The Effect of Transcutaneous Electrical Nerve Stimulation on Acute Pain in Patients with Tempromandibular Disorder

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Introduction: Temporomandibular disorder (TMD)-related pain can affect the patient's daily activities, their psychosocial functioning, and their quality of life. The aim of this study is to evaluate the effect of transcutaneous electrical nerve stimulation (TENS) on acute pain in patients with TMD. **Materials and Methods:** This is a double blind randomized clinical trial study. Patients were assigned in two groups: In group1 (Control group), patients received pharmacological agents with 7 sessions of passive TENS, patients in group 2 received the same protocol with 7 sessions of active TENS (every session 15 min). Age and gender were variables and pain severity *ie.*, based on visual analogue scale, and maximum mouth opening (MMO) 30 days after treatment were evaluated. **Results:** Sixty patients were studied in two groups. Seven days after treatment, the mean of pain severity was 3.63±0.80 in group 1 and 2.67±0.66 in group 2., The mean of MMO was 37.06±1.68 mm in group1 and 38.47±1.48 mm in group2.the statistical analysis of the data showed a significant difference between the two groups for pain severity and the mean of MMO (P=0.001). **Conclusion:** It seems use of TENS may improve pain relief in conjunction with pharmacological agents in patients with TMD.

Keywords: TENS, Pain, Temporomandibular disorder, Mandible

Introduction

Electrotherapy is a conservative and non-pharmacological method which commonly used in clinical practice as transcutaneous electrical nerve stimulation (TENS) (1). This methods has been approved for pain relief and secondary acute anxiety (2). It has been reported that TENS is effective in arthritic pain, cancer pain, labour pain, back pain and acute traumatic pain (2-4). The clinical use of TENS involves the delivery of an electrical current typically from a small battery-operated device to the skin via surface electrodes. Session typically lasts from 5 to 15 minutes and treatment and it might repeated as often as needed, depending on severity of pain (5). A theory for electroanalgesia, pain relief by electrical methods, was recognized in 1965 by Melzack and Wall's pain gate theory (5). According to this theory a gate existed in the dorsal horn, part of the spinal cord, which control the amount of incoming nociceptive traffic through small diameter afferent nerve fibers. This gate could be blocked by a variety of other types of stimuli such as touch, pressure and electrical currents which could stimulate the large diameter afferent fibers(5). TENS enhance release of endorphin which are produced in the body in response to pain or stress(6). Since the proper function of temporomandibular joint is essential for mastication , the etiology of temporomandibular disorders (TMD) is complex (7). TMD is the second common problem after tooth pain in patients referred to dental offices and about 40 to 60 % of the society has at least one sign of this disorder. this disorder is more comment in female gender and temporomandibular joint dysfunction is usually appeared in the second or third decade of the life(8). TMD-related pain can affect the individual's daily activities, psychosocial functioning, and quality of life (9).

The aim of this study is to compare pain severity in patients with temporomandibular joint pain with TENS therapy and without it.

Materials and Methods

The authors designed a randomized clinical trial study. The sample was derived from the population of patients introduced to Department of Oral and Maxillofacial surgery of Shiraz University of medical sciences between September 1, 2012 and May 31, 2015.The research has been approved by the ethical committee of Shiraz University of Medical Sciences.

Table1. Comparison of age and gender between control and treatment groups

Variables	Group 1	Group 2	*P*-value
Age (years)	28.73 ± 6.9	31.33 ±8.26	0.19*
Gender	8 males, 22 females	10 males,20 females	0.57**

**Independent T test ** Chi square test*

Table 2. Comparison of pain severity and MMO before and 30 days after treatments between control and treatment groups

Outcome	Group 1	Group 2	Independent T test
Pain(VAS) before treatment	4.96±1.12	4.56±0.88	*P*=0.13
Pain (VAS) after treatment	3.63±0.80	2.67±0.66	*P*=0.001
MMO(mm) before treatment	33.13±1.38	33.16±1.53	*P*=0.93
MMO(mm) after treatment	37.06±1.68	38.47±1.48	*P*=0.001

Table3. Evaluation of change of pain severity in each group before and 30 days after treatment.

Groups	Pain(VAS) before treatment	Pain (VAS) after treatment	Paired T test
Group1	4.96±1.12	3.63±0.80	*P*=0.001
Group 2	4.56±0.88	2.67±0.66	*P*=0.001

Table 4. Evaluation of change of MMO in each group before and 30 days after treatment

Groups	MMO(mm) before treatment	MMO(mm) after treatment	Paired T test
Group1	33.13±1.38	37.06±1.68	*P*=0.001
Group 2	33.16±1.53	38.47±1.48	*P*=0.001

The inclusion criteria for this study was the patients having severe pain on retromandibular joint and mastication muscles and restrict MMO (≤35 mm) (10). Subjects were removed from the study if they used psychological disorders or received psychological drugs, previous TMJ surgery or arthrocentesis.

The pain intensity was measured by visual analogue scale (VAS) ranging from 0 to 10. MMO was measured by a ruler between the upper and lower incisal in MMO.

Selected samples were randomly divided into the test and control groups (each includes 30 persons) in block randomization method. In group1(Control group), patients received Methocarbamol tablet (Amin pharmachological co, n) every 12 hours for 7 days with 7 sessions of passive TENS, patients in group 2 received the same protocol with 7 sessions of active TENS (Every session 15 min). TENS (Nihon Kohden Corporation, Japan) was applied as a NIHON KOHDEN unit (10 Hz frequency, 500 μs pulse width, 30 s stimulation duration). Patients received two intensity levels, a low intensity (sensory) level and a high intensity (motor) level.

VAS and MMO were measured before starting treatment and 7 days after it. Pain and MMO were evaluated by an examiner who did not involve in treatment process of all the patients. Age and gender were considered as variables of the study and use of TENS was a predictive factor.

Statistical Analysis

The statistical analyses were performed using the statistical package SPSS for PCs, version 19 (IBM, USA). The independent T test was applied to compare pain and MMO between group1 and group 2. Chi-square test was used to compare the number of men and females between the two groups. The change of pain and MMO in each group was assessed by using a Paired T test. We considered *P*-values < 0.05 as statistically significant.

Results

Sixty patients were enrolled in this study. The mean age was 28.73 ± 6.9 years in group 1 and 31.33 ±8.26 years in group 2. There was no difference between two groups (Table 1) (*P*=0.19).

Eight males and 22 females were studied in group 1 and 10males and 20 females were in group 2. Analysis of the data did not demonstrate any difference for gender between these groups (*P*=0.57) (Table1).

The mean of pain severity before treatment was 4.96±1.12 and 4.56±0.88 in group 1 and group2, respectively. There was no difference for pain severity between the two groups before treatment (P=0.13) (Table 2). Seven days after treatment, the mean of pain severity was 3.63±0.80 in group1 and 2.67±0.66 in group 2. Comparison of the mean of pain severity between

the two groups after treatment showed a significant difference (*P*=0.001) (Table 2).

The mean of MMO before the treatment was 33.13±1.38 mm in group1 and 33.16±1.53 mm in group2.There was no difference for MMO between the two groups (*P*=0.93) (Table 2). Seven days after treatment, the mean of MMO was 37.06±1.68 mm in group1 and 38.47±1.48 mm in group2.Analysis of the data showed a significant difference between the two groups (*P*=0.001) (Table2).

Evaluation of the data demonstrated significant changes for MMO and pain severity in each group before and 7 days after treatment (Table 3, 4).

Discussion

In TMD, pain relief is crucial to prevent relevant changes in neuronal circuits and secondary hyperalgesia produced by persistent afferent signs (10). Pain is affected by psychological, behavioral, and psychosocial factors (11). Analgesic therapies, mainly those based on drugs administration, have been used widely for the control and treatment of pain, but it is still lacking or scarce in the current literature data on the effects of nonsteroidal anti-inflammatory drugs associated with occlusal split and other therapeutic agents, such as TENS on the pain relief of patients with acute pain in patients with TMD (12).

The use of TENS is based on several interrelated theories for the mechanisms of pain transmission and blocking of these mechanisms. The first of these theories was the gate control theory advanced by Melzack and Wall (13). According to their theory, stimulation of large, peripheral A-delta nerve fibers closes a spinal gate and inhibits painful stimuli transmitted by small C-fibers to access the ascending signaling pathway. Another theory suggested that the favorable pain control efficacy of TENS was due to the release of endorphins, which attach to opioid receptors and block the transmission of noxious stimuli (5).

Low-intensity TENS decreases nociceptor cell activity and sensitization of the central nervous system when use in somatic receptive fields and after spinal cord transection. TENS-induced A-delta activity results in long-term depression of central nociceptor cell activity for up to two hours. The effect of TENS on small-diameter afferents (A-delta) leads to activation of the midbrain periaqueductal grey and rostral ventromedial medulla and inhibition of descending pain-facilitatory pathways (14). Also, TENS can block peripheral afferent impulses from a peripheral structure (15) and produce nerve impulses, which collide and extinguish afferent impulses arising from the peripheral structures. Peripheral blockade of nociceptive impulses is more likely when TENS affects A-delta fibers. Moreover, TENS blocks afferent activity in large-diameter fibers that may contribute to pain (14).

TENS is an inexpensive, non-invasive and safe method with no major side effects. It can be easily used by patients following a simple training and since there is no risk of toxicity, patients can adjust the dosage on an as-needed basis (16). It was suggested that self-reported pain in adolescents for evaluation of TMD was reliable (17). In this study, we considered self-reported pain as a subjective outcome and MMO as an objective outcome of efficacy of TENS in the study groups.

Johnson *et al.* evaluated TENS as a non-pharmacological modality based on delivering low-voltage electrical currents to the skin. They concluded that TENS reduced pain intensity significantly (18). Howevere; in the review study by Walsh et al, they could not make any definitive conclusion about the effectiveness of TENS as an isolated treatment for acute pain in adults due to insufficient extractable data in the studies included in their review.(5) Shanavas *et al.* studied use of TENS for TMD pain. They concluded TENS therapy could be applied as an adjuvant modality in the management of pain associated with TMDs (19). Chipaila *et al.* evaluated the effect of ultra-low frequency transcutaneous electrical nerve stimulation on patients with TMD. The results of this study supported the use of active and passive oral exercises and exercises to improve posture as effective interventions to reduce symptoms associated with TMD(20).

There were no reports on the adverse effects of TENS. Use of TENS is contraindicated in patients with cardiac pacemakers and epilepsy (14).The effects of TENS on pregnancy are unknown, although several reports have described the successful use of TENS in labour and delivery pains (21, 22).

Conclusion

It seems use of TENS may improve pain relief in conjunction with pharmacological agents in patients with TMD.

Conflict of Interest: 'None declared'.

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