PERCEPTION OF THE BED PARTNER AND THE INDIVIDUAL SUFFERING FROM SNORING/OSAS BEFORE AND AFTER SPEECH THERAPY

A percepção do acompanhante e do indivíduo com RONCO/SAOS antes e após fonoterapia

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ABSTRACT

Purposes: the purpose of this study was to evaluate the perception of bed partners, auto-evaluate individuals with snoring/obstructive sleep apnea syndrome, collect cervical and abdominal circumferences before and after speech therapy, and conduct a myofunctional evaluation to associate the results with the severity of sleep disorder. **Methods:** eleven patients between ages 25 and 75 years, of both genders presenting a recent polysomnographic diagnosis of obstructive sleep apnea syndrome of mild to severe and/or primary snoring were selected as subjects. All patients were subjected to speech therapy, myofunctional clinical assessment, and Berlin (adapted) and Epworth questionnaires before and after therapy. **Results:** the data obtained were statistically analyzed with the Wilcoxon test ($\alpha = 0.05$). Two individuals did not adhere to the treatment. No significant difference was observed between the initial and the final cervical and abdominal circumferences (cervical $p = 0.069$ / abdominal $p = 0.789$). All the patients improved their suprahyoid muscles tonus, lowering of the back of tongue, soft palate, bilateral chewing, speech, and nasal breathing. The results of the Berlin questionnaire showed a reduction in the perception of the bed partner in snoring intensity ($p = 0.005$) more so than frequency ($p = 0.05$). Significant reductions of the excessive diurnal somnolence were observed in all the patients ($p = 0.000$). **Conclusions:** considering the limitations of this study, it could be concluded that after speech therapy the perceptions of the patients with obstructive sleep apnea syndrome/snoring and their bed partners was that their sleep and life quality was improved, there was a reduction of snoring intensity, and an improved in their daily activities due to the excessive diurnal somnolence reduction.

KEYWORDS: obstructive sleep apnea; snoring; speech therapy

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is defined by the American Academy of Sleep Medicine (AASM) as the presence of recurring episodes of partial or total obstruction of the upper airway during sleep and is manifested as partial reductions (hypopneas) or complete cessations (apneas) of the airflow. OSAS is considered a chronic and progressive disease, associated with excessive daytime sleepiness, cardiovascular disease, and snoring [1,2]. The presence of obstructive sleep apnea (OSA) is often associated with snoring, which is characterized as a fricative noise in the soft tissues of the upper airways [3]. This symptom alone can be described in full polysomnography as isolated or primary snoring, in which snoring occurs without

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Conflict of interest: non existent

evidence of OSA, hypoventilation, awakenings, or insomnia [2]. Secondary snoring is accompanied by disruptions of the airflow such as apneas and hypopneas, that is, apnea syndrome and mild to severe obstructive sleep apnea-hypopnea syndrome (OSAHS).

The upper airway structures have several functions including being the muscles 50% responsible for the resistance required for adequate breathing [4]. During sleep, the pharyngeal muscles responsible for the maintenance of upper airway structures relax. In individuals suffering from OSAS and snoring, this reduction in the tone of dilator muscles results in a decrease in size and volume, thus generating a pressure imbalance and increasing negative pressure in the oropharynx during inspiration. This leads to resistance in upper airway structures, noises (snoring), reduction (hypopnea), or complete cessation of the airflow (apnea), and frequent sleep awakenings [5-8]. Other factors that cause obstruction of the upper airway structures include anatomical changes, poor craniofacial formations, poor dental occlusion [9], and functional changes such as obesity [7]. Obesity is the main risk factor for OSAS as about 2/3 of patients with this condition are obese [2,10,11]. It is estimated that obstructive sleep apnea syndrome affects 4% of male and 2% of female adults over age 40 [2,6].

People who snore or suffer from OSAS may affect the quality of life of their partners [2]. Sharief et al. (2008) [12] observed lower sleep quality, and consequently, a poorer quality of life in their spouses [13]. Therefore, a quick improvement of these factors is observed when spouses sleep in a different room than their partner who snores or has OSAS [14].

To make a subjective assessment of the parameters of snoring/OSAS, questionnaires/scales were given to patients and/or their partners. A variety of questionnaires were used including the Berlin Questionnaire, the Pittsburgh Sleep Quality Index (PSQI), and the Epworth Sleepiness Scale (ESS). The Berlin Questionnaire and Epworth Sleepiness Scale deserve more attention as they are simple methods used to diagnose OSAS in the general population [15,16]. The Epworth Sleepiness Scale (ESS) provides estimates of the level of daytime sleepiness of the individual. It includes 8 questions that assess the likelihood of falling asleep in situations commonly encountered in daily life [17]. This risk of falling sleep is defined as excessive daytime sleepiness (EDS), which is an increased tendency to sleep and a subjective compulsion to sleep, affecting from 0.5% to 14% of the population [18]. The Berlin Questionnaire is an instrument based on selected questions found in the literature, which highlight aspects or behaviors that predict the presence of a respiratory sleep disorder[19].

There are several treatments suggested for OSAS including surgery, functional oral appliances, and electromyographic stimulation. Increasing the size of the upper airway is recommended in all treatments. However, the indication and success of these treatments depends on the degree of OSAS and the adaptation of the patient. Recurrences may occur. Continuous positive airway pressure (CPAP) is considered the gold standard to treat OSAS as it mechanically opens upper airway structures and prevents their collapse. However, this treatment is often discontinued due to the occurrence of symptoms such as rhinorrhea, nasal congestion, and nasal and oral dryness, in addition to the need for behavioral changes [20].

Speech therapy that is derived of speech therapy is being considered as a new treatment option for OSAS. It involves exercises that recruit oropharyngeal muscles and provides myofunctional changes. The results in the improvements of the upper airway structures significantly improves the initial symptoms and improves quality of life, after a short period of time. Patients receiving speech therapy once a week showed a 62.5% improvement in symptoms and presented reduced in interruptions breathing, as well as a reduction in some of the symptoms like snoring and daytime sleepiness after three months of therapy [21]. Guimarães et al. [22] obtained results indicating an improvement in patients with moderate OSAS including a reduction in snoring and daytime sleepiness, and better sleep quality as a result of performing oropharyngeal exercises.

The objectives of this study were to assess the perceptions of the bed partner and the self-evaluation of the individual snoring or suffering from obstructive sleep apnea, on two occasions, before and after speech therapy, to collect abdominal (WC) and cervical (CC) circumference data at the beginning and end of the speech therapy process and to perform myofunctional assessments in order to correlate the results with the severity of the sleep disorder observed.

METHODS

This study was approved by the Research Ethics Committee of CEFAC, under the protocol number 016/10.

This longitudinal study was developed in clinics located in the cities, Itajubá on the Minas Gerais State, Guaratinguetá and Piracicaba on the São Paulo State. Eleven patients participated in this study; the objectives and procedures required for

the study were verbally explained to each of them and all patients gave written informed consent.

1 - Selection criteria

The inclusion criteria used were: 1) ages between 25 to 75 years, 2) male or female, 3) diagnosed with mild to severe OSAS and/or primary snoring through a recent full polysomnography with a maximum interval of three months between the date of the exam and the date in which the speech evaluation and myofunctional assessment began, and 4) having been referred by a doctor. The presence of any one of the following aspects were considered exclusion criteria: 1) body mass index (BMI) equal to or higher than 40 kg/m^2, 2) regular use of psychotropic medication, 3) use of CPAP, 3) hypothyroidism, 4) previous stroke, cardiac or neuromuscular disorders, 5) severe nasal obstruction, 6) craniofacial malformation, 7) temporomandibular dysfunction, 8) severe systemic disease, or 9) previous surgical procedures to correct OSAS, due to the potential interference of anatomical and tissue changes in the performance of the exercises proposed in this study.

2 - Speech assessment and myofunctional evaluation

For the speech assessment, we followed the protocol described in a previous study [23], which consisted of assessing the structures, mobility and motility of the oropharyngeal region, temporomandibular joint function, oral motor sensory system or stomatognathic system, and a respiratory evaluation. Anthropometric measurements of BMI were obtained, derived from weight and height, as well as abdominal and cervical circumference measurements for comparative analysis of the findings before and after speech therapy.

3 - Administration of the questionnaires

To assess individuals with OSAS and the perceptions of their bed partners, an adapted version of the Berlin Questionnaire [23] was used; it had only two questions on intensity and frequency. Scores for snoring intensity ranged from 1 to 3, where: 1 = *as loud as breathing*, 2 = *as loud as talking*, and 3 = *very loud and can be heard from another room*. Snoring frequency was determined on a scale of 0 to 4, where: 0 = *never or almost never*, 1 = *once to twice a month*, 2 = once to *twice a week*, 3 = *three to four times a week*, and 4 = *almost every day*. To check for EDS in everyday situations, the Epworth Sleepiness Scale was used [24]. Both questionnaires were given before and after speech therapy.

4 - Speech therapy

The speech therapy was based on the method developed by Guimarães (1999) [23], which was derived from a specialty in orofacial myology to treat OSAS in 12 individual sessions lasting 40 minutes each. The aim of the sessions is to work on mobility and to change the tonus of upper airway muscles, with emphasis on the oropharyngeal region through the tongue, soft palate, facial muscle exercises, breathing, exercising stomatognathic functions (like swallowing, chewing, sucking), and relaxing the cervical muscles.

The exercises focus on the following areas.

Soft palate. This requires pronouncing an oral vowel intermittently (isotonic exercise) and continuously (isometric exercise). The palatopharyngeus, palatoglossus, uvula, tensor veli palatini, and levator veli palatini muscles are recruited in this exercise. The isotonic exercises also recruits the lateral walls of the pharynx. These exercises are repeated for 3 minutes daily and supervised once a week.

Tongue. These exercises include: (1) brushing the lateral and superior surfaces of the tongue while it is positioned on the floor of the mouth (five times each movement, three times a day); (2) positioning the tip of the tongue against the front of the palate and sliding it backward (three minutes per day); (3) force the tongue sucking upward against the palate, pressing the entire tongue against the palate (three minutes per day); (4) force the back of the tongue against the floor of the mouth while keeping the tip of the tongue in contact with the inferior incisive teeth (three minutes per day).

Facial. Facial muscle exercises used in facial mimics work the orbicularis oris muscle, buccinator, major zygomaticu and minor zygomaticus muscles, levator labii superioris muscles, levator anguli oris muscles, and the lateral and medial pterygoid muscles. These exercises include the following. (1) Orbicularis oris muscle pressure with the mouth closed (isometric exercise), close with pressure for 30 seconds and then perform the next exercise; (2) Suction movements by contracting only the buccinator muscle. These exercises were performed in repetitions (isotonic) while maintaining position (isometric). (3) Exercising the buccinator muscle against the finger inserted into the oral cavity by pressing the buccinator muscle out. (4) Alternating elevation of the mouth angle muscle (isometric exercise) and then in repetitions (isotonic exercise). The patient should complete three sets of ten elevations cycles intermittently. (5) Lateral jaw movements with alternating elevation of the mouth angle muscle (isometric exercise).

Stomatognathic functions:

1. Breathing and speech: (1) Forced nasal inspiration and oral expiration in conjunction with phonation of an open vowel, while sitting; (2) Balloon inflation with nasal inspiration and forced oral expiration, repeated five times without taking the balloon away from the mouth.

2. Swallowing and chewing: 1) Alternating bilateral chewing and swallowing using the tongue on the palate, with teeth clenched, without perioral contraction, whenever feeding. 2) The supervised exercise consists of alternate bread mastication.

These exercises aimed for correct positioning of the tongue while eating in order to target the adaptation of tongue and jaw movements. Patients were instructed to use mastication pattern when eating.

5 - Analysis of the data obtained

The effect of speech therapy on the cervical and abdominal circumferences obtained, the results of the Berlin Questionnaires before and after therapy, were statistically analyzed using the Wilcoxon test ($\alpha = 0.05$) since the data were dependent and nonparametric. For the Epworth questionnaire, the paired Student's t-test was used since the points obtained in this questionnaire were normally distributed. Descriptive analyses of the myofunctional aspects were also carried out, correlating those with the data obtained from the polysomnographic.

RESULTS

1 - Description of the study population

Eleven patients with a polysomnographic diagnosis of OSAS and/or snoring were selected for speech therapy, but two were excluded for non-adherence to treatment.

Among the patients studied, 55.55% (5) were female and 44.44% (4) were male, aged between 39–72 years (mean age: 55.1 years). BMIs remained stable throughout the study, with the lowest BMI being 22.65 and the highest being 31.3 (mean BMI: 27.27). Changes found from the polysomnography revealed 4 patients diagnosed with severe OSAS (44.44%), 2 patients with moderate OSAS (22.22%), 1 patient with mild OSAS (11.11%), and 2 patients with primary snoring (22.22%).

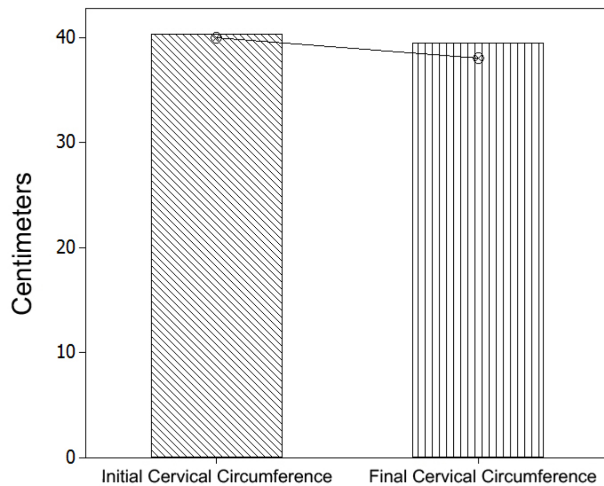
2 - Comparison of cervical and abdominal circumference measurements

Cervical (CC) and abdominal circumference (AC) measurements were conducted at the beginning and end of the speech therapy process and the results were related to the severity of the sleep disorder observed, as shown in Table 1. According to Figures 1 and 2, no statistical differences were observed between initial CC and AC measurements and final CC and AC measurements had a significance level of 5% (CC $p = 0.069$/CA $p = 0.789$).

Table 1 – Comparison of cervical and abdominal circumference measurements observed with severity of sleep disorder

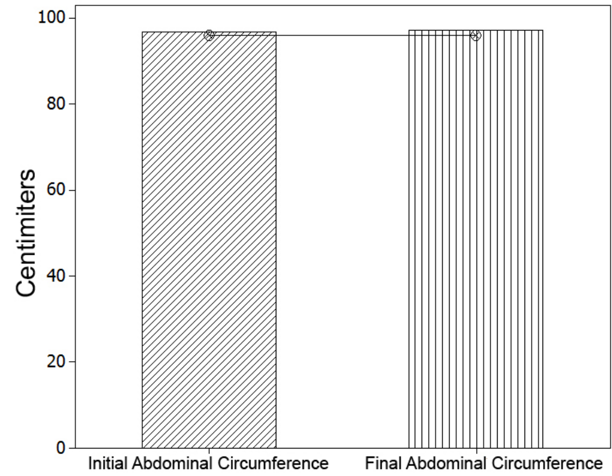
Patients	Severity of the sleep disorder	Cervical		Abdominal	
		Circumference (cm)			
		Initial	Final	Initial	Final
Patient 1	Severe OSAS	40	38	96	96
Patient 2	Primary Snoring	35	35	80	80
Patient 3	Severe OSAS	46	46	110	110
Patient 4	Mild OSAS	45	46	102	106
Patient 5	Moderate OSAS	41	41	109	109
Patient 6	Primary Snoring	35	35	89	90
Patient 7	Severe OSAS	47	43.5	104	102
Patient 8	Moderate OSAS	37	34.5	87	87
Patient 9	Severe OSAS	37	36	94	94
Mean		40.3	39.4	96.8	97.1

Legend: OSAS - Obstructive Sleep Apnea Syndrome



Wilcoxon test: $p = 0.069$ (not significant)

Figure 1 – Comparison of initial and final cervical circumference



Wilcoxon test: $p = 0.789$ (not significant)

Figure 2 – Comparison of initial and final abdominal circumference

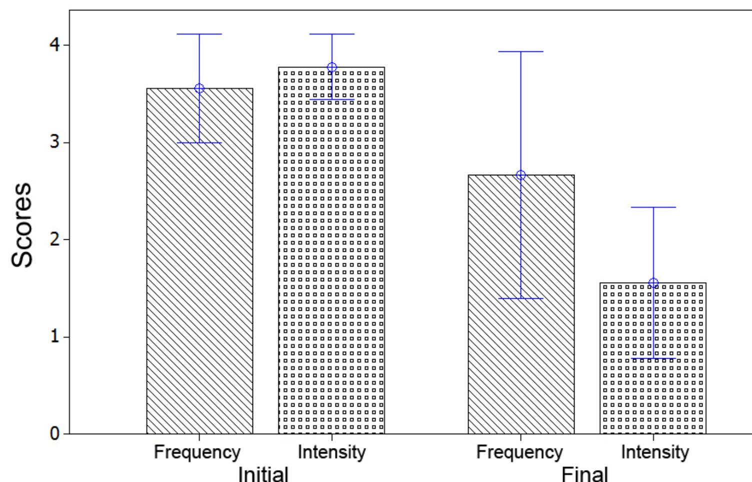
3 - Myofunctional Evaluation

Table 2 shows the results of the initial and final myofunctional evaluation. In the final evaluation, all patients presented an improvement of the following aspects: tonus adequacy of the suprahyoid muscles, lowering of the back of tongue, high soft palate, bilateral chewing, speech, and nasal breathing. There were no changes related to the tip of the tongue on the floor of the mouth at either of the times evaluations were performed.

Table 2 – Analysis of myofunctional adequacy before and after speech therapy.

Function/Position Evaluated	Before speech therapy			
	Severe OSAS (n = 4)	Moderate OSAS (n = 2)	Mild OSAS (n = 1)	Primary Snoring (n = 2)
Lowering of the back of the tongue	0%	0%	0%	0%
Tip of the tongue on the floor	75%	50%	0%	50%
Soft palate elevation	0%	0%	0%	0%
Nasal breathing	25%	0%	100%	50%
Bilateral chewing	50%	100%	100%	100%
Adequacy of the tonus of suprahyoid muscles	0%	0%	100%	0%
Speech adequacy	75%	100%	100%	100%
Function/Position Evaluated	**After speech therapy**			
	Severe OSAS (n = 4)	**Moderate OSAS (n = 2)**	**Mild OSAS (n = 1)**	**Primary Snoring (n = 2)**
Lowering of the back of the tongue	100%	100%	100%	100%
Tip of the tongue on the floor	75%	50%	0%	50%
Soft palate elevation	100%	100%	100%	100%
Nasal breathing	100%	100%	100%	100%
Bilateral chewing	100%	100%	100%	100%
Adequacy of the tonus of suprahyoid muscles	100%	100%	100%	100%
Speech adequacy	100%	100%	100%	100%

Legend: OSAS - Obstructive Sleep Apnea Syndrome
Percentage of patients with an appropriate pattern in the structure/function evaluated.



Intensity – Wilcoxon Test: p=0,005 (significant)
Frequency – Wilcoxon Test: p=0,05 (significant)

Figure 3 – Comparison of the scoreson the adapted Berlin Questionnaire before and after speech therapy

4 - Berlin Questionnaire and Epworth Sleepiness Scale

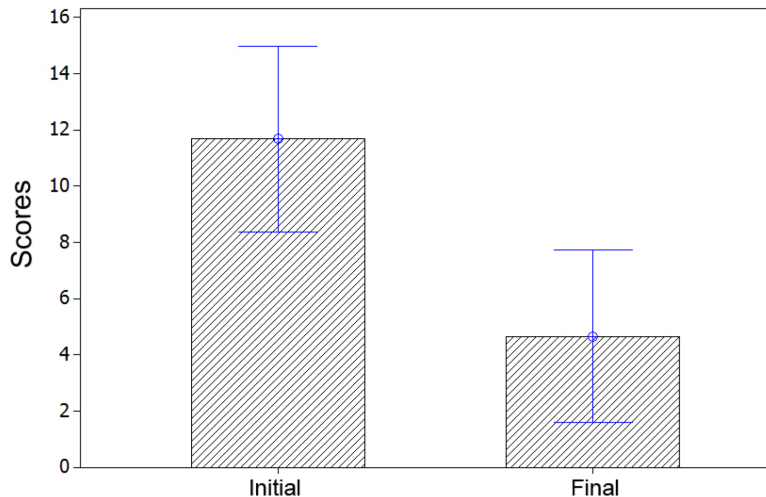
Based on the perception of the bed partner, the results of the Berlin Questionnaire showed a higher reduction in intensity (p = 0.005) than in frequency of snoring (p = 0.05), represented by Figure 3, regardless of the severity of the sleep disorder presented by the patient.

The results of the ESS found that 66% of the patients evaluated at the beginning of the study had scores higher than 10, which indicates the presence of EDS with an increased tendency to sleep during the day and a subjective compulsion to sleep. After completing the myofunctional exercises, there was a significant reduction (p = 0.000) of EDS in all patients and values close to zero in those who did not present EDS at the time of the first evaluation, as shown in Table 3 and Figure 4.

Table 3 – Epworth Sleepiness Scale results

Patients	Severity of the sleep disorder	Initial	Final
Patient 1	Severe OSAS	5	0
Patient 2	Primary Snoring	8	1
Patient 3	Severe OSAS	11	7
Patient 4	Mild OSAS	15	7
Patient 5	Moderate OSAS	16	10
Patient 6	Primary Snoring	14	10
Patient 7	Severe OSAS	15	3
Patient 8	Moderate OSAS	15	4
Patient 9	Severe OSAS	6	0
Mean		11,67	4,67

Legenda : OSAS – Obstructive Sleep Apnea Syndrome
Epworth Sleepiness Scale rating daytime sleepiness, where the patient assigns 0-3 for each situation (8 questions), according to the possibility of falling asleep in each situation. Total of 24 points where a score ≤ 10 is normal.



Paired Student's t-test: $p = 0.000$ (significant)

Figure 4 – Comparison of the Epworth questionnaire score

DISCUSSION

The propaedeutic proposed by Guimarães (2008) [23] and used in this study aim to work on stomatognathic functions such as sucking, swallowing, chewing, breathing, and speech, which are closely related to the muscles present in upper airway structures.

At the initial myofunctional evaluation, most of the patients in the study presented changes in positioning in the back of the tongue, soft palate, and tonus of the suprahyoid muscles, as reported in the literature [8,23]. These changes modify the oropharyngeal space and encourage the occurrence of tissue collapse during sleep [23,25-27].

By the end of the sessions, all patients presented improvements in the aspects described above including chewing and breathing patterns, which suggest an increase in the muscle tonus of the stomatognathic system, as well as of the orofacial, oropharyngeal, and cervical regions [6,23], as noted in the final evaluation using the protocol described in the study of Guimarães's (2008) [23].

The only aspect with no changes observed between before and after evaluations using the protocol was the tip of the tongue on the floor of the mouth. This finding, however, does not suggest it impairs the efficiency of the procedure since the back of the tongue appeared to be adequate.

In this study, no relationship was found between the severity of OSAS and/or snoring and the myofunctional changes shown, which may be explained by the absence of significant anatomical differences in computed tomography (CT) images of patients with OSAS and those who only snore [27]. However, studies with a larger number of participants should be performed to verify this fact.

The final results of ESS showed an absence of EDS in all study participants. These after speech therapy results indicate better sleep efficiency, and consequently, an improvement in the quality of life of the participants, characterized by reducing the impact of the disease on the ability to carry out daily activities [28]. However, it should be noted that ESS is a subjective test that may be influenced by other factors when applied.

Some patients did not show any possible relationship between the type of sleep disorder and the score obtained, unlike findings presented in other studies [15,24]. Two patients with severe OSAS showed no indices indicative of EDS. This data may be linked to a behavior, already described in the literature, of patients with OSAS underestimating their tendency to sleep during of clinical presentation, being accustomed to a state of sleepiness slowly progressive over the years [17].

The quality of life of the bed partners of OSAS/snoring patients also changed with the occurrence of nocturnal sleep interruptions due to snoring[12,14]. Studies on quality of life suggest that the self-reported information reflects the extent of the damage related to the disease on the general state of health; the information obtained from the partner of the patient is valuable for the clinical evaluation[13]. The evaluation of bed partners enables the avoidance of variations in the self-evaluations of patients, who may being accustomed to this state or even overvalue it [17].

The use of the Berlin Questionnaire as a tool for bed partners to assess the sleep disorders of their partners proved to be efficient in identifying improvements in the sleep disorders of the patients, which was confirmed by the results of ESS.

In this study, no statistically significant differences were observed between initial CC and AC and final CC and AC measurements. This allows us to infer that CC and AC measurements are not related to a reduction in the intensity and frequency of snoring assessed by the Berlin Questionnaire. Therefore, there were no reports found in the literature that supported a possible relationship between CC, intensity, and frequency of snoring. Further studies with larger samples would be required to assess this relationship.

Understanding the pathophysiology of OSAS and snoring has been discussed in several scientific studies without any conclusions on the relationship between the type of sleep disorder in different individuals, genders, and age ranges [27,29]. There have also been no conclusions on the improvement of early detection measurements of OSAS and its treatment [24,30]. Juliano et al. [29] describe the existence of a cephalometric pattern found in adults with sleep apnea that resembles a cephalometric pattern of oral breathing found in children, reinforcing the need for the identification and early treatment of respiratory disorders.

Speech therapy brings a new form of treatment for sleep disorders to the scientific community, since it has as one of its focuses of actuation, the orofacial myology area.

CONCLUSIONS

The perceptions of the bed partners of patients with OSAS and/or snoring in this study have shown an improvement in the quality of life, a reduction in the intensity of snoring, better sleep efficiency, and a reduction in the impact on their daily activities since there was a reduction of EDS in all study participants. All patients presented an improvement of myofunctional aspects after speech therapy, thus making it a therapeutic instrument and assessment tool for patients with OSAS also in speech-language clinics.

ACKNOWLEDGMENTS

The authors are grateful to FAPESP grant agency (2013/10281-7) for their support during this work. We would like to thank the Barros clinic on behalf of Dr. Carmen Freire de Barros for providing the space that rendered this study possible. We would also like to thank Ms. Lucas Hian da Silva for his help with statistical analysis and reviewing the manuscript.

RESUMO

Objetivo: verificar a percepção do acompanhante e a auto-avaliação do indivíduo com ronco/síndrome da apnéia obstrutiva do sono; coletar medidas das circunferências abdominal e cervical antes e após fonoterapia, além de realizar avaliação miofuncional para relacionar os resultados com a gravidade do distúrbio do sono observado. **Métodos:** participaram deste estudo onze indivíduos entre 25 e 75 anos de ambos os sexos com diagnóstico polissonográfico recente de síndrome da apnéia obstrutiva do sono leve a severo e/ou ronco primário. Os sujeitos receberam fonoterapia, exame clínico fonoaudiológico, aplicação de questionários de Berlim (adaptado) e Epworth nas fases pré e pós-fonoterapia. Os dados obtidos foram analisados estatisticamente por meio do teste de Wilcoxon ($\alpha = 0,05$). **Resultados:** dois indivíduos não aderiram ao tratamento. Não foi verificada diferença significante entre circunferências cervical e abdominal inicial e final (cervical p=0,069 / abdominal p=0,789). Todos os pacientes apresentaram melhora no tônus da musculatura supra-hióidea, rebaixamento de dorso de língua, elevação do palato mole, mastigação bilateral, fala e respiração nasal. Os resultados do questionário de Berlim mostraram redução na percepção do acompanhante na intensidade (p=0,005) do ronco maior do que na frequência (p=0,05). Houve redução significante (p=0,000) da sonolência diurna excessiva em todos os pacientes. **Conclusão:** Considerando-se as limitações deste estudo, conclui-se que após a fonoterapia as percepções dos acompanhantes e dos pacientes com síndrome da apnéia obstrutiva do sono/ronco ilustraram melhora efetiva do sono, da qualidade de vida, redução de intensidade do ronco e do comprometimento nas atividades diárias decorrentes da redução da sonolência diurna excessiva.

DESCRITORES: Apnéia do Sono Tipo Obstrutiva; Ronco; Fonoterapia

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Received on: October 30, 2012
Accepted on: March 04, 2013

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