouth opening (mm) at different time interval—between ultrasound therapy, TENS therapy, and splint group

Mouth opening (mm)		*N*	*Mean*	*Std. deviation*	*Std. error*	*95% confidence interval for mean*		*Minimum*	*Maximum*
						Lower bound	*Upper bound*		
0th day	Ultrasound therapy	11	26.55	5.70	1.72	22.72	30.37	18.0	40.0
	TENS therapy	11	28.55	4.18	1.26	25.74	31.35	22.0	38.0
	Splint	11	30.09	3.45	1.04	27.77	32.41	25.0	36.0
7th day	Ultrasound therapy	11	27.82	5.84	1.76	23.89	31.74	18.0	40.0
	TENS therapy	11	29.27	4.22	1.27	26.44	32.11	25.0	38.0
	Splint	11	30.91	2.88	0.87	28.97	32.84	27.0	36.0
30th day	Ultrasound therapy	11	28.45	5.99	1.81	24.43	32.48	18.0	40.0
	TENS therapy	11	29.45	4.06	1.22	26.73	32.18	25.0	38.0
	Splint	11	30.91	2.88	0.87	28.97	32.84	27.0	36.0
90th day	Ultrasound therapy	11	26.82	10.03	3.02	20.08	33.56	6.0	40.0
	TENS therapy	11	29.55	4.01	1.21	26.85	32.24	25.0	38.0
	Splint	11	31.45	2.98	0.90	29.45	33.46	28.0	36.0

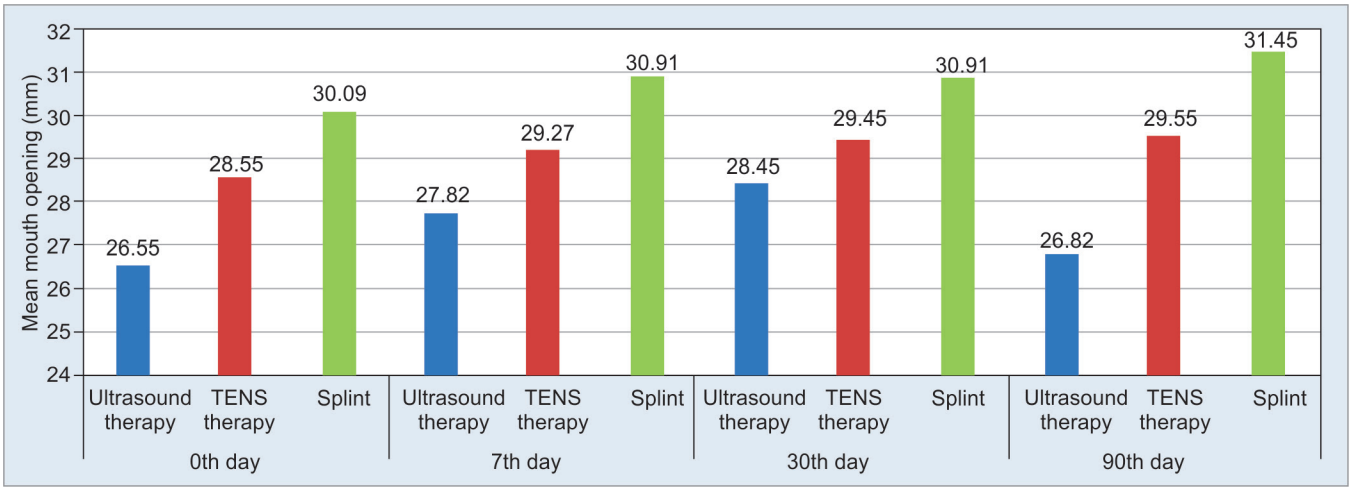


Fig. 5: Comparison of mean mouth opening (mm) at different time intervals between ultrasound therapy, TENS therapy, and splint group

respectively. For TENS group mean values of pain at 0th day, 7th day, 30th day, and 90th day were 7, 5, 5, and 4, respectively. The mean values of splint at 0th day, 7th day, 30th day, and 90th day were 8, 6, 6, and 5, respectively, as shown in (Table 3 and Fig. 6).

Significant reduction in pain score was observed on 30th day of the therapy with ultrasound, TENS, and splint. Also the reduction in pain score on 30th day was observed in 80% of the ultrasound patient followed by TENS (45%) and splint (36%) (Tables 4 to 7).

Pain score on 30th day was found to be significant between ultrasound and splint (Tables 8 and 9).

Reduction in muscle tenderness is greater with ultrasound therapy than the splint on 30th day (Table 10 and Fig. 7).

Discussion

Pain is the common trait linking variety of diagnosis in the field of medicine. It is easier to diagnose and challenging to treat.[8] Managing the chronic pain makes it even difficult. One such pain is those caused by temporomandibular joint disorders. The salient feature of TMJ includes pain in pre-auricular area or masticatory muscles, difficulty in jaw motions, clicking during mandibular movement. Due to multifactorial etiology, the initial treatment should be reversible.

There is now reasonable body of scientific data suggesting that behavioral and psychological factors are important in the development of some types of TMD, and particularly those associated with muscle pain and dysfuction.[10] Among all the factors that have been studied as the potential causes for TMD, behavioral and psychologic factors have received the most significant amount of attention during the past few years. Various modalities which are commonly used to alleviate the pain include use of analgesics, antidepressants surgery, etc. Conservative therapies like ultrasound and TENS help to reduce musculoskeletal pain and restore normal functions.[11–13]

Since ultrasound, TENS, and soft occlusal splint allow patients to depend less on chemical pain relievers which of course have various side effects; our purpose of this study was to compare the effect of ultrasound, TENS, and soft occlusal splint in myalgia. Three parameters were considered including pain, muscle tenderness, and mouth opening. The inferences drawn from the study include:

Pain

In our study the pain score reduced significantly with the use of soft splint on 30th day of the initiation of therapy, although there was reduction in VAS score in all three groups. This is accordance with the study conducted by Harkins et al.[14] where there was reduction

Table 3: Mouth muscle tenderness (VAS) at different time intervals in between ultrasound therapy, TENS therapy, and splint group

Muscle tenderness (VAS)		*N*	*Mean*	*Std. deviation*	*Std. error*	*95% confidence interval for mean*		*Minimum*	*Maximum*
						Lower bound	*Upper bound*		
0th day	Ultrasound therapy	11	6.91	1.51	0.46	5.89	7.93	4.0	9.0
	TENS therapy	11	7.64	1.43	0.43	6.67	8.60	5.0	9.0
	Splint	11	8.18	1.25	0.38	7.34	9.02	6.0	10.0
7th day	Ultrasound therapy	11	5.09	1.30	0.39	4.22	5.96	4.0	8.0
	TENS therapy	11	5.18	1.54	0.46	4.15	6.21	3.0	7.0
	Splint	11	6.36	1.43	0.43	5.40	7.33	5.0	10.0
30th day	Ultrasound therapy	11	4.36	1.50	0.45	3.35	5.37	3.0	8.0
	TENS therapy	11	5.18	1.54	0.46	4.15	6.21	3.0	7.0
	Splint	11	6.00	1.18	0.36	5.21	6.79	4.0	8.0
90th day	Ultrasound therapy	11	3.91	1.76	0.53	2.73	5.09	2.0	8.0
	TENS therapy	11	4.73	2.15	0.65	3.28	6.17	1.0	7.0
	Splint	11	5.64	1.69	0.51	4.50	6.77	2.0	8.0

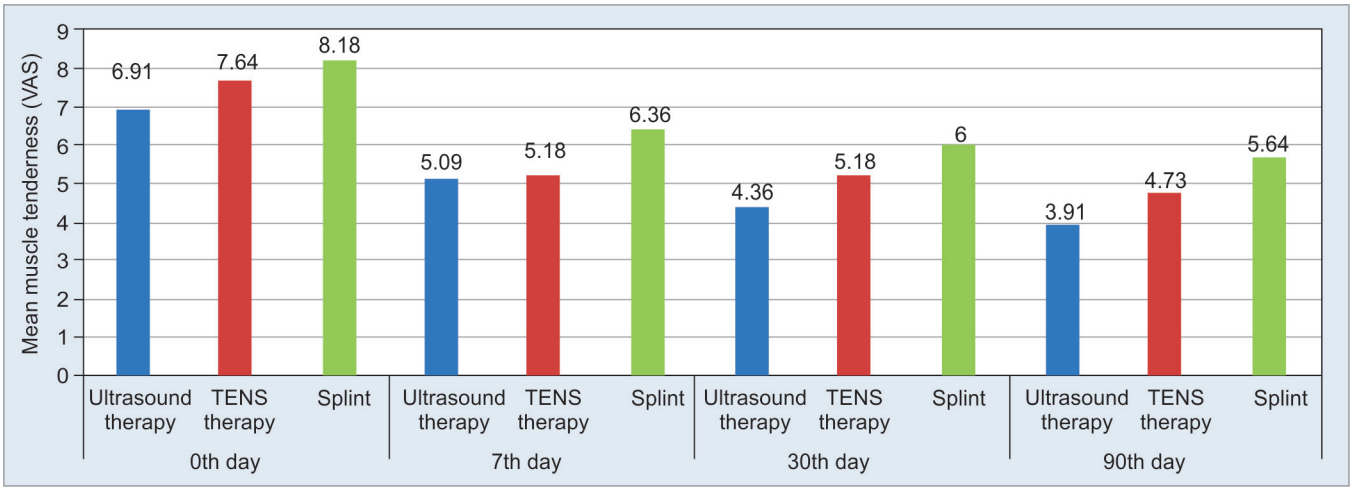


Fig. 6: Showing comparison of mean mouth muscle tenderness (VAS) at different time intervals in between ultrasound therapy, TENS therapy, and splint group by one-way ANOVA test

Table 4: Comparison of mean pain (VAS) at different time intervals in between ultrasound therapy, TENS therapy, and splint group by one-way ANOVA test

Pain (VAS)		*N*	*Mean*	*Std. deviation*	*F value*	*p value*
0th day	Ultrasound therapy	11	7.45	1.44	1.166	0.325
	TENS therapy	11	7.36	1.43		
	Splint	11	8.18	1.25		
7th day	Ultrasound therapy	11	5.27	1.27	3.029	0.063
	TENS therapy	11	5.00	1.41		
	Splint	11	6.36	1.43		
30th day	Ultrasound therapy	11	4.36	1.50	3.835	0.033*
	TENS therapy	11	5.00	1.48		
	Splint	11	6.00	1.18		
90th day	Ultrasound therapy	11	3.91	1.76	1.166	0.325
	TENS therapy	11	4.64	1.86		
	Splint	11	5.64	1.69		

Table 5: Comparison of mean mouth opening (mm) at different time intervals between ultrasound therapy, TENS therapy, and splint group by one-way ANOVA test

Mouth opening (mm)		*N*	*Mean*	*Std. deviation*	*F value*	*p value*
0th day	Ultrasound therapy	11	26.55	5.70	2.640	0.088
	TENS therapy	11	28.55	4.18		
	Splint	11	30.09	3.45		
7th day	Ultrasound therapy	11	27.82	5.84	1.686	0.202
	TENS therapy	11	29.27	4.22		
	Splint	11	30.91	2.88		
30th day	Ultrasound therapy	11	28.45	5.99	1.309	0.285
	TENS therapy	11	29.45	4.06		
	Splint	11	30.91	2.88		
90th day	Ultrasound therapy	11	26.82	10.03	2.640	0.088
	TENS therapy	11	29.55	4.01		
	Splint	11	31.45	2.98		

No significance difference in mouth opening was observed with ultrasound, TENS, and splint therapy

Table 6: Comparison of mean mouth muscle tenderness (VAS) at different time intervals in between ultrasound therapy, TENS therapy, and splint group by one-way ANOVA test

Muscle tenderness (VAS)		*N*	*Mean*	*Std. deviation*	*F value*	*p value*
0th day	Ultrasound therapy	11	6.91	1.51	2.723	0.082
	TENS therapy	11	7.64	1.43		
	Splint	11	8.18	1.25		
7th day	Ultrasound therapy	11	5.09	1.30	3.671	0.037*
	TENS therapy	11	5.18	1.54		
	Splint	11	6.36	1.43		
30th day	Ultrasound therapy	11	4.36	1.50	2.332	0.114
	TENS therapy	11	5.18	1.54		
	Splint	11	6.00	1.18		
90th day	Ultrasound therapy	11	3.91	1.76	2.723	0.082
	TENS therapy	11	4.73	2.15		
	Splint	11	5.64	1.69		

The muscle tenderness was reduced on the 7th day of the therapy with ultrasound, TENS, and splint

Table 7: Multiple comparison of mean pain (VAS) at different time intervals between ultrasound therapy, TENS therapy, and splint group by Tukey's *post-hoc* test

Pain (VAS)	*Group*	*Group*	*Mean difference*	*p value*
0th day	1.0	2.0	0.091	0.987
	1.0	3.0	−0.727	0.440
	2.0	3.0	−0.818	0.357
7th day	1.0	2.0	0.273	0.888
	1.0	3.0	−1.091	0.168
	2.0	3.0	−1.364	0.067
30th day	1.0	2.0	−0.636	0.541
	1.0	3.0	−1.6364*	0.026*
	2.0	3.0	−1.000	0.230
90th day	1.0	2.0	−0.727	0.605
	1.0	3.0	−1.727	0.073
	2.0	3.0	−1.000	0.393

*Statistically significant

Table 8: Multiple comparisons of mean mouth opening (mm) at different time intervals between ultrasound therapy, TENS therapy, and splint group by Tukey's *post-hoc* test

Mouth opening (mm)	*Group*	*Group*	*Mean difference*	*p value*
0th day	1.0	2.0	−2.000	0.562
	1.0	3.0	−3.545	0.177
	2.0	3.0	−1.545	0.707
7th day	1.0	2.0	−1.455	0.729
	1.0	3.0	−3.091	0.254
	2.0	3.0	−1.636	0.672
30th day	1.0	2.0	−1.000	0.861
	1.0	3.0	−2.455	0.417
	2.0	3.0	−1.455	0.731
90th day	1.0	2.0	−2.727	0.589
	1.0	3.0	−4.636	0.229
	2.0	3.0	−1.909	0.770

No significant difference in mouth opening was observed in comparing ultrasound, TENS, and splint

Table 9: Comparison of mean muscle tenderness (VAS) at different time intervals between ultrasound therapy, TENS therapy, and splint group by Tukey's *post-hoc* test

Muscle tenderness (VAS)	*Group*	*Group*	*Mean difference*	*p value*
0th day	1.0	2.0	−0.727	0.454
	1.0	3.0	−1.273	0.101
	2.0	3.0	−0.545	0.637
7th day	1.0	2.0	−0.091	0.988
	1.0	3.0	−1.273	0.109
	2.0	3.0	−1.182	0.144
30th day	1.0	2.0	−0.818	0.377
	1.0	3.0	−1.6364*	0.029*
	2.0	3.0	−0.818	0.377
90th day	1.0	2.0	−0.818	0.569
	1.0	3.0	−1.727	0.095
	2.0	3.0	−0.909	0.500

*Statistically significant

Table 10: Age distribution

Age-group (in years)	*Ultrasound therapy (n = 11)*	*TENS therapy (n = 11)*	*Splint (n = 11)*
18–25	2 (18.2%)	3 (27.3%)	3 (27.3%)
26–35	5 (45.5%)	4 (36.4%)	7 (63.6%)
36–45	2 (18.2%)	2 (18.2%)	1 (9.1%)
>45	2 (18.2%)	2 (18.2%)	0 (0%)
Mean age (in years)	36.24 ± 14.53	32.64 ± 11.82	28.64 ± 6.25

Most patients affected with myalgia lie within 26–35 years of age

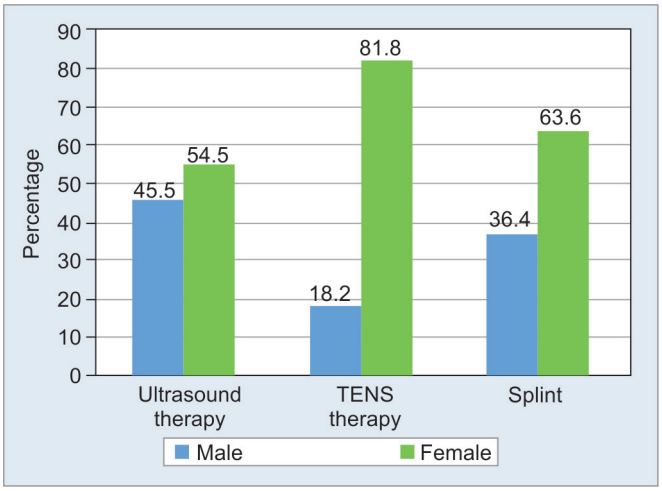


Fig. 7: Age predilection

in muscle tenderness in 74% of the patients. Raphael et al.[15] found a decrease in VAS scores during 6 weeks follow-up using splint. Pain as the primary complaint was reduced in the study conducted by Amin et al.[16] Splint was less effective in reducing when compared with TENS and ultrasound; patients have given significant reduction in pain. This is similar to the study conducted by Nevarro et al.[17] who studied that soft splints have no effect in reducing pain which is contradicted in our study as there is reduction in pain scores with splint on 30th day of the therapy.

Muscle Tenderness

The ultrasound therapy group (group I) had statistically significant reduction in muscle tenderness as compared to TENS and splint group on 30th day of follow-up. This is supported by a study conducted by Handa et al.[18] wherein ultrasound therapy was given to TMD patients for a period of 4 weeks. Muscle tenderness was reduced significantly with that of ultrasound when compared to TENS. The same results were seen in the study done by Kavadar G et al.[19] where the efficacy of ultrasound was more compared to TENS and other intraoral appliances. Wesseberg et al.[20] found that the efficacy of ultrasound is effective than TENS. Ninety-five percent of patient had reduced the intensity of pain after ultrasound and 86% success rate were obtained after 1 year with TENS and splint. Although in the present study all the three modalities are effective in reducing but the use of ultrasound therapy reduced pain with statistical significant value.

Mouth Opening

There was not much difference seen in our study after the use of TENS and ultrasound. Most of the patients have limited mouth opening due to alteration in articular disc, and therefore, achieving increased mouth opening from a conservative modality is difficult.[21]

Sex Predilection

In this study, of 33 patients 22 patients were females above 30 years of age. This is in agreement to the study done by Krogstad BS et al.[22] which states that women in age group of 20–30 years are most affected by TMD. These are linked to the alteration in the level of sex hormones which ultimately affect the collagen production. Steroid sex hormones affect the collagen and protein content of the TMJ disc. In addition to the effect on cartilage, estrogen and progesterone may have significant effects on bone.[21–23]

The VAS scores given by the females during first visit were more compared to males. This has been linked to the fact that pain perception in females is more compared to the males.[21] According to the present study it can be concluded that the initial line of treatment should be conservative in case of unknown etiology of the temporomandibular disorders. The therapeutic ultrasound has thermal effects. When ultrasound is applied to the skin, the sound waves causes vibration within the tissue thereby increasing the blood flow and bringing in all the essential nutrients required at the site for proper functioning and removes noxious stimuli.

TENS has various modes of action: one such type is—it causes release of morphine-like substance and other is that it has vibratory effect on the tissue causing decrease in edema and noxious substance. TENS activates thick, myelinated, and sensory fibers (which in turn blocks the impulse of thin pain-modulating fibers and therefore at the stage of the spinal cord, it closes the gate to pain signals).

Splint works by its resilient nature thereby providing even occlusal loading.[7] They allow muscle to function efficiently during contact and less active during postural function thereby, reducing abnormal muscle activity producing neuromuscular balance. This study suggests the use of conservative therapy as they are very effective in reducing pain and can be used as main stay for myalgia related to TMD. However, the choice of therapeutic modality has to be tailor-made according to individual needs.

Conclusion

Myalgia is easy to diagnose and difficult to treat. Due to its multifactorial etiology it becomes difficult to diagnose and treat the patient. Therefore, this study was intended to propose the benefits of conservative therapy as the first line of treatment. There are various treatment modalities which include the use of analgesics, hard splint, surgery, etc. But the above-mentioned modalities have their side effects and cause irreversible changes in the joint.

The present study aimed to compare and evaluate the efficacy of ultrasound, TENS, and splint in patients with myalgia. A total of 33 patients were included in the study. Three groups were made. Group I consisted of 11 patients of ultrasound, group II had 11 patients of TENS, and group III had 11 patients of soft splint. Pain, muscle tenderness, and mouth opening were the parameters for the study. Pain and muscle tenderness were measured on VAS and mouth opening was measured using vernier calliper. Patients coming with pain in facial area were randomly allocated into three groups. Ultrasound and TENS therapy were given for a period of 1 week and splint therapy for 1 month. Patients with splint were asked to wear splint at night to check for any parafunctional activities for a period of 1 month.

Follow-up was done on 0th day, 7th day, 30th day, and 90th day. Results showed that 80% of patients in ultrasound group were relieved of pain when compared to TENS (45%) and splint (36%). The efficacy of ultrasound sound in alleviating pain is highest on 30th day when compared to TENS and splint. The result with ultrasound and TENS were similar and no statistical difference was noted. Females were affected twice than males. Most of the patients were in the age range of 25–36 years. Thus with the present study it can definitely be said that ultrasound, TENS, and splint can be the choice of treatment in treating patient with the pain in facial muscles.

Limitations of the Study

- The study was conducted in a small population of 33 patients per treatment group.
- The pain is a subjective parameter. Thus, pain intensity felt by one person may not be graded as same for other patients. The subjective nature of the pain recording may have altered the obtained results.
- Mouth opening was not improved even after the pain was relieved.
- There was discomfort noted in the patients with splint in terms of discoloration and unpleasant odor.
- Due to the multiple sittings involved in the modalities, patient's cooperation was compromised.

Future Scope

More studies should be conducted to support the present study as to which TMD subgroups, if any, most likely would benefit from the above-mentioned modalities. Studies should be conducted about the correlation of TMD associated with age and sex.

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