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Effectiveness of 4 weeks of electrical vestibular stimulation in the management of temporomandibular pain

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ABSTRACT

Background: The non-surgical therapies prevail over surgical therapies in the management of temporomandibular disorders pain. Vestibular stimulation was known to relieve pain through its connections with analgesic brain areas. Although there is literature that supports the analgesic effect of vestibular stimulation, the research studies in this area are comparatively less in Indian settings. Hence, the present study was undertaken. **Aims and Objectives:** The present study was undertaken to observe the effectiveness of 4 weeks of electrical vestibular stimulation in managing temporomandibular pain. **Materials and Methods:** Sixty male and female participants who reported temporomandibular pain were recruited. They were then randomly assigned into two groups. The intervention group received electrical vestibular nerve stimulation for 4 weeks and regular treatment as an adjunctive therapy. Placebo stimulation was administered to the control group along with the regular treatment. The numerical pain rating scale, the Jaw functional limitation scale-8, and depression anxiety stress scales-21 were used in the study. **Results:** Pain score, jaw function score, and psychological parameters before intervention in the study and control groups were not significantly different. However, the pain score, jaw function score, and psychological parameters after intervention in the study group were significantly lower than in the control group. **Conclusion:** The study results support the analgesic effects of electrical vestibular nerve stimulation in pain management in patients with temporomandibular pain. The study recommends more studies in this area to recommend the implementation of electrical vestibular stimulation in the management of temporomandibular pain.

Key words: Pain; Vestibular system; Sixth sense; Electrical stimulation

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INTRODUCTION

Temporomandibular disorders (TMD) were reported to have a significantly high prevalence with 3.7–12%. Further, they are reported to occur more commonly in women.[1,2] The primary problem with the TMD is the pain that is experienced by the patient. Multiple management strategies have been available including surgical and non-surgical interventions. The non-surgical therapies prevail over the surgical therapies in the management of TMD pain.[3-7] However, the severity of the pain determines the type of treatment used. Usually in the early stages, non-invasive or minimally invasive methods are preferred whereas in severe cases invasive methods are preferred in the management.[8-13] The vestibular system is one of the sensory systems that starts functioning right from the intrauterine life. Although it is mainly for maintaining posture and equilibrium, it involves regulating multiple body functions. Hence, the vestibular system is called the sixth sense. It has immense connections both to and for almost all the brain structures.[14]

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Vestibular stimulation was known to relieve pain through its connections with analgesic brain areas.[15] Although there is literature that supports the analgesic effect of vestibular stimulation, the research studies in this area are comparatively less in Indian settings. Hence, the present study was undertaken.

Aims and objectives

The present study aimed to observe the effectiveness of 4 weeks of electrical vestibular stimulation in managing temporomandibular pain. The main objective of the study is to observe the pain scores before and after the stimulation.

MATERIALS AND METHODS

The present study was an experimental study conducted from February 2024 to September 2024. The study protocol was approved by the Institutional Human Ethical Committee (IEC Ref No: 01/2020). As this is a pilot study, we have fixed a sample size of 30 per group as recommended by Julious SA, 2005. After obtaining written informed consent, 60 male and female participants who reported temporomandibular pain were recruited. Male and female participants within the 35–60 age group having pain in the temporomandibular joint with a minimum score of 6–8 on a numerical pain rating scale and reduced mouth opening (3–5 mm) and willing to participate were included in the stud, were part of the study. Patients with any severe complications were excluded from the study. After the recruitment, they were randomly assigned into two groups with 30 participants in each group. The intervention group received electrical vestibular nerve stimulation for 4 weeks and regular treatment as an adjunctive therapy.[16] Electrical vestibular nerve stimulation was administered for five sessions a week and each session duration was 60 min. Placebo stimulation was administered to the control group along with the regular treatment. Bilateral application of electrical VeNS using a battery-powered vestibular nerve stimulator (ML1000, Neurovalens, UK) was practiced.[16] Numerical pain rating scale was used to assess the pain scores before and after the intervention.[17,18] The Jaw functional limitation scale-8 is used to measure the functional limitation of the jaw. This is a standard questionnaire available in the literature.[19] Depression anxiety stress scales-21 were used to measure the negative psychological emotions.[20]

Statistical analysis

Data were analyzed using SPSS 24.0. Student t-test was applied to observe the significance of the difference between the groups. A $P<0.05$ was considered significant.

RESULTS

Table 1 represents the demographic data of the participants. Demographic data were not significantly different between the study group and control groups. Table 2 presents the pain score, jaw function score, and psychological parameters before intervention in the study and control groups. Pain score, jaw function score, and psychological parameters before intervention in the study and control groups were not significantly different. Table 3 presents the pain score, jaw function score, and psychological parameters after intervention in the study and control groups. There was a significant decrease in the pain score, jaw function score, and psychological parameters after intervention in the study group when compared with the control group.

DISCUSSION

The present study was undertaken to observe the effectiveness of 4 weeks of electrical vestibular stimulation in managing temporomandibular pain. Demographic data

Table 1: Demographic data of the parameters

Parameter	Study group	Control group	P-value
Age (years)	47.73±7.55	51.71±4.82	0.2295
Height (cm)	158.86±10.7	155.14±14.03	0.5878
Weight (kg)	82±11.33	83.13±10.16	0.8374

Data were expressed as mean and SD. (no significant difference was observed)

Table 2: Pain score, jaw function score, and psychological parameters before intervention in the study group and control groups before intervention

Parameter	Study group	Control group	P-value
Pain score	8.36±0.67	8.38±0.77	0.9445
Jaw function score	66.70±6.83	71.70±8.49	0.1639
Depression	24.33±2.92	25.25±1.83	0.4568
Anxiety	16.25±2.49	17.60±1.65	0.1585
Stress	28.22±3.49	29.63±2.62	0.3685

Data were expressed as mean and SD

Table 3: Pain score, jaw function score, and psychological parameters after intervention in the study group and control groups after intervention

Parameter	Study group	Control group	P-value
Pain score	6.10±0.88	7.33±0.50	0.00017**
Jaw function score	59.75±2.80	64.78±3.49	0.0016**
Depression	18.70±1.64	21.30±2.54	0.0140*
Anxiety	12.71±1.14	14.67±1.07	0.0002**
Stress	22.27±1.79	25.44±1.33	0.0003**

Data were expressed as mean and SD.*P<0.05 is significant. **P<0.01 is significant

were not significantly different between the study and control groups. Pain score, jaw function score, and psychological parameters before intervention in the study and control groups were not significantly different. However, the pain score, jaw function score, and psychological parameters after intervention in the study group were significantly lower than in the control group. Pain management is a difficult task for medical and dental patients. Allopathic medications are effective in the management of pain but are associated with side effects. Hence, there is a need for adjunctive therapies that are cost-effective and have no or minimal side effects. The vestibular system is the sensory system mainly for maintaining balance and equilibrium. It is the system that relates us to gravity. The analgesic effects of vestibular stimulation were reported as a result of inhibition of the brain stem followed by the vestibular stimulation. Imaging studies reported that activity of the thalamus, insula, and cingulate cortex was modulated followed by vestibular stimulation. Modulation of autonomic activity with decreased sympathetic and increased vagal activity was a noted response followed by vestibular stimulation. It is well known that vagal stimulation is being used in the management of pain. Stimulation of the vestibular system activates the dorsal raphe nucleus, which causes the release of serotonin and inhibits the pain pathway.[21] The neurotransmitter nor-epinephrine also plays an important role in this inhibition. The hypothalamic pain inhibitory nucleus, the periventricular nucleus, has extensive connections with the vestibular system.[22] Through these connections the vestibular system also inhibits the pain pathway.[23] Opioids were reported to play a key role in this inhibition. Vestibular stimulation also inhibits the pain pathway through its connections with the cerebellum. Cerebellar projections act through the reticular pathways and inhibit the pain pathway. Interestingly, vestibular stimulation was reported to cause sound sleep and regulate emotional behavior that further favors the management of the pain. In the clinical setting, vestibular stimulation is being used in the management of pain in patients with migraine, pre-menstrual syndrome, etc.[24] The calming effects of vestibular stimulation are well-known universally. The vestibular system has numerous connections with the brain areas both to and fro and offers the relaxation effect and brings the individual to stress less condition. This calming effect will also favor in pain reduction. The literature regarding the applicability of vestibular stimulation in the management of temporomandibular pain is very sparse with evidence that only one related publication was available in the PubMed. The available study conducted by Monzani et al. stated that occlusal splint therapy was effective in patients experiencing vestibular disorder as well as TMD.[25] The study results support the analgesic effects of electrical vestibular nerve stimulation in pain management in patients with temporomandibular pain. The study recommends more studies in this area to recommend the implementation of electrical vestibular stimulation in the management of temporomandibular pain.

Limitations of the study

The study includes fewer participants and hence the results cannot be generalized.

CONCLUSION

The study results support the analgesic effects of electrical vestibular nerve stimulation in pain management in patients with temporomandibular pain. The study recommends more studies in this area to recommend the implementation of electrical vestibular stimulation in the management of temporomandibular pain.

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YGR, AG, DK- Design of the study, review of literature, analysis, and preparing the manuscript; **KN, YGR**- Data collection and preparing the manuscript; **SSKG, MJK**- Analysis and preparing the manuscript.

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