BREATHING CHARACTERISTICS OF INDIVIDUALS WITH DENTOFACIAL DEFORMITY

Características respiratórias de indivíduos com deformidade dentofacial

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ABSTRACT

Purpose: comprehend the respiratory characteristics of individuals with dentofacial deformities and verify if there are differences comparatively to individuals with dentofacial balance. **Methods:** participated 60 individuals (18 to 40 years old), 30 with a dentofacial deformities and 30 of a control group. The assessment of the Maximum Phonation Time for the emissions /a/, /i/, /u/, /s/, /z/ and the number counting was evaluated using the program Sound Forge (Sony); the vital capacity and pneumophonic coordination by the PonyFx spirometer. The results were compared by using the "t" Student test. **Results:** the individuals with dentofacial deformities presented lower Maximum Phonation Time values than individuals with dentofacial balance in the emissions: "s" for those with skeletal Class II malocclusion and men; "z" for individuals with Class II malocclusion; number counting for men. The measures extracted by the spirometry were similar between the individuals with and without dentofacial deformities. **Conclusion:** there were no differences regarding the vital capacity and pneumophonic coordination, but the dentofacial deformities group presented lower values of Maximum Phonation Time in the emissions that contain consonant phonemes.

KEYWORDS: Voice; Breathing; Spirometry; Jaw Abnormalities; Malocclusion

INTRODUCTION

The balance of the stomatognathic system may be disrupted by factors that alter the structure of soft and hard tissues. When this happens, dentofacial deformities may occur, which interfere with the functional aspects, facial esthetics, personality, attitudes and behavior of individuals[1].

The anatomical characteristics in dentofacial deformities (DFD) may be related to breathing manifestations of individuals with these deformities[2,3].

There has been report of smaller volume of the oropharynx airway in individuals with Class II malocclusion compared to individuals with Class I and III malocclusions, reporting that mandibular positioning in relation to the cranial base influences the oropharynx volume. Also, individuals with Class II malocclusion present smaller nasal air volume compared to Class I individuals[4]. Functional abnormalities that affect nasal breathing, including septal deviation, nasal valve constriction and turbinate hypertrophy, are observed in individuals with skeletal maxillary deformity[5].

In cases of maxillary constriction, which produce a narrow nasal valve, a study revealed that maxillary expansion increased the nasal permeability in the

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short term; however, the effect did not persist over time and was unable to change the breathing pattern for most individuals[6].

In cases of individuals with Class III malocclusion submitted to bimaxillary osteotomy, involving mandibular setback and maxillary advancement, there are reports of inferior repositioning of the hyoid bone, posterior displacement of the tongue and soft palate, narrowing of the oropharynx and hypopharynx and widening of the nasopharynx and velopharynx five months after surgery[7]. Other authors reported significant increase in the flow limitation index and reduced oxygen saturation in the ventilation during sleep in individuals with Class III malocclusion, eight and a half months after osteotomy[8]. In case of surgery involving only mandibular setback, studies did not report significant changes in the upper airway[9,10]. Conversely, in surgeries involving only maxillary advancement, there are reports of reduced nasal obstruction[11].

The anatomical changes present in individuals with dentofacial deformities are related with mouth breathing, since several authors describe that this breathing pattern promotes elevation and greater head extension related to the cervical spine, influencing the hyoid bone and different intermaxillary positions[12]. The mandibular positioning and tongue posture are influenced by the breathing needs, altering the balance of mandibular and teeth pressures, affecting both the cranial morphology and tooth positioning[13].

The relationship between breathing and malocclusion has usually been described in studies on children, yet it is necessary to consider the possibility of maintenance of mouth breathing up to adulthood. Some authors report a close relationship between mouth breathing and malocclusion, since studies on mouth-breathing children revealed that most of them presented Angle Class II malocclusion[14,15].

Also, some studies demonstrate that allergies influence the occlusal development, with greater influence from rhinitis, both allergic and vasomotor, and atopic asthma to a lesser extent. The changes in nasal function induced by rhinitis may lead to the development of bronchial asthma due to loss of the natural mechanism of nasal filtering, because of the development of edema. This change in nasal function may trigger the antigen presentation in the airway, and the inflammatory reaction initiated on the nose may lead to airway inflammation by a systemic pathway[16].

Therefore, several studies have addressed aspects of breathing in individuals with DFD, especially focusing on upper airway disorders[4,5,7,8,11], considering that these individuals often present mouth breathing[17,18], which, as described, may be triggered by allergic pulmonary disorders[16]. Evaluation of spirometry measurements including vital capacity, pulmonary volume and pulmonary flow, besides evaluation of the maximum phonation time (MPT), may contribute to the understanding on breathing disorders in these individuals.

Therefore, this study aimed to analyze the respiratory characteristics of individuals with dentofacial deformities submitted to preoperative orthodontic treatment compared to individuals with dentofacial balance, as to the following aspects: maximum phonation times, vital capacity and pneumophonic coordination.

METHODS

This study was approved by the Institutional Review Board of Bauru School of Dentistry, University of São Paulo, process n. 049/2009. All participants signed the Informed Consent Form.

Young adults with dentofacial deformities in orthodontic treatment and candidates for orthognathic surgery, with the agreement of directors of orthodontic clinics and institutes, were invited to participate in this study. Young adults without dentofacial deformities from the community were also invited to participate.

The inclusion criteria for the study were age between 18 and 40 years, regardless of gender, presenting Class II or Class III dentofacial deformity, having completed preoperative orthodontic treatment for orthognathic surgery, and presenting oral or oronasal breathing in accordance with the Orofacial Myofunctional Evaluation, MBGR protocol [19].

The experimental group (EG) consisted of 22 young adults aged 18 to 40 years with dentofacial deformities, being 14 with Class III skeletal malocclusion and 8 with Class II malocclusion, among whom 13 were females and nine were males. All individuals showed oral or oronasal breathing. The control group (CG) consisted of 22 individuals with dentofacial balance, adjusted by gender and age according to the study group, with relationship between dental arches with horizontal and vertical overlap between 1 and 3 mm, natural teeth at least up to the second premolar, and average facial type and nasal breathing, in accordance with the Orofacial Myofunctional Evaluation, MBGR protocol [19].

Exclusion criteria for the experimental and control group, obtained by reports from the participants, included neurological and/or psychiatric syndromes, chronic pulmonary obstruction, smoking, voice changes and previous laryngeal surgery, facial trauma, or prior orthognathic surgery.

Characterization of the control group revealed mean height of 1.70 cm and weight 69.07 kg; for the experimental group, the values were 1.70 cm and 67.75 kg.

To evaluate the maximum phonation time (MPT), three prolonged emissions of the vowels /a/, /i/ and /u/; the fricatives /s/ and /z/; and the counting of numbers were recorded, and the means of the three productions of each emission were considered. The time for such measures was counted using the auditory aid and visual timescale of the software Sound Forge 9.0

Spirometry was performed using the spirometer PonyFX of 12 L. For that purpose, the individual was comfortably seated in a chair with the arms supported. A mouthpiece coupled to a filter and the spirometer were positioned in the vestibule of the individual's mouth, and the individual was asked to breathe normally to get accustomed to the system. To obtain the vital capacity, the individual was instructed to practice some breaths cycles and, when he or she felt comfortable, to perform maximum inspiration followed by a pause of few seconds and then maximum expiration in the form of forced blowing. During expiration, the examiner verbally asked the individual to perform the longest possible expiration, and this procedure was repeated three times to calculate the mean in liters of the three values obtained.

For quantitative evaluation of pneumophonic coordination, the same equipment was used, which graphically recorded the equivalent curve of each emission. The phonation volume and mean flow were obtained from the vowel emissions produced with the same spirometer. The individual was instructed to take some breaths cycles and, when he or she felt comfortable, to perform maximum inspiration followed by prolonged emission of the vowel /a/. The examiner also verbally instructed that the emission should be as long as possible, and this procedure was repeated three times to calculate a mean value. The phonation volume, measured in milliliters, refers to the quantity of air used for phonation of the prolonged vowel, with normality parameters relative to vital capacity mean values of 67% for men and 59% for women[18.] The phonation medium flow, calculated in milliliters per second, indicates the air outlet control for speech and was calculated as the ratio between the phonation volume and the MPT.

Besides these parameters, the study also calculated the simple phonic quotients (SPQ) obtained by evaluating the ratio between vital capacity and MPT of the vowel /a/.

The results were compared between experimental and control groups, which were subdivided by gender and malocclusion type. The statistical Student t test was used, at a significance level of 5%.

RESULTS

Analysis of the relative results for MPT showed statistically significant difference in "s" and "z" emissions and numbers for individuals in the Class II malocclusion subgroup and in "s" emissions in the male subgroup, in which the values of the experimental group were smaller than the control group (Tables 1 and 2).

Concerning the relative results for the spirometry evaluation, differences were not found between the experimental and control groups, for all individuals, men and women subgroups and Class II and III malocclusions concerning the vital capacity, phonation volume, phonation flow and simple phonic coefficient (Tables 3 and 4).

Table 1- Values of maximum phonation time (MPT) emissions /a/, /i, /u/,/s/,/z/; and counting of numbers from individuals in the Experimental Group and Control Group for the total of individuals and gender subgroup

		Experimental group	Control group	p
		Mean (±sd)	Mean (±sd)	
Total of individuals (n=44)	"a"	17.00(±5.45)	17.20(±5.19)	0.901
	"i"	17.75(±6.27)	17.27(±5.56)	0.852
	"u"	15.60(±6.52)	14.74(±3.77)	0.595
	"s"	13.67(±6.00)	16.25(±4.97)	0.122
	"z"	14.48(±6.59)	17.39(±6.82)	0.157
	"numbers"	18.41(±5.26)	20.32(±4.19)	0.190
females (n=26)	"a"	15.42(±4.98)	15.63(±3.58)	0.902
	"i"	16.49 (±6.39)	15.60 (±4.15)	0.677
	"u"	15.02(±7.05)	13.49(±3.73)	0.496
	"s"	14.27(±7.28)	15.30(±4.30)	0.664
	"z"	13.98 (±7.16)	14.77 (±3.79)	0.728
	"numbers"	18.21 (±4.77)	18.54 (±3.51)	0.842
males (n=18)	"a"	19.28(±5.55)	19.49(±6.46)	0.941
	"i"	19.58 (±5.96)	19.69 (±6.66)	0.971
	"u"	16.44 (±5.96)	16.54 (±3.20)	0.965
	"s"	12.80 (±3.68)	17.62 (±5.78)	**0.049***
	"z"	15.21 (±6.00)	21.17 (±8.57)	0.106
	"numbers"	18.70 (±6.18)	22.90 (±3.87)	0.103

*p<0.05 – statistically significant

Table 2 – Values of maximum phonation time (MPT) emissions /a/, /i, /u/,/s/,/z/; and counting of numbers from individuals in the Experimental Group and Control Group subdivided by malocclusion type

		Experimental group	Control group	p
		Mean (±sd)	Mean (±sd)	
Class III (n=28)	"a"	17.88 (±5.32)	16.19 (±3.82)	0.343
	"i"	18.37 (±6.67)	16.62 (±4.28)	0.421
	"u"	16.47 (±7.84)	14.79 (±4.47)	0.501
	"s"	16.16 (±6.02)	16.03 (±4.89)	0.953
	"z"	17.28 (±6.71)	15.88 (±4.92)	0.534
	"numbers"	20.12 (±4.40)	19.84 (±4.39)	0.867
Class II (n=16)	"a"	15.45 (±5.67)	18.98 (±6.94)	0.284
	"i"	16.67 (±5.78)	18.42 (±7.52)	0.609
	"u"	14.08 (±3.02)	14.65 (±2.35)	0.679
	"s"	9.31 (±2.56)	16.63 (±5.42)	**0.003***
	"z"	9.58 (±1.88)	20.04 (±9.05)	**0.006***
	"numbers"	15.42 (±5.55)	21.18 (±3.95)	**0.031***

*p<0.05 – statistically significant

Table 3 – Values of spirometry measures including mean vital capacity, phonation volume and flow, simple phonic quotients, from individuals in the Experimental Group and Control Group for the total of individuals and gender subgroup

		Experimental group	Control group	P
		Mean (±sd)	Mean (±sd)	
Total of individuals (n=44)	VC mean (ml)	3.785(±1.02)	3.974 (±1.00)	0.536
	Phonation volume(ml)	4.191 (±1.51)	4.579 (±1.53)	0.399
	Phonation flow (ml/s)	0.266 (±0.12)	0.396 (±0.56)	0.417
	SPQ(ml/s)	0.235 (±0.08)	0.242 (±0.07)	0.759
Females (n=26)	VC mean (ml)	3.154 (±0.61)	3.236 (±0.43)	0.667
	Phonation volume(ml)	3.406 (±1.34)	3.581 (±0.84)	0.701
	Phonation flow (ml/s)	0.243 (±0.12)	0.239 (±0.06)	0.915
	SPQ(ml/s)	0.216 (±0.08)	0.217 (±0.05)	0.733
Males (n=18)	VC mean (ml)	4.696 (±0.56)	5.039 (±0.46)	0.178
	Phonation volume(ml)	5.324 (±0.90)	6.019 (±1.05)	0.148
	Phonation flow (ml/s)	0.298 (±0.11)	0.622 (±0.85)	0.273
	SPQ(ml/s)	0.262 (±0.08)	0.278 (±0.09)	0.713

Legend: VC: Vital Capacity and SPQ: Simple Phonic Quotients

Table 4 – Values of spirometry measures including vital capacity, phonation volume and flow, simple phonic quotients, from the Experimental Group and the Control Group subdivided by malocclusion type.

		Experimental group	Control group	p
		Mean (±sd)	Mean (±sd)	
Class III (n=28)	VC mean (ml)	3.859 (±0.91)	3.979 (±1.07)	0.750
	Phonation volume (ml)	4.128 (±1.56)	4.675 (±1.74)	0.386
	Phonation flow (ml/s)	0.250 (±0.12)	0.292 (±0.09)	0.902
	SPQ(ml/s)	0.227 (±0.08)	0.244 (±0.07)	0.274
Class II (n=16)	VC mean (ml)	3.654 (±1.10)	3.965 (±0.95)	0.543
	Phonation volume (ml)	4.30 (±1.51)	4.41 (±1.14)	0.871
	Phonation flow (ml/s)	0.29 (±0.10)	0.58 (±0.93)	0.395
	SPQ(ml/s)	0.25 (0.07)	0.24 (±0.07)	0.779

Legend: VC: Vital Capacity and SPQ: Simple Phonic Quotients

DISCUSSION

Considering that previous studies demonstrated relationship between malocclusion and breathing disorders, this study investigated whether there is difference in the breathing pattern of individuals with dentofacial deformities (DFD) compared to individuals with normal occlusion, by measuring the vital capacity and pneumophonic coordination, besides analysis of MPT.

Because MPTs are related to sustaining phonation, they experience interference from several factors, such as breathing function control, glottal efficiency, vital capacity, and laryngeal control [20]. However, this study cannot state that there was altered respiratory airflow control in individuals with DFD, because MPT was altered only for fricatives production and chained speech (Tables 1 and 2), which suggests that the individuals' difficulty is related to articulation.

The production of vowels "a", "i", "u" involves opening the mouth wider and increasing the distance between the teeth. Conversely, the production of "s" and "z" involves control of the airflow so that the teeth stay close, at which point adjustments may occur to the muscle that brings the mandible to a position at which premature dental and occlusal interference can result. Therefore, individuals with malocclusion have difficulty in producing these phonemes [21].

In relation to the MPT consonants /s/ and /z/, the emission of /s/ allows evaluation of an individual's capacity to control the pulmonary air support. Since in its production there is no vibration of the vocal folds, it is possible to evaluate the frictional sound origin. With /z/, there is an additional possibility to evaluate the glottal origin, because larynx vibration occurs in its production [22].

In general, the MPTs of individuals in the control group were in accordance with the normal standards established by authors, which preconize values in the 20s for men and 14s for women. The same cannot be stated for the experimental group, whose values were below the normal [23].

The results showed that the values related to vital capacity for both study groups are in agreement with normality, which, according to a study, would be 4.64 ± 0.77 liters for males and 3.14 ± 0.65 liters for women [23].

Some studies [16] have shown that mouth breathing can be triggered by allergic pulmonary alteration, while other authors described a relationship between malocclusion and breathing alteration [14,15]. Considering that the majority of individuals with DFD in this study showed oral or oronasal breathing, the breathing alteration was expected, yet differences in spirometry measures were not noted (Tables 3 and 4), which can indicate that the respiratory characteristics of EG did not interfere with pulmonary volumes or the ability to control the air flow during phonation.

Several studies addressed the relationship between DFD and upper airway changes [4,5,7,8,11]; however, not all studies observed changes in these aspects in individuals with DFD[7,8], which agrees with the outcomes of absence of breathing alterations in individuals in this study. Therefore, further studies like this are warranted, analyzing groups with larger number of balanced individuals as to gender and facial pattern.

The contribution of the present study is the observation that, during vocal evaluation of MPT in the clinical practice, a reduction in time of the fricative emission of "s" can occur due to the presence of dentofacial deformities, unrelated to alterations in the respiratory control of airflow.

CONCLUSION

The group of patients with DFD did not show different vital capacity measures and pneumophonic coordination from those of the control group, yet it showed reduced MPT values in emissions of consonantal phoneme.

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RESUMO

Objetivo: compreender as características respiratórias em indivíduos com deformidades dentofaciais e verificar se há diferenças comparativamente a indivíduos com equilíbrio dentofacial. **Métodos:** participaram 60 indivíduos (18 a 40 anos), 30 portadores de deformidade dentofacial e 30 de um grupo controle. Foi realizada avaliação do Tempo Maximo de Fonação das emissões /a/, /i/, /u/, /s/, /z/ e contagem de números pelo programa *Sound Forge (Sony)*; avaliação da capacidade vital e coordenação pneumofonoarticulatória, pelo espirômetro *PonyFx*. Os resultados foram comparados pelo teste "t" de *Student.* **Resultados:** os indivíduos com deformidade dentofacial apresentaram valores de Tempo Maximo de Fonação inferiores aos indivíduos com equilíbrio dentofacial nas emissões: "s" para aqueles com má oclusão esquelética classe II e homens; "z" para indivíduos com má oclusão classe II; contagem de números para os homens. As medidas extraídas pela espirometria foram semelhantes entre os indivíduos com e sem deformidade dentofacial. **Conclusão:** não houve diferenças em relação à capacidade vital e coordenação pneumofonoarticulatória, mas o grupo com deformidade dentofacial apresentou valores reduzidos de Tempo Maximo de Fonação em emissões que contêm fonemas consonantais.

DESCRITORES: Voz; Respiração; Espirometria; Anormalidades Maxilomandibulares; Má Oclusão

REFERENCES

1. Ribas MO, Reis LFG, França BHS, Lima AAS. Cirurgia ortognática: orientações legais aos ortodontistas e cirurgiões bucofaciais. R Dental Press Ortodon Ortop Facial. 2005;10(6):75-83.

2. Hwang S, Chung CJ, Choi YJ Huh JK, Kim KH. Changes of hyoid, tongue and pharyngeal airway after mandibular set-back surgery by intraoral vertical ramus osteotomy. Angle Orthod. 2010;80:302-8.

3. Kim JS, Kim JK, Hong S-C, Cho JH. Pharyngeal airway changes after sagittal split ramus osteotomy of the mandible: a comparison between genders. J Oral Maxillofac Surg. 2010;68:1802-6.

4. El Hakan, Palomo JM. Airway volume for different dentofacial skeletal patterns. Am J Orthod Dentofacial Orthop. 2011;139:511-21.

5. Moche JA; Palmer O. Surgical management of nasal obstruction. Oral Maxillofac Surg Clin North Am. 2012 ;24:229.

6. Berretin-Felix G, Yamashita RP, Nary-Filho H, Gonçales ES, Trindade Jr AS, Trindade IEK. Short- and Long-Term Effect of Surgically Assisted Maxillary Expansion on Nasal Airway Size. Journal of Craniofacial Surgery. 2006;17(6):1045-97.

7. Gokce SM, S Gorgulu, Gokce HS, Bengi O, Sabuncuoglu F, Ozgen F et al. Changes in posterior airway space, pulmonary fuction and sleep quality following bimaxillary orthognathic surgery. 2012;41:820-9.

8. Foltan R Hoffmannová J, Donev F, Vlk M, Sedy , Kufa R, Bulik O. The impact of Le Fort I advancement and bilateral sagital split osteotomy setback on ventilation during sleep. Int J Oral Maxillofac Surg. 2009;38:1036-40.

9. Gu GM, Nagata J, Suto M, Anraku Y, Nakamura K, Kuroe K, Ito G. Hyoid position, pharyngeal airway and head posture in relation to relapse after the mandibular setback in skeletal class III. Clin Orthod Res. 2000;3:67-77.

10. Kiatagawara K, Kobayashi T, Goto H, Yokobayashi T, Kitamura N, Saito C. Effects of mandibular setback surgery on oropharyngeal airway and arterial oxygen saturation. Int J Oral Maxillofac Surg. 2008;37:328-33.

11. Williams BJD;Isom A; Laureano-filho JR; O'Ryan FS. Nasal airway function after maxillary surgery: a prospective cohort study using the nasal obstruction symptom evaluation scale. J oral Maxillofac Surg.2013;71:343-50.

12. Cuccia AM, Lotti M, Caradonna D. Oral breathing and head posture. Angle Orthod. 2008;78(1):77-82.

13. Karacay AKIN, Ortakoglu K, Bengi AO. Dynamic MRI evaluation of tongue posture and deglutitive movements in a surgically corrected open bite. Angle Orthod. 2006;76(6):1057-65.

14. Motta RJ. Relação da postura cervical e oclusão dentária em crianças respiradoras orais. Rev CEFAC. 2009;11(3):298-304.

15. Almeida FL, Silva AMT, Serpa E. O. Relação entre má oclusão e hábitos orais em respiradores orais. Rev CEFAC. 2009;11(1):86-93.

16. Lampasso JD, lampasso JF. Allergy Nasal Obstruction, and Occlusion Seminars in Orthodontics. 2004;10(1):39-44

17. Almeida FL, Silva AMT, Serpa EO. Relação entre má oclusão e hábitos orais em respiradores orais. Rev CEFAC. 2009;11(1):86-93.

18. Sies ML, Faria SR, Vieira MM. Respiração oral: relação entre o tipo facial e a oclusão dentária em adolescentes. Rev Soc Bras Fonoaudiol. 2007;12(3):191-8.

19.Genaro KF, Berretin-Felix G, Rehder MIBC, Marchesan IQ. Avaliação miofuncional orofacial – protocolo MBGR. Rev CEFAC. 2009;11(2):237-55.

20.Mendes A, Castro E. Analise acústica da avaliação vocal I: tarefas fonatória e medidads acústicas. Rev Port ORL. 2005;43(2):127-36.

21.Vallino LD, Tompson AB. Perceptual Characteristics of Consonan errors associated with malocclusion. J Oral Maxillofac Surg. 1993;51:850-6.

22.Behlau M, Azevedo R, Pontes P. Avaliação de voz. In: Behlau MS. (org.) Voz – O livro do especialista. Rio de Janeiro: Revinter; 2001, vol. 1. P. 85-246.

23.Pereira C, Sato T, Rodrigues SC. New reference values for forced spirometry in white adults in Brazil. J Bras Pneumol. 2007;33(4):397-406.

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