

Effects of combined application of transcutaneous electrical nerve stimulation and yoga techniques in patients with temporomandibular disorders

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Abstract: *Treatment of temporomandibular disorders is based on long-term noninvasive conservative treatments. The aim of the present study was to investigate the effects of yoga and transcutaneous electrical nerve stimulation therapy on pain and maximum mouth opening without pain in patients with temporomandibular disorders. A total of 28 individuals with the diagnosis of TMJ arthralgia participated in the study. In the first group patients practiced yoga with emphasis on the struck area, in the second patients received TENS, in the last group patients received TENS in combination with yoga practice. The results of the present study showed that most pronounced improvement was achieved in patients who received combined yoga and TENS therapy. It was concluded that yoga therapy combined with TENS could be used as an effective treatment for pain reduction and improving function of the orofacial system in patients with temporomandibular disorders.*

Key words: *yoga, temporomandibular disorders, pain, TENS, physical therapy*

Introduction

Temporomandibular disorders (TMD) are musculoskeletal and neuromuscular pain conditions characterized by pain in the temporomandibular joints (TMJ) and/or the associated structures (De Leeuw R. 2013). Therapy of TMD usually demands long-term conservative treatment (Okeson, 2008). Surgical intervention on a temporomandibular joint in the majority of clinical cases doesn't yield desirable result and leads to loss of function, which is connected with complexity of a structure and features of physiology. The modern medicine offers conservative treatments based on removal of an inflammation and hypostasis, which include pharmacological treatment or different physical therapy modalities. Pharmacological treatment of temporomandibular disorders usually consists of nonsteroidal anti-inflammatory drugs (NSAIDs) which may have serious side effects, such as gastrointestinal complications, promoting asthma attack etc. Therefore, protocols of new noninvasive procedures in treatment of these conditions are needed to be established.

Transcutaneous electrical nerve stimulation (TENS) is one of the physical therapy procedures that leads to the suppression and control of pain. This method is based on acupuncture where the active agent is electric current attached to the struck area. Surface electrodes are placed over the painful area and the stimulation is delivered at high frequency and low intensity (below pain threshold), which results in the intense activation of $A\beta$ afferents and evoke paresthesiae that cover the painful area. It is suggested that

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the reduction of pain is probably caused by opioid effect and acupuncture stimulation (Vance et al. 2007, Nicola et al, 2013). Many studies have showed that TENS therapy has no side effects and can effectively achieve reduction of pain (Lung et al. 2007, Djordjevic et al. 2014)

Yoga is regarded as a part of Complementary and Alternative Medicine. Results of the recent studies suggested that yoga techniques have a positive effect on chronic pain. Yoga practices, including asanas, mudras, pranayamas, pratyahara, dhyana and dharana, may increase physical flexibility, coordination and strength, diminish anxiety and stress, which are all considered an important factors in the aethiology of TMD (Raub 2002, Sherman et al, 2011, Posadzki et al, 2011, Büssing et al, 2012, Yudin et al. 2012, Cramer et al, 2013, 2013a).

The aim of the present study was to investigate the effects of yoga and TENS therapy on pain and mandibular function of the orofacial system in patients with temporomandibular disorders.

Patients and methods

A total of 28 individuals of both genders with the diagnosis of TMJ arthralgia who complained on the chronicle pain in preauricular region and temporomandibular joint participated in the study. Patients were divided into three groups. In the first group patients practiced yoga with emphasis on the struck area, in the second patients received TENS, in the last group patients received TENS in combination with yoga practice.

Yoga therapy included series of asana affecting area of the neck, shoulders and arms, pranayama (full yoga breathing and *ujjayi*) and meditation. Patients underwent yoga therapy during one month, three times per week. Each yoga session lasted 60 minutes. In the group which was treated with both TENS and yoga therapy patients received TENS therapy before each yoga session.

TENS therapy was performed using device "EPB-50-01 Electronics". Surface electrodes were placed over the painful area of the TM joint or painful area innervated by trigeminal nerve. (Figure 1). High frequency ultra-short impulse of low intensity was used. Patients underwent TENS therapy total of 3 times per week during two weeks. Each session lasted 35 minutes. No negative side effects of the therapy were recorded.

The pain intensity and the range of maximal mouth opening were measured at baseline, immediately after treatment and 30 days after treatment. The pain intensity measuring was conducted using Numeric Rating Scale from 0 to 10. Maximum mouth opening (MMO) without pain (MMO) was measured using the millimeter ruler. Patients were instructed to open their mouths as far as possible, without feeling any pain. Vertical distance from the incisal edge of the upper central incisor to the labioincisal edge of the opposing lower central incisor was recorded.

Statistical analysis were performed using the SPSS®21 software.



Figure 1. Fixing of electrodes over the painful area in patients with TMJ arthralgia

Results

The descriptive statistics for demographic characteristics of the studied sample are shown in Table 1. There were no statistically significant difference among groups in regards to age ($p=0.294$) and gender ($p=0.751$).

Table 1. Sociodemographic characteristics of the studied sample

The observed parameters		Therapy			p- value
		Yoga	TENS	Yoga+TENS	
N		9	10	9	
Age (X±SD)		51.67±14.22	40.9±16.9	42.4±20.3	^a $p=0.294$
Gender (%)	Male	4 (44.4%)	3 (30%)	3 (30%)	^b $p=0.751$
	Female	5 (55.6%)	7 (70%)	7 (70%)	

^a Kruskal-Wallis test; ^b Pearson Chi-Square

No differences were registered among groups for pain intensity (Kruskal-Wallis test, $p=0.706$) and maximum mouth opening (Kruskal-Wallis test, $p=0.562$) at baseline.

A reduction in pain intensity and increase of the maximum mouth opening were observed in each group when comparing baseline and immediately after treatment values (Wilcoxon Signed Ranks Test, $p=0.01$, $p=0.004$ and $p=0.005$ for pain intensity scores, and $p=0.007$, $p=0.005$ and 0.004 for maximum mouth opening, respectively). No differences in pain intensity and increase of the maximum mouth opening immediately after treatment and 30 days after treatment within groups were found ($p>0,05$) (Figure 2 and 3). In yoga group the mean pain intensity score at baseline was 5.89 ± 1.17 , immediately after treatment score was 3.89 ± 0.78 and 30 days after treatment score was 4.11 ± 0.78 . In TENS group the mean pain

intensity score at baseline was 6.3 ± 0.94 , immediately after treatment score was 1.1 ± 0.74 and 30 days after treatment score was 1.7 ± 0.68 . In TENS+YOGA group the mean pain intensity score at baseline was 6 ± 1.41 , immediately after treatment score was 0.2 ± 0.42 and 30 days after treatment score was 0.5 ± 0.57 . In yoga group the mean MMO score at baseline was 19.44 ± 1.9 mm, immediately after treatment score was 25.33 ± 0.87 mm and 30 days after treatment score was 24.11 ± 0.78 mm. In TENS group the mean MMO score at baseline was 19.3 ± 2.8 mm, immediately after treatment score was 36.5 ± 1.43 mm and 30 days after treatment score was 37.8 ± 1.3 mm. In TENS+YOGA group the mean MMO score at baseline was 18.9 ± 2.6 mm, immediately after treatment score was 41 ± 0.95 mm and 30 days after treatment score was 40.8 ± 1.6 mm.

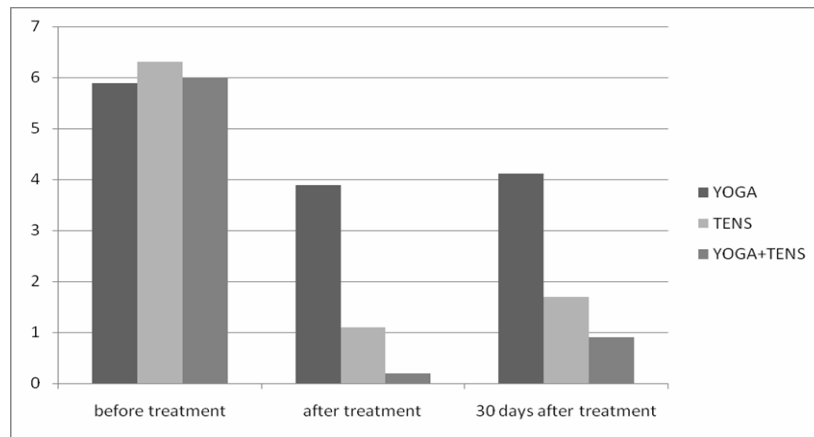


Figure 2. Pain intensity scores at baseline, at the end of the treatment and 30-days after the treatment

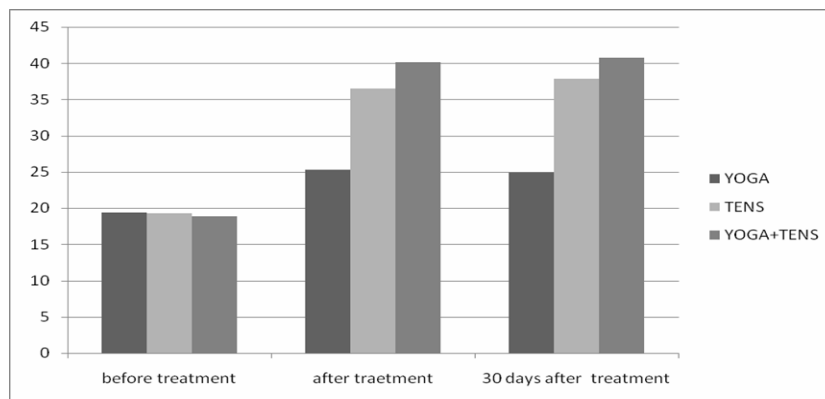


Figure 3. Maximum mouth opening at baseline, at the end of the treatment and 30-days after the treatment

Although the reduction of pain and increase of maximum mouth opening were observed within each group, significant differences were evident among groups (Kruskal-Wallis test, $p < 0.001$). The most pronounced improvement was registered in patients within group which received combined yoga and TENS therapy.

Discussion

As far as we know, this is the first study that evaluates the effects yoga therapy in combination with TENS therapy on pain in patients with TMD. Our hypothesis was that yoga therapy is effective in reducing pain in TMD as a single or additional therapy. The results of our study showed that combined yoga and TENS therapy achieved the best improvement in reducing pain, compared to single yoga or TENS therapy, consequently increasing maximum mouth opening as a parameter of the orofacial system's function. This sheds a new light on the method of yoga practice as a contribution factor that increases the efficiency of existing therapeutic modalities in treatment of TMD.

Many authors suggested that yoga can be recommended as main or additional therapy of chronic pain in patients with musculoskeletal disorders. Tekur et al. suggested that intensive yoga practice reduces pain and improves spinal mobility in patients with chronic low back pain (Tekur et al, 2012). In the systematic review, Cramer et al. concluded that yoga can be recommended as an additional therapy to patients with chronic low back pain (Cramer et al, 2013). Results of another study showed that yoga is effective in reducing pain and improvement of neck-related disability in patients with chronic neck pain, highlighting that sustained yoga practice seems to be the most important predictor of long term effectiveness (Cramer et al, 2013a). Since TMD belongs to the group of musculoskeletal disorders, results of the recent studies investigating the effectiveness of yoga therapy on pain in different musculoskeletal disorders are encouraging. TMD, as a second common cause of musculoskeletal pain and second common cause of pain in orofacial region, significantly affects the psycho-social functioning and quality of life of patients. On the basis of studies which showed that yoga practice improves psychological status and quality of life of individuals (Vera et al. 2009, Kiecolt-Glaser et al. 2010, Nikić, Janjušević 2013), it could be suggested that yoga is a path to the holistic treatment approach which may lead to a long term effectiveness in improvement of signs and symptoms of TMD, affecting not only the manifestations, but also the roots of that disorder.

Conclusion

The results of the present study indicate that yoga therapy combined with TENS therapy could be used as an effective treatment for pain reduction and improving function of the orofacial system in patients with TMD. Single TENS therapy was found to be effective, but significantly higher improvement was registered when TENS was combined with yoga therapy. Bearing in mind that yoga therapy is completely noninvasive method, through which many psycho-physical benefits could be achieved, it could be recommended as an additional therapy of TMD. However, this was a pilot study conducted on a small sample and further investigations with a greater sample size will be needed in order to evaluate more accurately the effectiveness of this modality.

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Received: October 15, 2014
Accepted: December 2, 2014