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Case Report

USE OF PREFABRICATED MANDIBULAR ADVANCEMENT DEVICE FOR TREATMENT OF SLEEP APNEA SYNDROME IN INTERCITY TRANSPORT DRIVER: case report

Utilização de dispositivo de avanço mandibular pré-fabricado para tratamento da síndrome de apneia do sono em motorista de transporte intermunicipal: relato de caso

Uso de un dispositivo de avance mandibular prefabricado para el tratamiento del síndrome de apnea del sueño en conductor de transporte interurbano: reporte de caso

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ABSTRACT

Introduction: in obstructive sleep apnea syndrome there are obstructions in the upper airway that cause desaturation, sleep disorders and an increased risk of involvement in car accidents due to poor sleep quality. The mandibular advancement device is one of the therapeutic alternatives for this syndrome. **Objective:** to evaluate the effects of mandibular advancement device in an intercity public transport driver with obstructive sleep apnea syndrome. **Methods:** this is a case report of an individual submitted to mandibular advancement device for a period of eight weeks. The Epworth Sleepiness Scale, the Apnea-Hypopnea Index were evaluated using the polysomnographic profile, and the quality of life using the SF-36 questionnaire. The severity of obstructive sleep apnea syndrome was defined by the Apnea-Hypopnea Index (mild: ≥ 5 and ≤ 14; moderate: ≥ 15 and ≤ 29; severe: ≥ 30). **Results:** there was a reduction in the Apnea-Hypopnea Index from moderate to normal ($16.0 \rightarrow 1.8$ ev/h), a reduction in the Epworth Sleepiness Scale ($5 \rightarrow 3$), an increase in the domains of the quality of life questionnaire in the domains of functional capacity ($65 \rightarrow 90$), physical limitations ($75 \rightarrow 100$), general condition ($30 \rightarrow 35$), vitality ($50 \rightarrow 55$), emotional aspects ($33 \rightarrow 100$) and mental health ($52 \rightarrow 76$). **Conclusion:** there was a reduction in the severity of obstructive sleep apnea syndrome and sleepiness and an increase in quality of life after the use of the mandibular advancement device by intercity public transport drivers.
Keywords: Obstructive sleep apnea; Quality of life; Sleepiness; Dental research.

RESUMO

Introdução: na síndrome da apneia obstrutiva do sono ocorrem obstruções nas vias aéreas superiores que causam dessaturação, distúrbios do sono e aumento do risco de envolvimento em acidentes automobilísticos devido à má qualidade do sono. O dispositivo de avanço mandibular é uma das alternativas terapêuticas para esta síndrome. **Objetivo:** avaliar os efeitos do dispositivo de avanço mandibular em um motorista de transporte coletivo intermunicipal com síndrome da apneia obstrutiva do sono. **Métodos:** trata-se de um relato de caso de um indivíduo submetido ao dispositivo de avanço mandibular por um período de oito semanas. A Escala de Sonolência de Epworth e o Índice de Apneia-Hipopneia foram avaliados por meio do perfil polissonográfico, e a qualidade de vida pelo questionário SF-36. A gravidade da síndrome da apneia obstrutiva do sono foi definida pelo Índice de Apneia-Hipopneia (leve: ≥ 5 e ≤ 14; moderado: ≥ 15 e ≤ 29; grave: ≥ 30). **Resultados:** houve redução do Índice de Apneia-Hipopneia de moderado para normal ($16,0 \rightarrow 1,8$ ev/h), redução da Escala de Sonolência de Epworth ($5 \rightarrow 3$), aumento dos domínios do questionário de qualidade de vida nos domínios da capacidade funcional ($65 \rightarrow 90$), limitações físicas ($75 \rightarrow 100$), estado geral ($30 \rightarrow 35$), vitalidade ($50 \rightarrow 55$), aspectos emocionais ($33 \rightarrow 100$) e saúde mental ($52 \rightarrow 76$). **Conclusão:** houve redução da gravidade da síndrome da apneia obstrutiva do sono e sonolência e aumento da qualidade de vida após o uso do dispositivo de avanço mandibular pelo motorista de transporte coletivo intermunicipal.
Palavras-chave: Apneia obstrutiva do sono; Qualidade de vida; Sonolência; Pesquisa em odontologia.

RESUMEN

Introducción: en el síndrome de apnea obstructiva del sueño existen obstrucciones en la vía aérea superior que provocan desaturación, trastornos del sueño y mayor riesgo de involucrarse en accidentes automovilísticos por mala calidad del sueño. El dispositivo de avance mandibular es una de las alternativas terapéuticas para este síndrome. **Objetivo:** evaluar los efectos del dispositivo de avance mandibular en un conductor de transporte público interurbano con síndrome de apnea obstructiva del sueño. **Métodos:** este es el reporte de un caso de un individuo que se sometió a un dispositivo de avance mandibular durante un período de ocho semanas. Se evaluó la Escala de Somnolencia de Epworth y el Índice de Apnea-Hipopnea mediante el perfil polisomnográfico, y la calidad de vida mediante el cuestionario SF-36. La gravedad del síndrome de apnea obstructiva del sueño se definió mediante el Índice de Apnea-Hipopnea (leve: ≥ 5 y ≤ 15; moderado: ≥ 15 y < 29; grave: ≥ 30). **Resultados:** hubo reducción del Índice de Apnea-Hipopnea de moderado a normal ($16,0 \rightarrow 1,8$ ev/h), reducción de la Escala de Somnolencia de Epworth ($5 \rightarrow 3$), aumento de los dominios del cuestionario de calidad de vida en los dominios de capacidad funcional ($65 \rightarrow 90$), limitaciones físicas ($75 \rightarrow 100$), estado general ($30 \rightarrow 35$), vitalidad ($50 \rightarrow 55$), aspectos emocionales ($33 \rightarrow 100$) y salud mental ($52 \rightarrow 76$). **Conclusión:** hubo una reducción en la gravedad del síndrome de apnea obstructiva del sueño y la somnolencia y un aumento en la calidad de vida después del uso del dispositivo de avance mandibular por parte del conductor de transporte público interurbano.
Palabra Clave: Apnea Obstructiva del sueño; Calidad de vida; Somnolencia; Investigación dental.

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is caused by recurrent upper airway obstructions generating desaturations and sleep alterations.[1] This condition is more prevalent in adult and male individuals, with greater severity in the older population, it is associated with the development or worsening of other clinical conditions, such as cardiovascular diseases.[1] The increase in the severity of coronary diseases is one of the clinical outcomes of OSAS, and therefore, the importance of early diagnosis and treatment should be considered in order to reduce the long-term consequences.[2] There are high risks of car accidents in individuals with OSAS due to lack of sleep quality, which causes a reduction in the ability to maintain performance behind the wheel.[3-4]

The diagnosis of OSAS is based on symptoms such as awakening with pauses in breathing, choking, insomnia, fatigue, snoring, and excessive daytime sleepiness. The clinical severity of the polysomnographic profile can be quantified through Type III polysomnographic examination, which is performed at home.[5] Excessive daytime sleepiness is one of the symptoms of OSAS and can be assessed using the Epworth Sleepiness Scale (ESS), which is an effective instrument for measuring daytime sleepiness.[6-7] Due to the symptoms arising from OSAS, it is relevant to assess the quality of life (QoL), since there is an impact on it. One of the most used instruments to assess QoL is the SF-36 questionnaire, which provides reliable and validated information for patients with OSAS.[8-9]

Non-invasive therapies for OSAS such as the use of a mandibular advancement device (MAD) are indicated, especially in cases of mild and moderate OSAS and in patients who are resistant or unable to use continuous positive airway pressure (CPAP).[10] Therefore, the present study aimed to evaluate the effect of the mandibular advancement device on sleep apnea syndrome in an intercity public transport driver.

CASE REPORT

Patient E.R., male, 36 years old, linked to an intercity urban transport company located in the city of Santa Cruz do Sul, has 11 years of experience as a driver. As for his past medical condition he had systemic arterial hypertension, apathy, and frequent tiredness. He was a member of the research carried out by the University of Santa Cruz do Sul entitled "Effects of the mandibular advancement device on the polysomnographic profile, daytime sleepiness and quality of sleep life in public transport drivers with obstructive sleep apnea syndrome" which is duly approved by the Ethics and Research Committee of the University of Santa Cruz do Sul (protocol nº 3.078.259). After signing the Informed Consent Form, the individual was evaluated regarding the anthropometric characteristics, daytime sleepiness, QoL and polysomnographic profile. Prior to submission to assessment, the individual was subjected to a health education approach on OSAS and its implications on quality of life, as well as the work activity performed by the same.

Their body mass and height measured using a mechanical anthropometric scale (Filizola®, Brazil), body mass index (BMI) was calculated using the ratio between body mass [kg]/height [m]².[11] The following parameters were measured using an anthropometric tape (Sanny Medical® model SN-4010, Brazil) with the individual in an orthostatic position: waist circumference (WC), measured at the midpoint between the tenth rib and the iliac crest; hip circumference (HC), measured at the greatest hip protuberance; waist-hip ratio (WHR), measured by the waist and hip circumference ratio; neck circumference (NC), measured at mean neck height.[11]

The presence of excessive daytime sleepiness was assessed using the ESS. This tool consists of 8 questions with a scale of 0 to 3 points, which asks about the probability of daytime

sleepiness in the following situations: sitting and reading, watching television, sitting in a public place, riding in a car for an hour without stopping, sitting after lunch without drinking alcohol, in a car stopped in traffic for a few minutes. The score ranges from 0 to 24 points, and when ≥ 10, increased daytime sleepiness is indicated.[4]

QoL was assessed using the SF-36 quality of life questionnaire, consisting of eight domains that translate quality of life: functional capacity, physical aspects, pain, general health status, vitality, social aspects, emotional aspects and mental health. To calculate the final score, 0 is considered the worst score and 100 is the best in a given domain.[5,12]

After answering the questionnaires, Type III polysomnographic examination was performed (Resmed ApneaLink Air® Australia). Such an examination was performed at the patient's home during sleep. The patient watched a video and was trained in order to instruct him on how to use the equipment. The severity of OSAS was defined by the apnea-hypopnea index (AHI) score as: mild ≥ 5 and ≤ 14; moderate ≥ 15 and ≤ 29; or severe AHI ≥ 30.[6] It is noteworthy that the individual did not undergo any type of multidisciplinary monitoring or treatment for OSAS prior to the study.

The intervention procedure consisted of the application of MAD (BluePro®; BlueSom, France) thermoplastic, customized and titratable, which contains sufficient retention forces capable of resisting the forces of opening the mouth (Figure 1). MAD positioning was performed by the dentist. The patient remained with the MAD for 8 weeks and two adjustments were made in order to achieve maximum comfort.[13-14]

Figure 1 - BluePro® mandibular advancement device.

The position of maximum mandibular advancement reached was a total of 5 mm in relation to the initial position, measured between the lower right central incisor in relation to the upper right incisor, this position was maintained with use during all nights for the period of 8 weeks. After this period, the individual underwent a new assessment of the anthropometric measurements, daytime sleepiness, QoL and polysomnographic profile.

RESULTS

Before MAD implementation, patient E. R. had a BMI of 32.33 Kg/m², WHR de 0.96 cm and a NC of 43.5 cm. After our intervention, BMI turned to 29.38 Kg/m², WHR 0.97 cm and NC 42.7 cm. It is noteworthy that the advances made in the MAD were gradual and controlled by the adjustments offered on the sides of the device. Two consultations were carried out at 15-day intervals, with a 5 mm maximum advance reached. A third appointment was requested by

the patient days after the last advancement. He requested the return of the MAD to a position of lower advancement to maintain greater comfort; we reduced the advancement to 4 mm. Due to this request, it was not possible to make any further advances for the following weeks until the performance of the new polysomnographic examination, which would have the objective of assessing the effect of MAD on the mandibular advancement position.

It was observed that after the use of MAD, there was a reduction in the AHI and in obstructive apnea, which changed from moderate to normal (Table 1). The reduction in the AHI, as well as the oxyhemoglobin desaturation index, prove the improvement in respiratory indices during sleep in the exams without and with the prefabricated MAD. However, during the period in which the individual used the device, there was also a reduction in anthropometric measurements taken from the first pre-intervention examination to the post-intervention examination. The worsening of pain presented in the SF-36 questionnaire could be attributed to the patient's report of teeth discomfort after removing the device in the morning.

Table 1 - Polysomnographic profile, daytime sleepiness, and quality of life before and after the Mandibular Advancement Device procedure.

Variables	Pre	Post
Anthropometric measurements		
BMI (Kg/m²)	32.33	29.38
NC (cm)	43.5	42.7
HC (cm)	109.1	102.5
WC (cm)	113.5	105.2
WHR (cm)	0.961	0.974
Epworth Sleepiness Scale	5	3
Oxyhemoglobin desaturation index (ev/h)	28.5	5.3
AHI (ev/h)	16.0	1.8
Apnea and Hypopnea in the supine position (ev/h)	49.1	4.1
Apnea and Hypopnea in non-dorsal decubitus (ev/h)	5.5	1.0
Quality of Life SF-36		
Functional capacity	65	90
Physical limitations	75	100
Pain	60	40
General health status	30	35
Vitality	50	55
Emotional aspects	33	100
Social aspects	50	38
Mental health	52	76

Data presented in absolute values; ev/h: events per hour; AHI: apnea-hypopnea index; BMI: body mass index; NC: neck circumference; HC: hip circumference; WC: waist circumference; WHR: waist-hip circumference.

After using the MAD for 8 weeks, the patient was reassessed after 70 days with a new polysomnographic examination, at that moment he presented reduced body weight. There was a reduction of apnea episodes compared to the moment before the adaptation of the MAD, however, it was observed that only with the use of the MAD this reduction was greater after its implementation (Table 2).

Table 2 - Results of polysomnography exams without the use of a mandibular advancement device and after body mass reduction.

Polysomnographic variables	Pre-MAD	Post-MAD	Without MAD
Oxyhemoglobin desaturation index (ev/h)	28.5	5.3	17.3
AHI (ev/h)	16.0	1.8	11.1
Apnea and Hypopnea in the supine position (ev/h)	49.1	4.1	49.7
Apnea and Hypopnea in non-dorsal decubitus (ev/h)	5.5	1.0	1.9

Data presented in absolute values; ev/h: events per hour; AHI: apnea-hypopnea index; Pre-MAD: before the use of the mandibular advancement device; Post- MAD: after 8 weeks of usage of the mandibular advancement device; Without MAD: without the mandibular advancement device for 70 days.

DISCUSSION

The present clinical case evaluated the effectiveness of prefabricated MAD in the treatment of an individual with moderate OSAS, in which we observed a reduction in AHI as well as in oxyhemoglobin desaturation rates. After 8 weeks of MAD use, the maximum supported by the patient was reached with gradual advances, every 2 weeks, so that he could use the device comfortably to sleep. In addition, there was an improvement in QoL in most domains of the SF-36 questionnaire: functional capacity, physical limitations, general status, vitality, emotional aspects, and mental health.

OSAS is diagnosed through clinical criteria such as fatigue, excessive daytime sleepiness, insomnia, unrefreshing sleep, pauses in breathing, and choking during sleep. Individuals with mild OSAS show drowsiness in activities that require little attention, such as reading and watching television, with an AHI between 5-15.[14] While, in cases of moderate OSAS, individuals may already experience drowsiness in activities that require more attention, the AHI is between 15-30 ev/h, which was the case of the patient in the present study.

The main risk factors for the development of OSAS are obesity, male gender, systemic arterial hypertension, high neck circumference, smoking, alcohol consumption and family history.[5,15] In addition to behavioral measures such as weight loss, cessation of alcohol consumption and change in sleep position, other therapeutic measures should be adopted, such as the use of MAD, aiming to remove airway obstruction and prevent or correct comorbidities arising from OSAS.[15]

Non-invasive therapies, especially MAD, are safe and effective options in the treatment of OSAS, in addition to being an alternative treatment for patients who do not tolerate CPAP.[16-17] Patients with positional OSAS have at least one respiratory event in the supine position compared to the lateral position, while patients with non-positional OSAS have many respiratory events in the supine position compared to the lateral position.[18-19] The therapies indicated for patients with non-positional OSAS are CPAP and mandibular advancement devices.[17] With the analysis of the data from the present case, we can observe that the studied patient presented worse results when in the supine position. It is noteworthy that positional apnea has an important role that can be controlled with MAD or adequate positioning in lateral decubitus.[19]

MADs also offer positive effects on the QoL of individuals with OSAS, according to a study by Vries et al.[7] MADs are a good first-choice treatment option in moderate OSAS. Feltner et al.[9] in their meta-analysis showed a significant improvement in MAD on sleepiness, general productivity, and activity, in addition to improving respiratory function and quality of life in general. In a systematic review by Schwartz et al.[20], they did not observe differences in QoL between MAD and CPAP, but the second is still more effective in reducing the AHI, but MAD promotes greater adherence to individuals and in the present case study it demonstrates that the patient also showed an improvement in AHI and QoL.

CONCLUSION

The mandibular advancement device was efficient in enabling an improvement in the polysomnographic profile and in the quality of life of an intercity public transport driver.

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