Arq Neuropsiquiatr 1994, 52(4): 560-565

OBSTRUCTIVE SLEEP APNEA TREATMENT WITH DENTAL APPLIANCE

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SUMMARY - The case of a 40-year-old male patient with obstructive sleep apnea syndrome (OSAS) is reported, with emphasis on treatment with a dental appliance. This therapeutic approach, which has been focused on recent research, has as its objective, the posturing of the mandibule and, consequently, the tongue more anteriorly, thus in turn leading to an increase in the posterior oropharyngeal airway space (PAS). Cephalometry contributed determining in this case whereby enlargement limits were observed in the PAS with mandibular displacement. Clinical and polysomnographic controls showed subjective reduction of the excessive daytime sleepiness and objective decrease in apneas intensity to normal limits. Eight months follow-up evidenced the steady improvement.

KEY WORDS: sleep apnea syndrome, apnea, dental appliance, treatment, cephalometry, polysomnography.

Apnéia do sono tipo obstrutiva: tratamento com aparelho dentário

RESUMO - É relatado o caso de um paciente do sexo masculino, de 40 anos de idade, com síndrome de apnéia do sono tipo obstrutivo, tratado por meio de aparelho dentário. Esta terapêutica, alvo de pesquisas recentes, visa, no caso aqui descrito, modificar a posição da mandíbula e consequentemente da língua, aumentando o espaço aéreo posterior faríngeo. Cefalometria contribuiu na escolha do caso para uso de aparelho dentário pois evidenciou incremento do espaço aéreo posterior faríngeo atingindo dimensões normais ao se realizar o deslocamento anterior da mandíbula. Controles clínico e polissonográfico mostraram redução subjetiva da sonolência excessiva diurna e objetiva da severidade das apnéias e do ronco, levando-os a níveis normais. Em seguimento realizado por 8 meses, a melhora manteve-se inalterada.

PALAVRAS-CHAVE: síndrome de apnéia do sono, apnéia, aparelho dentário, tratamento, cefalometria, polissonografia.

Obstructive sleep apnea syndrome (OSAS) treatment has a broad spectrum of possibilities which include the clinical use of drugs and weight reduction, various types of surgery, and the utilization of a nasal positive continuous airway pressure mask (CPAP)[7]. More recently, another therapeutic method that has been subjected to research is the use of dental appliances, often with the objective of modifing the mandible and tongue positions, subsequently enlarging the oropharyngeal airway space.

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In this paper, we report a case of OSAS with favorable results using a dental appliance, with clinical and polysomnographic controls.

CASE REPORT

BW, a 40 year old white male patient, was referred to sleep evaluation for having presented excessive daytime sleepiness for the last 3 years, and loud snoring for the last 5 years. He reported, what was suspected to be, breathing pauses, noticed by his bedpartner, for the last 3 years. He sleeps predominantly on his sides and the snoring as well as the pauses in breathing are reported to occur in any position. Few choking spells during the night were noticed afterwards. His sleep-wake schedule is regular, with a reported sleep onset at 23:00h and

Table 1. Polysomnographic baseline data (Night 1) and with dental appliance (Night 2). Patient BW.

		Night 1	Night 2
Total time in bed	min	398	382
Total sleep time	min	371	363
	%*	93.2	95.0
Total time awake	min	27	19
	%*	6.7	4.9
Sleep latency	min	4	11
REM latency (ST 1)	min	46	97
REM latency (ST 2)	min	44	96
Stage REM	min	62	72
	%***	16.7	19.8
REM density	min	4.7	8.5
	%**	7.5	11.8
NREM stages	min	309	291
	%***	83.2	80.1
Stage 1	min	18	7
	%***	4.8	1.9
Stage 2	min	276	213
	%***	74.3	58.6
Stage 3	min	4	13
	%***	1.0	3.5
Stage 4	min	11	58
	%***	2.9	15.9
Arousals	N	51	27
Awakenings	N	4	3
Apnea index		25.2	1.3
A+H index		36.3	1.6
Baseline Sat02	%	97	99
Lowest Sat02	%	94	98
Sat02 < 90%	min		
Longest apnea	s	52	16

Legend: %*, percentage in relation to total time in bed; %**, percentage in relation to total REM sleep time; %***, percentage in relation to total sleep time; Sat02, oxigen saturation; Sat02 < 90%, sleep time with Sat02 < 90%; apnea index, number of obstructive apneas per hour of sleep; A+H index, number of obstructive apneas+hypopneas per hour of sleep.

Table 2. Cephalometric data at rest, "end to end", and "full protusion" standard positions [6,10,18]. Patient BW.

	Rest	End to End	Full Protusion
SNA	77.1	77.1	77.1
SNB	75.8	76.9	82.8
ANB	1.3	0.2	5.7
PAS	5.1	11.1	11.1
PNS-P	47.4	41.5	43.2
MP-H	17.7	19.6	16.5
N-ANS	61.9	61.9	61.9
ANS-Gn	78.1	80.7	80.2
GoGn-SN	30.3	29.3	27.4

Legend: SNA, angle measurement from sella to nasion to point A; SNB, angle measurement from sella to nasion to point B; ANB, difference between SNA and SNB; PAS, posterior airway space; PNS-P, distance from posterior nasal spine to tip of the soft palate; MP-H, distance from hyoid to mandibular plane; N-ANS, vertical measurement from nasion to anterior nasal spine; ANS-Gn, vertical measurement from anterior nasal spine to gnathion; GoGn-SN, measurement from gonion to gnathion to sella.

a final wake up at 06:30h. He also wakes up briefly 2 to 4 times per night to urinate, immediately returning to sleep. In the morning he feels tired and is apt to sleep while engaged in monotonous tasks such as driving, reading, watching television, and attending business meetings. This has diminished his willingness to work, impairing his job. He does not have regular daytime naps. This patient has been otherwise healthy, and it should be noted that he denies high blood pressure, smoking, alcohol or regular drug intake. General physical examination was normal and showed weigth 68 Kg, height 173 cm, BP 125x80 mmHg. Neurological examination was normal.

Polysomnography, obtained during all-night standard recording[16,17,21], included electroencephalogram (C3/A2, C4/A1), electrooculogram, submentalis electromyogram, electrocardiogram (modified V2 lead), and anterior tibialis electromyogram. Abdominal and thoracic strain gauges were utilized for monitoring respiraton; thermistors were applied for measuring nasal and oral airflow. Continuous transcutaneous oxygen saturation (Sat02) was quantified by finger oximetric method. Snoring sounds were recorded and sleeping movements were videotaped. The study was done in a pleasant light-proof, sound-attenuated room at the Sleep Disorders Center, which was controlled at a constant temperature (21° C), and furnished with a comfortable bed. The results (Table 1) of this baseline first night showed total time in bed and total sleep time adequate for his age. Sleep latency, as well as REM latencies were short. The time spent in each stage evidenced marked reduction of stages REM, 3 and 4. There were arousals associated with apneas. The apneas were predominantly obstructive and mixed, with an apnea index of 25.2/h; the apnea+hypopnea index (RDI, respiratory distress index) was 36.3/h. The longest apneas reached 52s, being accompanied by bradicardia and followed by tachicardia. No other cardiac arrhythmia was detected. Loud snoring was present most of the total sleep time, with the patient sleeping predominantly on his sides. The baseline Sat02 was 97%; the lowest was 94%. Such polysomnographic pattern characterizes moderate OSAS, with systemic impairment, and sleep fragmentation.

Lateral cephalometric radiographs were obtained, with head fixed with a cephalostat (Fig 1), according to standardized technique and nomenclature[6,11,12,19] (Table 2). Cephalometric data evidenced narrowing of the posterior airway space (PAS), in the oropharynx, due to backward displacement of the tongue, which in turn is due to mandibular moderate backward displacement. In the "end to end" cephalometric position, as well as in the "full protusion" position, the PAS is widened to normal limits. A dental appliance that displaces the mandibule anteriorly to the extent that it is seen in the cephalometric "end to end" position, would be enough to obtain an adequate PAS.

In the case here presented, there are two areas of obstruction: above the base of the tongue, associated with large soft palate and behind the base of the tongue, with retroposition of the lower mandibule and large distance between mandibular plane and hyoid bone. In the lateral cephalometric analysis in three positions (rest, end to end, and full protusion), it is particularly important to observe the PAS values, the relation of the condile in the articular cavity in each standard position, and clinically, the miofacial and intra-articular behavior.

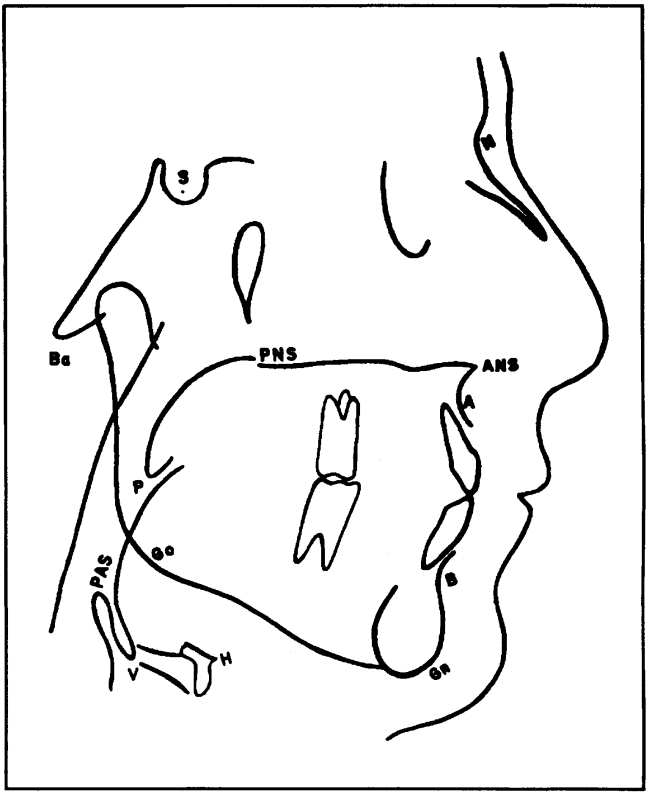

Fig 1. Cephalometric tracing at rest. Patient BW.

The clinical evaluation was performed prior to making the dental appliance, in order to evaluate the estomatognathic system, and it was within normal limits, including absence of occlusal disorders, temporomandibular intra-articular disorders, and miofacial disorders. Clinical tests simulating the appliance were applied, decreasing the movement of dearticulation of the condiles, as well as reducing muscular distention. These tests allowed the selection of the end to end bite, with intermaxilar distance of 7 mm. In such position there were no complaints of muscular fatigue or any articular symptomatology.

The dental appliance chosen was the Bionator Basic, which corrects the retroposition of the mandible and, consequently, repositions the tongue. It juts the retroposition of the mandible anteriorly so that the biting edges of the incisors are aligned in such way that they are butted against each other, keeping the anterior interocclusal space at 7 mm. Thereby, the oropharyngeal airway is opened during sleep, as a result of the anterior displacement of the tongue and hyoid bone, and in turn, the mouth is inhibited from opening wide.

Such dental appliance consists of relatively thin acrylic body, adapted to the lingual and palatal sides, superposed 2 mm beyond the gengival margin. It covers the occlusal and lower incisive edges of the teeth without, however, covering their vestibular sides. We performed a variation in which the inter-occlusal anterior space was determined the same as before, at 7 mm, but in which we applied a thin resinous layer to the biting edges of the incisors in order to avoid dental extrusion, and added a 3 mm groove to the anterior face of the appliance, in order to channel saliva flow. The Bionator Basic acrylic body in linked to a rigid stainless steel arch which in the present case, served to provide durable strength and to decrease the weight of the appliance while, at the same time, preserving the inner space of the oral cavity and allowing adjustment of the tongue in this new position. The vestibular arch of the dental appliance, also of hard steel, from the first molar to the contralateral first molar, keeps the labial and jugal tissues apart from the acrylic plaque.

Adaption to the dental appliance in the oral cavity went smoothly, in our case. It was suggested to the patient that he use the appliance every night for a period of a week and then to return for re-evaluation. It was also suggested that, in the morning, he remove the appliance, exercise the forced occlusion for a few minutes, returning to the centric occlusion. During the period of the first week, there was no reported discomfort, nor apprehension due to the appliance; compliance was adequate from the beginning. No complaint of miofacial or articular symptomatology was reported. Subjective improvement was noticed, with reported absence of snoring, reduction of daytime sleepiness, and reduction of tiredness. We have being following up this patient for eight months, with these steady improvements.

A second all-night polysomnographic recording was obtained, utilizing the same methodology, in 10 weeks of proper use of the dental appliance (12 weeks after the first polysomnography). This polysomnographic study was obtained using the dental appliance, for the entire night (Table 1). The result was markedly distinct from the first night study. Stages REM, 3 and 4 sleep were close to normal limits. The obstructive apneas and hypopneas, as well as Sat02 were within normal limits. The patient did not snore nor had abnormal apnea index on the second night, and he slept on his sides most of the total sleep time.

COMMENTS

The OSAS diagnosis is based on clinical and polysomnographic data. Polysomnography allows quantifying not only duration but also the sleep stages, cycles, and secondary systemic impairment. In the case here presented, OSAS was diagnosed , and polysomnography was shown to be of moderate intensity regarding apnea frequency and duration; but with Sat02 significant decline. As usual in this pathology, excessive daytime sleepiness has developed as consequence of the apneas, requiring treatment.

OSAS therapeutic approaches include surgeries[7,14,18] consisting of tracheostomy, uvulopalatopharyngoplasty (UPPP), adenotonsillectomy, septoplasty, and advancement of the maxila, mandibule and hyoid bone. The surgery will depend on the site of obstruction. Patients with obstruction at both the nasopharynx and oropharynx, also called OSAS Type II, as in the case here presented, will rarely be cured by UPPP alone[13]. If the surgical approach is chosen, these patients require UPPP in combination with advancement of the geniotubercles and superior/anterior suspension of the hyoid bone. Non-surgical methods include weight reduction, alcohol as well as sedative abstinance, changes in sleeping body positions, and chronic use of CPAP. Our patient would not benefit from all but the last one, as he was not overweight, had not consumed alcohol or sedatives, and was already sleeping on his sides. Today, CPAP is considered the standard most appropriate medical treatment modality of OSAS. The second generation machines improve and maintain a constant airway pressure during the dynamic process of breathing. However, long term compliance is its main drawback[3,14,15].

There are a number of dental devices recently proposed for the treatment of OSAS[4,20] that vary technically in their objectives, the main group being the mandibular repositioning appliances (MRA). The reduction of snoring and OSAS, observed when wearing a MRA is attributed to the displacement of all structures attached to the mandibule, mainly the genioglossus, which is carried forward with the mandibule[5]. Therefore, they seem useful only when retrognathia is present. However, some recent data[9] suggest that in OSAS patients with a relatively large distance between the mandibular plane and hyoid bone, as in our case, the low hyoid bone is an etiological factor of snoring and OSAS. Therefore, stabilization of the mandibule by MRA would give a more secure anchor for the geniohyoid to dilate the airway via protaction of the hyoid.

We must consider that, although in our case there were two distinct obstruction sites, the oropharynx and the nasopharynx, the marked improvement was observed with MRA, which is basically directed to the oropharyngeal obstruction. With such reduction of the OSAS, other treatment modalities have not been required up to this point.

Similar favorable results were obtained by others with MRA[8]. In our patient, clinical and polysomnographic improvement is attributed to the adequate displacement of the mandibule and tongue, and the subsequently enlarging of the PAS, as measured by cephalometry. The mandibular stabilization facilitating geniohyoid to dilate the airway via protraction of the hyoid[9] bone may have added to the OSAS reduction. There is still a lack of long-term efficacy data on any of the several dental appliances tested till now[1,2,10], but the favorable outcome detected in the case here presented and in others[8] supports to proceed on this therapeutic research line.

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