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Treatment of obstructive sleep apnea patients using oral appliances – our experiences

Lečenje opstruktivne apneje u snu pomoću oralnih aparata – naša iskustva

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Abstract

Background/Aim. Obstructive sleep apnea (OSA) is one of the most prevalent sleep disorders. It is recognized as a serious risk factor for car and workplace accidents due to daytime sleepiness, and factor for coronary heart diseases and stroke. The aim of this study was to examine the effectiveness of oral appliances for mandibular advance in treating mild to moderate OSA. **Methods.** A total of 15 patients were included in this study, all diagnosed with mild or moderate OSA. Oral appliances were custom made for each patient in protrusive position at 50% of maximum mandibular advancement. The patients were given instructions not to sleep on their backs and avoid alcohol consumption during the study as these are the factors that can contribute to symptoms progression. **Results.** Complete and partial treatment success was achieve in 14 of the patients. Apnea-hypopnea index values were significantly lower ($p < 0.05$) at the end of a 6-month observation period compared to those at the treatment beginning. A great improvement in symptoms was observed, with daytime sleepiness index values significantly reduced already within the first month of the treatment. **Conclusion.** Treatment of obstructive sleep apnea with oral appliances has proven successful. Patients were comfortable using oral appliances and were ready to wear them for prolonged period of time. Use of oral appliances is very common in the world and should not be discarded. They are also very comfortable, practical and affordable comparing to continuous positive airway pressure (CPAP) apparatus, not to mention surgery. Use of oral appliances is safe and very well tolerated, and ought to be offered to patients with OSA.

Key words:
sleep apnea, obstructive; orthodontic appliances; treatment outcome.

Apstrakt

Uvod/Cilj. Opstruktivna apneja u snu je jedan od najčešćih poremećaja spavanja. Dokazano je da su bolesnici koji pate od ovog poremećaja skloniji saobraćajnim nezgodama i povredama na radu, kao i da su izloženi većem riziku od nastanka koronarne bolesti srca i moždanog udara. Cilj ovog istraživanja bio je da se utvrdi uspešnost terapije blage i umerene opstruktivne apneje u snu oralnim aparatima. **Metode.** Ukupno 15 bolesnika sa prethodno uspostavljenom dijagnozom blage ili umerene opstruktivne apneje u snu bilo je uključeno u istraživanje. Oralni aparati su individualno urađeni za svakog bolesnika, sa mandibulom u protruzionom položaju 50% od maksimalnog. Bolesnicima je preporučeno da izbegavaju spavanje na leđima i unošenje alkohola tokom trajanja studije, jer ovi faktori mogu uticati na pogoršanje simptoma. **Rezultati.** Potpuni i delimični uspeh terapije postignut je kod 14 bolesnika. Vrednosti apneja-hipopneja indeksa bile su statistički značajno niže ($p < 0,05$) od početnih vrednosti na kraju 6-mesečnog perioda posmatranja. Registrovano je i značajno poboljšanje simptoma, kao i značajno umanjenje vretnosti indeksa dnevne pospanosti već posle prvog meseca terapije. **Zaključak.** Oralni aparati su bili uspešni u lečenju opstruktivne apneje u snu. Bolesnici su iskazali veliku lagodnost i bili su spremni da nose oralne aparate i duži vremenski period. Upotreba oralnih aparata je uobičajena u svetu, i ne treba da bude zanemarena. Vrlo su praktični, lagodni za nošenje i pristupačniji u poređenju sa aparatom za kontinuirani pozitivni pritisak u disajnim putevima (CPAP), a pogotovo sa hirurškom intervencijom. Upotreba oralnih aparata je bezbedna i trebalo bi je ponuditi bolesnicima kao jedno od mogućih rešenja.

Ključne reči:
apneja u snu, opstruktivna; ortodontski aparati; lečenje, ishod.

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Introduction

One third of human life is spent sleeping, so the need for a healthy and undisturbed night sleep is of essence. There are many sleep disorders described so far [1], obstructive sleep apnea (OSA) being one of the most common, affecting at least 1–5% of adult population [2, 3]. Due to structurally small or highly collapsible upper airways, patients suffer from abnormal ventilation during sleep, manifesting in a complete or partial blockade of breathing, repeatedly during the night. Fragmented sleep affects daytime concentration and presents significant problem for the patients. It is described that people suffering from OSA are prone to work place accidents, and more often involved in car crashes due to overt sleep and inattention due to sleepiness [4, 5]. OSA is recognized as a serious risk factor for hypertension, coronary heart disease and stroke [6–8], and as such, it needs to be properly diagnosed and treated accordingly. In addition, patients are not well educated and informed about symptoms and risks of obstructive sleep apnea, and are not aware that they suffer from this serious condition. Furthermore, patients who are diagnosed are mainly offered only continuous positive airway pressure (CPAP). CPAP is the use of continuous positive pressure to maintain a continuous level of positive airway pressure but apparatus used for this is highly uncomfortable and patients can not adequately adjust [9]. Another treatment modality for OSA patients is surgery but, as all surgery options, it represents a risk for patients, and thus, alternative treatments that are safe, effective, and acceptable are needed.

Oral appliances for mandibular advance are used for treating mild and moderate OSA, and are proved very successful [10–12]. In addition, patients reported high levels of comfort, and were prepared to use oral appliances for longer period of time [12]. Varieties of oral appliances are used for treating OSA, and are all quite effective [13]. It is important to present oral appliances for mandibular advance as treatment modality to both patients suffering from OSA and medical practitioners treating them.

The aim of this study was to examine effectiveness of oral appliances for mandibular advance (Thornton adjustable positioner – TAP) in treating mild to moderate OSA.

Methods

A total of 15 patients (ten men and five women) were included in this study. All of the patients were diagnosed with mild or moderate obstructive sleep apnea by sleep medicine specialist during nocturnal polysomnography (Stardust II Sleep Recorder, Philips Respironics, Amsterdam, The Netherlands) using a standard method [14]. All the patients had an apnea / hypopnea index (AHI) > 10. Before enrolling in the study dental exam was performed. All of the patients were found to have 10 periodontally healthy teeth needed to adequately wear the oral appliance. In addition, none of them was found to suffer from craniomandibular dysfunctions. Oral appliances were custom made for each patient (Figure 1).

After taking the impressions maximal lower jaw advancement was determined. Using specially designed bite registrator (Figure 2) occlusal impressions were taken in protrusive position at 50% of maximum mandibular advancement.

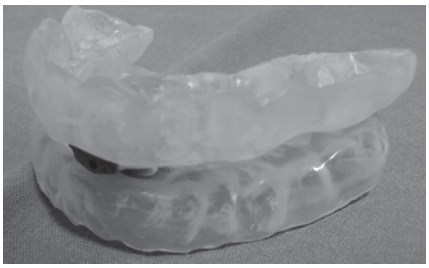

Fig. 1 – Thornton adjustable positioner (TAP) oral appliance for mandibular advance

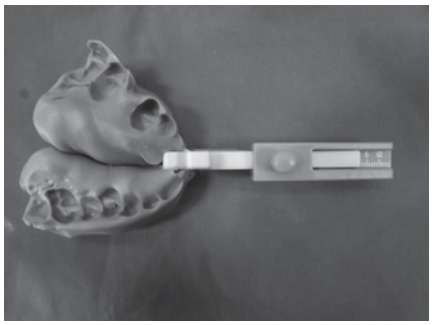

Fig. 2 – Bite registrator

This position was described comfortable by the patients. Before receiving appliances patients were given rubber spatulas to chew on for a period of one week to accommodate temporomandibular joints to protrusive position of the lower jaw (Figure 3). After receiving oral appliances patients were given instructions not to sleep on their backs and avoid alcohol consumption during the study, as these are the factors that can contribute to symptoms progression [15].

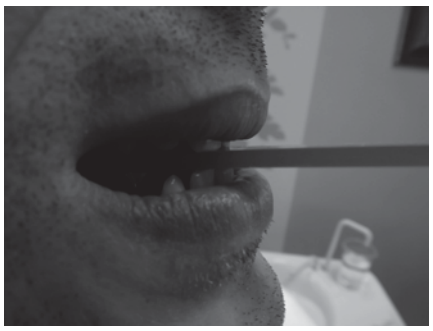

Fig. 3 – Chewing spatula

During observational period that lasted for 6 months, follow-up exams were conducted on the first, third and sixth month. At the beginning of the observational period and at the follow-ups patients were asked to fill questionnaires for subjective assessment of the frequency and intensity of snoring, and sleepiness index, designed by the author specifically to help access treatment success, already used in previous study [12]. The sleepiness index contained 6 questions: 1) “Do you wake up rested in the morning?”; 2) “Does

the sleep invigorate you?"; 3) "Do you continuously wake up during night sleep?"; 4) "Do you have trouble performing your daytime activities due to sleepiness"; 5) "Do you ever fall asleep while waiting at the doctors, bank etc.?"; 6) "Do you regularly take naps during the day?". The answers for each question were graded from 0 to 4, 0 being with no symptoms or problems at all, while 4 being fully expressed symptoms or problems. Scores were designed in the way that 0–10 points meant normal range, 10–12 borderline and 12–24 abnormal. Also, data about snoring and quality of life was gathered from participants' partners. At the end of observational period patients had once again undergone polysomnography, and AHI values were recorded.

Success of the treatment was defined according to recommendations of American Academy of Sleep Medicine. Complete success of the treatment was defined as reduction in AHI index to ≤ 5 with the resolution of symptoms, while partial success was defined as improvement in symptoms and reduction of AHI index for more than 50% compared to baseline measurement but AHI remaining ≥ 5. Treatment failure was defined as ongoing clinical symptoms with AHI reduction less than 50% compared to the baseline. Severity of OSA was defined based on the AHI: mild from 5 to less than 15, moderate from 15 to 30 and severe over 30 apneic episodes *per* hour of sleep [16].

Data were analyzed using a statistical package (SPSS version 17.0, SPSS Inc. Chicago, IL, USA). Paired *t*-tests were used to compare AHI values before and after the treatment and daytime sleepiness index before the treatment and after 1, 3 and 6 months within the group. A *p*-value of < 0.05 was used to assign statistical significance for all tests. All descriptive statistics are presented as mean ± SD.

Results

All of the patients involved in the study completed the protocol. The average age of the patients was 49 (SD ± 7), and there was no statistical difference in age between male and female participants. Baseline AHI measurements were between 15 and 28 apnea/hypopnea episodes per hour (h^{-1}) (average 20.87 ± 3.64) with no statistical significance between genders. Average protrusion value was 5.46 mm (SD ± 1.06). TAP appliance was well tolerated by all of the patients, with three of them reported transient excessive salivation. On the first follow-up patients and their partners reported substantial reduction in symptoms, 80% of the patients snored less, 73% slept better. After the third month these percentages raised, and on the second follow-up all of the patients reported improvement in sleeping quality and decline in snoring. In addition, the patients were quite comfortable wearing oral appliances. The baseline sleepiness index results showed abnormal results regarding daytime sleepiness, and sleep quality with average value of 17.3 (SD ± 2.4), without statistical significance between male and female patients. A statistically significant difference was observed between the values for baseline sleepiness index measurement and measurements after the first, third and sixth month ($p < 0.05$), but not between follow-ups (Figure 4).

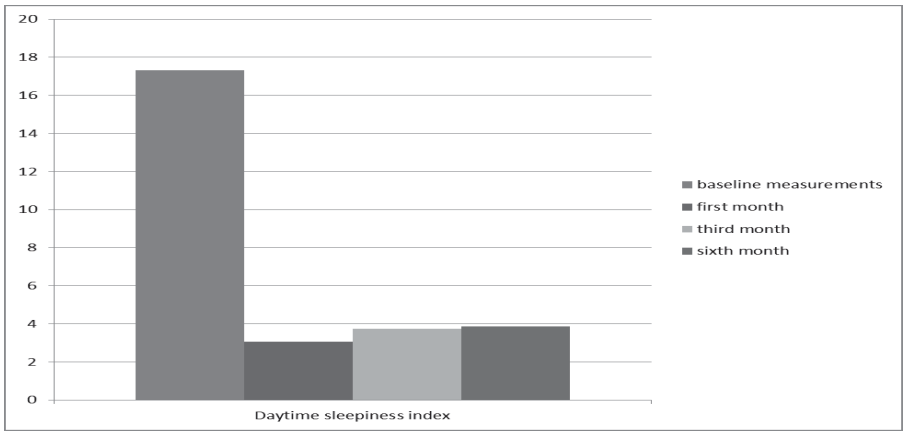

Fig. 4 – Daytime sleepiness index values

Also, the AHI values after observational period were significantly lower than baseline ($p < 0.05$), averaging 6.1 ± 3.5 (Table 1). No difference could be observed regarding gender. In seven patients a complete treatment success was achieved, partial success in seven patients and treatment failure was reported for only one patient. All of the patients reported that they were abiding by the instructions regarding alcohol consumption and sleeping on their side.

Discussion

A complete therapy success was recorded in 7 out of 15 (47%) patients who participated in the study. In addition to 7 patients with partial success rate, 14 out of the 15 patients included in the study reported substantial improvement in their condition and regression if not elimination of symptoms. Treatment failure was recorded in only one patient, but with noticeable subjective improvements. Subjective parameters regarding the success of the treatment show that all of the participants in the study slept better, snored less, and functioned more efficiently during the day, thus improving their quality of life. These findings should be used with caution, as any subjective data should be. Data regarding sleepiness index showed

an improvement and reduction in the values, showing the reduction of daytime sleepiness, and related problems. These results correspond with the findings in other studies [17, 18]. It is important to emphasize that patients were comfortable wearing oral appliances, without any noticeable side effects.

The proper diagnose of obstructive sleep apnea is very important, if we are to prevent risks associated with this condition. Snoring is one of the main symptoms of OSA. Every patient that suffers from OSA snores, but not everyone who snores suffers from OSA. Patients should be properly informed about the symptoms, risks and treatment modalities of OSA. Oral appliances are proven to reduce collapsibility of upper airways, thus reducing objective and subjective symptoms of OSA [19]. They are also very comfortable, practical and affordable comparing to CPAP, not to mention surgery.

Conclusion

Oral appliances use is very common in the world and should not be discarded. Oral appliances are not novelties, but proven and efficient treatment for people suffering from mild or moderate obstructive sleep apnea, and should be used accordingly. Oral appliances use is safe and very well tolerated, and ought to be offered to patients with OSA.

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