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Orofacial myofunctional profile of patients with sleep disorders: relationship with result of polysomnography

Perfil miofuncional orofacial de pacientes com distúrbios do sono: relação com resultado da polissonografia

Keywords

Sleep Disorders
Sleep Apnea Syndromes
Snoring
Speech Therapy
Quality of Life

ABSTRACT

Purpose: This study aims to characterize the orofacial myofunctional profile of patients with sleep disorders and to relate them to the severity of the polysomnography result. **Methods:** A cross-sectional, field study of patients referred to polysomnography with a random sample of adult patients of both genders complaining of snoring who were not receiving any form of treatment for sleep disorder. An anthroposcopic speech-language evaluation was performed and the results of the polysomnography examination were collected in order to respond to the objectives of the study. **Results:** There was a significant association between the severity of the sleep disorder and environmental variables, such as smoking and alcoholism; also with individual characteristics, such as race, body mass index, waist circumference and systemic arterial hypertension. From the point of view of the myofunctional characteristics, there was a positive relationship between the severity of Obstructive Sleep Apnea and Hypopnea Syndrome with mental muscle contraction, Mallampati class, tongue dorsum elevation, tongue thickness, uvula characteristics, extension and mobility of the soft palate, and alteration in the respiratory pattern. **Conclusion:** This study made it possible to describe a trend of the existence of orofacial myofunctional alterations in individuals with Sleep Apnea and Obstructive Hypopnea Syndrome and also revealed that the greater the degree of impairment of orofacial structures, the greater the degree of disturbance is also revealed.

Descritores

Transtornos do Sono
Síndromes da Apneia do Sono
Ronco
Fonoaudiologia
Qualidade de Vida

RESUMO

Objetivo: Este trabalho se propõe a caracterizar o perfil miofuncional orofacial de pacientes com distúrbios do sono e relacionar esses com a gravidade do resultado da polissonografia. **Método:** Estudo transversal, de campo, realizado com pacientes encaminhados para polissonografia, com amostra aleatória, composta por pacientes adultos, de ambos os gêneros, com queixa de ronco e que não estivessem recebendo alguma forma de tratamento para o distúrbio do sono. Foi realizada avaliação fonoaudiológica antroposcópica e coletado o resultado do exame de polissonografia, a fim de responder aos objetivos do trabalho. **Resultados:** Verificou-se associação significativa entre a gravidade do distúrbio de sono e variáveis ambientais, tais como tabagismo e etilismo; também com características individuais, tais como raça, índice de massa corporal, circunferência abdominal e hipertensão arterial sistêmica. Do ponto de vista das características miofuncionais, verificou-se relação positiva entre a gravidade da Síndrome da Apneia e Hipopneia Obstrutiva do Sono com a contração do músculo mentual, classe de Mallampati, elevação de dorso de língua, espessura de língua, características da úvula, extensão e mobilidade de palato mole, e alteração no padrão respiratório. **Conclusão:** A pesquisa possibilitou descrever uma tendência da existência de alterações miofuncionais orofaciais em indivíduos com Síndrome da Apneia e Hipopneia Obstrutiva do Sono e revelou, ainda, que quanto maior o grau de comprometimento das estruturas orofaciais, maior também se revela o grau do distúrbio.

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INTRODUCTION

Obstructive sleep apnea syndrome (OSAHS) is characterized by recurrent episodes of upper airway obstruction during sleep due to collapsed tongue and soft palate structures in the lateral walls of the oropharynx. This change generates from a small resistance (RERAs) to the impedance (partial or total) of the air flow. When such an obstruction lasts more than 10 seconds, it is called apnea; shorter periods of cessation correspond to hypoapies. The patient may have one or more episodes of apnea / hypoapnea during sleep. The duration and frequency of such events will determine the severity of OSAHS[1]. It is estimated that from 1% to more than 6% of the adult population presents OSAHS[1-3], making it a public health problem[4].

The potential risk of OSAHS, associated with the symptoms of the syndrome and its prevalence, has caused this disorder to be extensively studied in the last decades. In this way, a large number of information was obtained from several areas of interest, on the diagnosis, consequences and treatment options of the syndrome[2]. The different therapeutic methods proposed presuppose an individualized care, specific for each patient, taking into account the anatomical factors, disease severity indexes, comorbidities and adherence to the treatment. Regardless of the treatment option to be chosen, multiprofessional involvement is the best alternative to be offered[5], seeking to provide more and more quality of sleep and consequently life for people who have this disorder.

The speech-language pathology in these cases consists of the adequacy of the anatomo-morphological and anatomic-functional components of the phonoarticulatory organs, which, as a consequence of the disorder, present flaccidity. Specific muscle activities performed during speech therapy may reduce oropharyngeal changes resulting from inadequate breathing[6].

In addition to this re-adjustment of the orofacial musculature, speech therapy also acts to reduce snoring[6,7], an important signal for the diagnosis of OSAHS, since studies indicate that the vast majority of patients who present the syndrome snore[8]. Snoring alone is a sleep disorder that affects 40% of the population aged 40 years or more[9], and is the result of the vibration mechanism of upper airway anatomical structures.

Despite the speech-language success reported by professionals in these cases[6,7,10], there are still few studies on the subject. We believe that the more severe myofunctional orofacial changes, the greater the severity of the polysomnography result. Therefore, this work proposes to characterize the orofacial myofunctional profile of patients with sleep disorders and to compare the results of the polysomnography examination to, from these data, to aid in the evaluation process - being able to identify the tendency of the orofacial aspects of the patients with each type of sleep alteration - and, later, in directing the speech-language therapy, since the professional will already have a characterization of each profile, according to the polysomnography exam that he / she receives, thus contributing to the clinic and science in this area.

METHODS

This is a cross-sectional field study conducted at the clinic of neurophysiology clinic of a hospital in the city of Porto Alegre - Rio Grande do Sul, from August to September 2010 and from April to July 2014. The sample consisted of random form. Inclusion criteria were: adult patients (above 18 years of age) of both genders, referred for polysomnography, who reported snoring, and were not receiving any form of treatment for sleep disturbance. Exclusion criteria were: patients presenting diagnosed neurodegenerative diseases, previous vascular encephalic accidents, or facial paralysis. All subjects signed a Free and Informed Consent Term to participate in the research, according to a project approved by the Research Ethics Committee of the institutions involved, under the opinion of No. 833.492.

All patients underwent a Speech-Language Pathology Assessment Protocol for OSAHS[11] (adapted by the researchers) - because they were classified: mentation strain, Mallampati classification, tongue back position, tongue thickness, uvula aspect, soft palate, hard palate, mobility of the palate and type of respiration. Abdominal circumference (AC)[12] and Body Mass Index (BMI) were measured[13]. The protocol was applied in each patient by a researcher, in total, three researchers during the time of collection participated in the collection of study data, after establishing the patterns of orofacial examination, to ensure uniformity.

The data were collected through an interview, and the evaluation of the phonoarticulatory organs and their functions were assessed by means of the antroposcopic evaluation. Items in which the patient could not perform the requested movement, or in which the researcher found it impossible to classify (difficulties in visualization, restriction of oral cavity opening, nauseated patient, etc.), were classified as "Impossibility of Classification" to cancel the erroneous classification of the collection. The AC measurements were obtained by the researchers using a flexible tape measure. The weight and height used to calculate the BMI were taken from the patient record, belonging to the Neurophysiology Outpatient Clinic, and these data were obtained by filling out a questionnaire for the service in question. All data were collected before the polysomnography examination in an office within the sleep neurophysiology laboratory and, after two days, the results of the polysomnography of each patient were collected in the medical records, which patient had some sleep disorder, such as OSAHS, and its degree of severity. The degree of severity of OSAHS is classified by the service, through the number of Apnea and Hypopnea Indexes, following Brazilian recommendations[14].

We considered the responses and transferred the results to the database, according to the measures oriented in the protocol[11]. The statistical analysis of this work was performed through descriptive statistics and the Fisher Exact Association Test. The results for all the tests applied were considered significant at a maximum significance level of 5% ($p \leq 0.05$) and for the processing and analysis of these data the statistical software SPSS version 19.0 was used.

RESULTS

A total of 97 patients were evaluated during the data collection period, ranging from 18 to 72 years, with a mean age of 49.78 years, of which 55 were male. Of these individuals, the majority presented a high degree of impairment in relation to sleep. The distribution of the subjects regarding the result of the polysomnography is described in Table 1. The variables found in the assessment protocol were analyzed through the results of the Fisher's exact association test, and there was a significant association with the polysomnography result for the following variables: black race associated with severe outcome; smoker associated with moderate outcome and non-smokers associated with RERAs; associated with the severe and non-alcoholic outcome associated with RERAs. As for those with systemic arterial hypertension (SAH), they were associated with the severe outcome, and those who did not present were associated with moderate and RERA results. Furthermore, a significant association was found between the BMI and the polysomnography results, where normal weight may be associated with RERA results and, when obesity is found, may be related to the severe outcome. Regarding abdominal circumference, he was associated without risk to moderate outcome and very high risk associated with severe outcome (Table 2).

In the speech-language evaluation, the following significant associations were found between the variables and the polysomnography result, according to Fisher's exact association test. Mental muscle tension, when contracted, may be associated with the severe and normotensive outcome to the moderate outcome. Regarding Mallampati's classification, Class I may be associated with RERAs, Class II associated with the mild result and Class IV associated with severe. Regarding the tongue back, there was a significant association in which, when high, it is associated with severe, and, when low, associated to the result of RERAs. As for tongue thickness, increased, associated with moderate result, and normal thickness when associated with RERAs.

Still in the speech-language evaluation, the normal uvula is associated with the long and short RERA result associated with severe and swollen, associated with mild and moderate results. The high soft palate may be associated with the light and elongated results associated with the severe outcome. The normal hard palate can be associated with the result of RERAs, the ogival, the light result, and the narrow, to the severe result. Regarding palate mobility, it was possible to observe significance between RERAs and good mobility, and poor mobility to severe outcome. On the type of respiration: superior, associated to the severe result, costodiaphragmatic associated with the light result, and abdominal, associated to the result of RERAs (Table 3).

Table 1. Distribution of the sample regarding the severity of obstructive sleep apnea and hypopnea syndrome

Severity of OSAHS	Cases	%
Severe	35	36.1
Moderate	16	16.5
Mild	32	33
Resistance of VAS	12	12.4
Normal	2	2.1

Caption: OSAHS = Obstructive Sleep Apnea and Hypopnea Syndrome; VAS = Upper airways

Table 2. Characteristics, habits and pathologies related to the distribution of the subjects regarding the result of polysomnography

Variable	Result	Result of Polysomnography										p
		Light		Moderate		Severe		Resistence of VAS		Normal		
		n	%	n	%	n	%	n	%	n	%	
Race	White	32	100.0	16	100.0	26	74.3	12	100.0	1	50.0	0.000**
	Black	-	-	-	-	**9**	**25.7**	-	-	1	50.0	
Smoker	Yes	8	25.0	**10**	**62.5**	10	28.6	-	-	-	-	0.004**
	No	24	75.0	6	37.5	25	71.4	**12**	**100.0**	2	100.0	
Ethyl Ester	Yes	11	34.4	4	25.0	**17**	**48.6**	-	-	1	50.0	0.014*
	No	21	65.6	12	75.0	18	51.4	**12**	**100.0**	1	50.0	
Systemic Arterial Hypertension	Yes	9	28.1	1	6.3	**22**	**62.9**	1	8.3	2	100.0	0.000**
	No	23	71.9	**15**	**93.8**	13	37.1	**11**	**91.7**	-	-	
BMI	Normal Weight	9	28.1	3	18.8	2	5.7	**8**	**66.7**	-	-	0.000**
	Overweight	22	68.8	13	81.3	21	60.0	3	25.0	1	50.0	
	Obesity	1	3.1	-	-	**12**	**34.3**	1	8.3	1	50.0	
Abdominal Circumference	No Risk	4	12.5	**5**	**31.3**	1	2.9	3	25.0	-	-	0.039*
	High Risk	7	21.9	1	6.3	3	8.6	3	25.0	-	-	
	Very High Risk	21	65.0	10	62.5	**31**	**88.6**	6	50.0	2	100.0	

Fisher's exact association test (p): *significant p≤0.05; **significant p≤0.01
Caption: n = number; VAS = Upper airways; BMI = body mass index. Bold items in the table indicate where significant results were found for each variable

Table 3. Orofacial structures and altered functions related to the distribution of the subjects regarding the result of the polysomnography

Variable	Result	Resultado da Polysomnography										p
		Light		Moderate		Severe		Resistence of VAS		Normal		
		n	%	n	%	n	%	n	%	n	%	
Mentalis	Normotenso	23	71.9	**16**	**100.0**	23	65.7	11	91.7	2	100.0	0.027*
	Contracted	9	28.1	-	-	**12**	**34.3**	1	8.3	-	-	
Mallampati	Class I	6	18.8	7	43.8	-	-	**9**	**75.0**	1	50.0	0.000**
	Class II	**12**	**37.5**	2	12.5	9	25.7	1	8.3	-	-	
	Class III	13	40.6	7	43.8	16	45.7	1	8.3	-	-	
	Class IV	1	3.1	-	-	**10**	**28.6**	1	8.3	1	50.0	
Back (Language)	High	17	53.1	11	68.8	**27**	**77.1**	2	16.7	2	100.0	0.002**
	Low	15	46.9	5	31.3	8	22.9	**10**	**83.3**	-	-	
Thickness (Language)	Normal	16	50.0	2	12.5	12	34.3	**9**	**75.0**	2	100.0	0.002**
	Augmented	16	50.0	**14**	**87.5**	23	65.7	3	25.0	-	-	
Uvula (Palate)	Unable to Qualify	2	6.3	-	-	2	5.7	-	-	-	-	0.000**
	Normal	11	34.4	5	31.3	4	11.4	**9**	**75.0**	1	50.0	
	Long	3	9.4	4	25.0	**14**	**40.0**	2	16.7	1	50.0	
	Short	2	6.3	1	6.3	**14**	**40.0**	1	8.3	-	-	
	Edemaciada	**13**	**40.6**	**6**	**37.5**	-	-	-	-	-	-	
	Long / Edemaciada	1	3.1	-	-	1	2.9	-	-	-	-	
Soft palate	Unable to Qualify	2	6.3	-	-	2	5.7	-	-	-	-	0.000**
	High	**21**	**65.6**	8	50.0	4	11.4	8	66.7	1	50.0	
	Stretched	9	28.1	8	50.0	**29**	**82.9**	4	33.3	1	50.0	
Hard palate	Unable to Qualify	1	3.1	-	-	-	-	-	-	-	-	0.000**
	Normal	17	53.1	9	56.3	14	40.0	**11**	**91.7**	2	100.0	
	Ogival	**13**	**40.6**	6	37.5	1	2.9	-	-	-	-	
	Narrow	-	-	1	6.3	**20**	**57.1**	1	8.3	-	-	
	High	1	3.1	-	-	-	-	-	-	-	-	
Mobility (Palate)	Unable to Qualify	2	6.3	-	-	2	5.7	-	-	-	-	0.005**
	Good	22	68.8	12	75.0	14	40.0	**12**	**100.0**	1	50.0	
	Bad	8	25.0	4	25.0	**19**	**54.3**	-	-	1	50.0	
Type of Breathing	Higher	13	40.6	4	25.0	**26**	**74.3**	4	33.3	1	50.0	0.000**
	Costodiaphragmatic	**11**	**34.4**	1	6.3	7	20.0	1	8.3	1	50.0	
	Abdominal	8	25.0	**11**	**68.8**	2	5.7	**7**	**58.3**	-	-	

Fisher's exact association test (p): *significant p≤0.05; **significant p≤0.01
Caption: n = number; VAS = Upper airways. Bold items in the table indicate where significant results were found for each variable

DISCUSSION

The first aspect to be commented is that articles were not found in the literature comparing speech and language pathology findings with the degree of OSAHS, and this article is innovative in research on this theme. In recent years, there has been a trend towards a reduction in the number of hours of sleep, both during the week and at weekends, increasing the risk of developing sleep disorders, with the prevalence of sleep disruption in the general population[15]. However, a large part of the population remains undiagnosed, and this is due to several factors, including difficult access to diagnostic methods and reduced perception of sleep symptoms as a problem[5]. Polysomnography is the reference diagnostic procedure for OSAHS, since it consists of the simultaneous recording of neurophysiological variables that allow us to study sleep and its correlation with different cardiorespiratory variables[16].

However, the difficulty of access to the polysomnographic examination[17] ends up reducing the number of people who come to this reliable diagnosis of the disorder. Considering this aspect, the sample of this study, although restricted, is significant if we take into account the portion of the population that performs the procedure. Proof of this is that the characteristics of this sample do not escape the profile of the patient with sleep disorder given in the literature: middle-aged, overweight men[1,3].

Another variable associated with the characteristics of the sample studied, which was pointed out in this study as intervening in sleep impairment, but on which the literature is not profitable, is the question of race. As for the statistically significant findings in the speech-language pathology, the black race was associated with a severe polysomnography result, which can be explained by the fact that black ethnic individuals have larger measurements in the lower third of the face and greater soft tissue deposition, narrowing the light of the pharynx, aspects that are also observed in the population with OSAHS[15,17].

In addition to the individual characteristics that are associated with sleep disorder, some habits and pathologies that were studied in this sample also appear as aggravating factors of

the phenomenon, corroborating data from the literature[2]. Risk factors for the syndrome include alcohol and tobacco consumption[18]. In the studied sample, it is observed that these were significantly associated with a greater impairment of the sleep disorder, while, conversely, non-alcoholic and non-smokers were significantly related to the diagnosis of RERAs. Smoking causes chronic irritation and potentially irreversible inflammation in the airways, and thus, anatomical and physiological changes in the properties of the respiratory tract, affecting airflow. While alcoholism is associated as a predisposing etiological factor of sleep disorders due to the hypotonicity effect of the musculature that can cause[18]. As for the research participants with SAH, these were associated with the severe outcome, corroborating other findings[19], because snoring is accompanied by a potent inspiratory effort against a semi-fluid pharynx, with large variations in pleural pressure affecting cardiac load[20].

It is known that obesity is considered an important risk factor for OSAHS, which may increase the prevalence of the syndrome among obese adults, which corroborates the findings of this study, which show the BMI of obese individuals with statistically significant significance in individuals who presented as a result of severe grade polysomnography. The relationship between obesity and OSAHS can be explained by a higher airflow resistance in these individuals, due to deposition of adipose tissue around the airway and changes in the tension of the orofacial musculature that serves the respiration[21]. When comparing the BMI index obtained between the subjects of the sample and the degree of severity of OSAHS, there is a relationship between these variables: the higher the level of OSAHS, the higher the mean BMI obtained.

Regarding the AC measures, another important parameter for determining the diagnosis of OSAHS, the mean values of the sample were altered and positively related to the severity of OSAHS, corroborating the data found in the literature that infer central obesity - reflected by the relationship between waist and hip - as a similar predictor or even better than the BMI for apnea[22].

In fact, apnea observed during sleep is a result of an incoordination of the respiratory flow caused by the decrease of the air column, usually related to changes in structure, tone and positioning of the phonoarticulatory organs[5]. This disorder can be defined as altering the respiratory pattern of these individuals who tend to have a shorter cycle, characterized by oral and upper type[23]. In this sample, there was a significant relationship between upper breathing and severe OSAHS result, corroborating the literature data.

When we observe the relationship between the levels of OSAHS severity and the other phonoaudiological aspects evaluated in this study, it is noticed that the greater the impairment of the myofunctional structures, the greater the level of sleep impairment presented in the polysomnography examination. This relationship is evidenced by the positive association between the severe outcome and the excessive contraction of the mental muscle, greater impairment of the oropharyngeal lumen by Mallampati classification, tongue with high back, alteration in uvula size, as well as alteration of its mobility, and narrowing of palate.

The contraction of the mental muscle can be explained by the sagging muscles of the facial mime, common in this population, since many of these individuals are also mouth breathers[24]. This opposing behavior reflects the pressure of the perioral muscles in this flaccid structure, in the sense of trying to maintain the minimum of tonus and posture adequate for the region.

Regarding the classification of Mallampati, it can be observed from the results presented that, the greater the impairment in this evaluation, the greater the association with high degrees of polysomnography, and the reverse is also true. The classification of Mallampati evaluates the light of the oropharyngeal space, so this relationship between the analyzed variables is explained by the reduction in the pharyngeal area, with an increase in the size of the tongue, alteration in its tonicity and even retroposicionamento next to the posterior wall of the pharynx, characteristics that the individuals affected by this disorder may present[7]. Associated with this picture, the relationship between the severity of OSAHS and the changes in posture and morphology of the tongue found in this sample is therefore explained[11]. Elevation of the back corresponds to findings in the literature that patients with OSAHS have tongue retropositioning, while the increased thickness, also characteristic of the OSAHS population, results in upper airways narrowing, where the tongue, soft palate and soft tissues move subsequently[6,7].

Still related to the reduction of the oropharyngeal light, with consequent relation with the symptoms of OSAHS, the speech-language evaluation of the subjects surveyed indicated alterations of uvula and soft palate. Changes in uvula structure corresponded to more severe results in polysomnographic examination. In addition, the presence of edema was significantly related to mild and / or moderate outcome[25]. It is known that upper airways soft tissue size - such as the uvula - is determined by genetic conditions but can be affected by environmental factors such as inflammation, infection and infiltration by metabolic components, alternating the tone and shape of the muscles of these structures, predisposing to narrowing and collapse during sleep[26]. This table is also corroborated by the relationship between severe results and elongated soft palate, indicating narrowing of upper airways and consequent displacement of soft tissues, tongue and palate, which is often enlarged and enlarged[26].

Like soft tissue structures, the hard palate also undergoes changes due to its conformation to the posture of these. Thus, the findings of this research, relating severe OSAS involvement to the presence of narrow hard palate, close the described picture and are echoed in the literature, insofar as the increase of the lower third of the face[2] is associated with OSAHS, hard palate in ogival and oral breathing[24]. As to palate mobility, it was possible to observe a significant difference between poor mobility and severe outcome, which can also be explained by the sagging in the oropharyngeal muscles of individuals with OSAHS[11].

Although this study contributes to speech-language science, it presents some limitations such as the performance of the clinical speech-language evaluation is subjective and can vary the presentation of responses according to the evaluator. This bias was minimized when we conducted training to standardize

data collection. Also, we identified the clinical evaluation as the most complete evaluation of all the items proposed by the protocol. In addition, a control group of patients with no change in polysomnography could validate data from normality. Future research with longitudinal follow-up of patients may indicate whether the changes are the cause or consequence of the sleep disorder. Future research, comparing apneic subjects with the general population, may also provide a better view of the differences between the oral myofunctional characteristics of the two populations, thus establishing a differential profile of the subject with OSAHS. However, it is important to note that the comparison with a control group should be based on polysomnography, in order to establish the differences between these populations, with reliable results.

CONCLUSION

The present study made it possible to describe a trend of the existence of orofacial myofunctional alterations in individuals with OSAHS. This trend revealed that the greater the degree of involvement of the orofacial structures, the greater the severity of OSAHS.

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Author contributions

VSGM participated in the study in the preparation of the project, data collection, database preparation, writing and publication of this study; GB participated in the drafting of database, writing and publication of the study; DCGMV participated in the quality of guidance, correction, assistance in the preparation of the project, writing of the scientific article.