

Effect of Jaw Opening Exercise on Prevention of Temporomandibular Disorders Pain Associated with Oral Appliance Therapy in Obstructive Sleep Apnea Patient: A Randomized Double Blind Placebo Controlled Trial

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ABSTRACT

Background: Oral appliance (OA) can effectively treat obstructive sleep apnea; however, numerous types of oral appliances and designs are variable and the precise mechanisms behind differences in treatment outcomes are uncertain. **Aim of the study:** To study the effect of jaw opening exercise on prevention of temporomandibular disorders pain associated with oral appliance therapy in obstructive sleep apnea patient.

Materials and methods: The present study was conducted in the Dental institute. Ethical clearance was obtained from the ethical board of the institute. For the study, only those patients were selected who had been diagnosed for sleep disorders using polysomnography (PSG) according to the American Academy of Sleep Medicine guidelines in 2007. The age of the participants ranged from 18 to 55 years. Patients who had BMI more than 30 kg/m², who had other sleep disorders and who had previously been treated for OSA were excluded from the study. The subjects were equally divided into two random groups, jaw opening exercise group (JE) and placebo exercise (PE). OA compliance, TMD signs and treatment outcomes were evaluated prior to start of exercises and at intervals of 1 month.

Results: A total of 20 subjects with confirmed diagnosis of sleep apnea were recruited in the study. 10 subjects were grouped into JE group and 10 in PE group. We observed that apnea hypopnea index, sleep efficiency, Rem sleep and Arousal index improved significantly in JE group. On the other hand, there was not any significant improvements in the treatment outcomes in PE group.

Conclusion: From the results of the present study this can be concluded that jaw opening exercises are highly efficacious in patients with obstructive sleep apnea and should be the first treatment of choice.

Keywords: Oral appliance, sleep apnea, jaw exercises.

INTRODUCTION

Oral appliance (OA) can effectively treat obstructive sleep apnea; however, numerous types of oral appliances and designs are variable and the precise mechanisms behind differences in treatment outcomes are uncertain.^{1, 2} Many people with obstructive sleep apnea (OSA) wear oral appliances for a lifetime to enlarge the pharyngeal airway by

repositioning the mandible anteriorly. Studies have recently reported that long-term use of an oral appliance is sometimes accompanied, especially during the initial phase of therapy, by jaw discomfort with difficulty chewing in the morning. Long-term occlusal changes have also been noted.^{3, 4} One of the treatments used for OSAS is the application of oral appliances (OAs); these are generally designed to increase the airway patency

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of patient by preventing the collapse of the mandible and correcting the tongue position. The most common OA type is that which holds the mandible in a more anterior position to enable correction of the anatomical balance, especially in the upper airways.^{5,6} Hence, the present study was planned to study the effect of jaw opening exercise on prevention of temporomandibular disorders pain associated with oral appliance therapy in obstructive sleep apnea patient.

MATERIALS AND METHODS

The present study was conducted in the Dental institute. Ethical clearance was obtained from the ethical board of the institute. For the study, only those patients were selected who had been diagnosed for sleep disorders using polysomnography (PSG) according to the American Academy of Sleep Medicine guidelines in 2007. A written informed consent was signed from the participants after explaining them the protocol of the study. The age of the participants ranged from 18 to 55 years. Patients who had BMI more than 30 kg/m², who had other sleep disorders and who had previously been treated for OSA were excluded from the study. The subjects were equally divided into two random groups, jaw opening exercise group (JE) and placebo exercise (PE). OA compliance, TMD signs and treatment outcomes were evaluated prior to start of exercises and at intervals of 1 month.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS

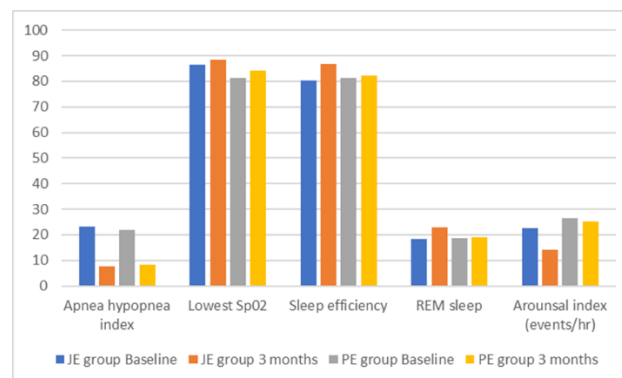
A total of 20 subjects with confirmed diagnosis of sleep apnea were recruited in the study. 10 subjects were grouped into JE group and 10 in PE group. Table 1 shows mean values of treatment outcomes at baseline and after 3 months. We observed that apnea hypopnea index, sleep efficiency, Rem sleep and Arousal index improved significantly in JE group. On the other hand, there was not any significant improvements in the treatment outcomes in JE group.

DISCUSSION

Table 1: Mean values of treatment outcomes at baseline and after 3 months

	JE group (n=10)		PE group (n=10)	
	Baseline	3 months	Baseline	3 months
Apnea hypopnea index	23.12	7.65	21.98	8.26
Lowest SpO ₂	86.45	88.36	81.32	84.23
Sleep efficiency	80.32	86.95	81.32	82.1
REM sleep	18.32	22.85	18.54	19.01
Arousal index (events/hr)	22.65	14.23	26.54	25.12

Fig 1: Treatment outcomes for both groups.



In the present study, we observed that various parameters for treatment outcomes improved significantly in patients who did jaw exercises for 3 months as compared to patients who were instructed to do placebo exercises. The results were found to be statistically significant. Similar studies were performed in the past and our results are consistent with previous studies. Ishiyama H et al determined the effect of jaw-opening exercise on TMD pain associated with OA therapy in OSA patients. Twenty-five OSA patients without pain-related TMD were consecutively enrolled into a two-arm, randomized, double-blind, placebo-controlled trial. One group performed jaw-opening exercise (JE, n=13), and the other group performed placebo exercise (PE, n=12) for 1-month, and had started 2-weeks prior to insertion of an adjustable OA. TMD sign using the Research Diagnostic Criteria for Temporomandibular Disorders and TMD pain intensity using a visual analog scale (VAS) in the morning and daytime were evaluated at baseline

(pre-exercise) and at 2-weeks, 1-month, and 3-months after OA insertion. Pain-related TMD was not observed in the JE-group at all evaluation periods, although one subject in the PE-group was diagnosed with arthralgia at the 1-month evaluation. The JE-group showed lower morning and daytime VAS scores than the those of the PE-group at all evaluation periods, and significant group differences were found in terms of chewing pain and jaw-opening pain in the morning at the 1-month evaluation, and of jaw-opening pain during daytime at the 3-month evaluation. Within the limitations of the study, jaw-opening exercise prior to OA therapy reduced the risk of TMD pain associated with OA use. Therefore, jaw-opening exercise may contribute to the prevention of TMD pain. Ueda H et al compared the effects on objective occlusal function of 2 types of jaw exercises during oral appliance therapy in patients with obstructive sleep apnea (OSA). Sixteen consecutive subjects with snoring or OSA undergoing oral appliance therapy were included in this study; the results were based on 10 patients who completed it. The patients were randomized to start with either a jig exercise or stretching movements for 1 month; after 1 month without exercise, they crossed over to the other exercise for 1 month. An occlusal diagnostic system that consisted of a pressure-sensitive sheet and an image scanner was used to evaluate occlusal contact area and bite force. Both exercises produced significant increases in occlusal contact area and bite force in the morning compared with the period of no exercise. At night, the molar region had significant improvements in occlusal contact area and bite force only during stretching movements. We found no significant differences between the 2 exercises, but stretching movements tended to be more effective in the molar region, whereas the jig exercise tended to be more effective in the anterior region. They concluded that jaw exercises might help relieve masticatory muscle stiffness and accelerate the repositioning of the mandible to the normal position, in addition to inhibiting or minimizing the occlusal functional changes in predisposed patients.^{7,8}

Doff MH et al assessed variations in the occurrence of temporomandibular disorders (TMDs) and the risk of developing pain and function impairment of the temporomandibular complex in obstructive sleep apnea syndrome (OSAS) patients treated with

either an oral appliance (mandibular advancement device) or continuous positive airway pressure (CPAP) in a 2-year follow-up study. In addition, we assessed the relationship between the mean mandibular protrusion and the frequency of wearing the appliance during follow-up with the occurrence of pain and function impairment of the temporomandibular complex. Fifty-one patients were randomized to oral appliance therapy and 52 patients to CPAP therapy. TMDs (diagnosed according to the Axis I Research Diagnostic Criteria for TMD), pain intensity and disability and mandibular function impairment were recorded at baseline, after 2 months, 1 year and 2 years of therapy. Only in the initial period of treatment the occurrence of pain-related TMDs was considerably higher (24%) in the oral appliance group compared to CPAP (6%). Oral appliance therapy furthermore resulted in more temporomandibular pain compared to CPAP (odds ratio 2.33, 95% confidence interval (1.22-4.43)). However, there were no limitations in mandibular function in both groups during the (entire) follow-up period. Although generally not serious and of transient nature, oral appliance therapy results in more pain-related TMDs in the initial period of use compared with CPAP therapy. Oral appliance therapy is associated with increased pain in the temporomandibular complex in the initial period of use. Because of the transient nature, this pain is not a reason to contraindicate an oral appliance in OSAS patients. Moreover, TMDs and the risk of developing pain and function impairment of the temporomandibular complex appear limited with long-term oral appliance use. Cunali PA et al evaluated the prevalence of pain associated with temporomandibular disorders (TMD) in obstructive sleep apnea syndrome (OSAS) patients referred for oral appliance therapy. Eighty-seven patients (46 men and 41 women), between 18 and 65 years of age, with an apnea-hypopnea index (AHI) of > 5 and < 30 (events by sleep hour), and body mass index (BMI) of $\geq$ or < 30 Kg/m² were evaluated according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to determine the presence of signs and symptoms of TMD. Statistical analyses included correlations assessed by Pearson's test. Fifty-two percent of patients presented symptoms of TMD. Thirty-two patients (average age 47 +/- 11 years, AHI 17.3 +/- 8.7, BMI 25.9 +/- 3.8 kg/m²) completed the study.

According to the Scoring Protocol for Graded Chronic Pain (Axis II-RDC/TMD), 75% of the patients presented chronic pain related to TMD, categorized as low disability grade I (< 50 points for pain intensity, and < 3 disability points). The most common TMD diagnosis was myofascial pain with and without limited mouth opening and arthralgia (50%). They concluded that the high prevalence of TMD in the current study indicates that patients with OSAS referred for oral appliance therapy require specific evaluation related to TMD.^{9,10}

CONCLUSION

From the results of the present study this can be concluded that jaw opening exercises are highly efficacious in patients with obstructive sleep apnea and should be the first treatment of choice.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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