FACIAL ANTHROPOMETRIC MEASUREMENTS ACCORDING TO DIAGNOSIS OF BREATHING MODE AND GENDER IN ADULTS

Medidas antropométricas faciais de adultos segundo diagnóstico do modo respiratório e o sexo

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ABSTRACT

Purpose: to compare the facial anthropometric measures in adults according to the breathing mode and genre. **Methods:** the study sample comprised 82 adult subjects, aged 18 to 35 years old, 59 females and 23 males. From the speech pathology and otorhinolaryngologic assessments, 46 nasal breathers and 36 mouth breathers were diagnosed. The facial measures were achieved with a caliper and compared according to the subject's breathing mode diagnosis and genre, through the Student's t-test and Pearson's Correlation, with a significance level of 5%. **Results:** the vertical anthropometric measures (middle third, lower third, facial height, upper lip and lower lip) were found to be significantly greater in mouth breathers and displayed positive correlation with the breathing mode. All facial measurements performed were found to be higher in males and showed positive correlation with the variable genre. **Conclusion:** the facial anthropometric measures of vertical plane were found to be greater in mouth breathers, suggesting a more elongated facial pattern of growth in these subjects. All the facial anthropometric measures obtained in the vertical, horizontal and transverse planes were found to be higher in male subjects.

KEYWORDS: Face; Measures; Anthropometry; Mouth Breathing; Adult

INTRODUCTION

Mouth breathing is a pathology that can cause alterations in the structures and functions of the stomatognathic system, in body posture, craniofacial morphology and dental occlusion, as well as in the patients' behavior and quality of life[1,2].

Taking into account the possible damages to the individual, mouth breathing mode has been addressed in several studies, especially involving the child population. The altered breathing mode, oronasal or mouth breathing, may persist until adulthood if not appropriately treated in childhood.

Nevertheless, it can be observed that only a few studies have sought to assess the impact of mouth breathing in adults, which motivated this research. It is believed that the study of the orofacial morphology in adult mouth breathers may contribute to the clinical practice and the completion of other studies, considering that the impact of mouth breathing in adulthood, after the pubertal growth period, has not been clearly evidenced to date.

The craniofacial morphology can be studied through orofacial anthropometric assessment as a qualitative method complementing the clinical

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Source of support: scholarship granted by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Conflict of interest: non-existent

assessment, and constitutes one of the evaluation items for the protocols in the orofacial myology and motricity area[3,4]. It is widely used as it is a simple, low-cost, non-invasive method, and easy to interpret[5].

Based on the above, the purpose of this study was to compare the facial anthropometric measurements in adults according to the breathing mode and gender.

METHODS

This analytic cross-sectional study was approved by the research ethics committee of the Federal University of Santa Maria under the protocol number 04039912.7.0000.5346. All the participants had the Free and Informed Consent Term signed.

The sample comprised subjects from orthodontic, otorhinolaryngology, speech-language pathology and physiotherapy clinics, and the wider community, with previous divulgation in newspapers, radio stations, social networks and posters affixed in health service facilities, characterizing a non-probability convenience sample.

Subjects aged 18 to 35, leukodermas, both sexes, were included in the study. Subjects with craniofacial syndrome and/or malformation, presenting with a history of orthodontic and/or speech-language pathology and/or physiotherapy treatment were excluded.

In order to form groups according to the breathing mode, the subjects underwent speech-language and othorhinolaryngologic assessment. The speech-language was performed based on the MBGR protocol (clinical history and orofacial myofunctional assessment)[3,4]. Based on this assessment, it was verified the morphological and functional characterization of the stomatognathic system, which contributed to the breathing mode diagnosis and served as a basis to verify the conformity with the criteria for the formation of the nasal and mouth breathers groups.

The otorhinolaryngologic assessment comprised the anamnesis, oroscopy, anterior rhinoscopy, otoscopy and nasofibropharyngoscopy. The endoscopic examination was performed with nasofibroscope Pentax FNL – 10 RP3, 3.7mm diameter, inserted into the nasal cavity to the region of the rhinopharynx, where the presence of pharyngeal tonsils (adenoids) was assessed.

The orofacial anthropometric assessment was performed by a single speech-language pathologist having experience in orofacial motricity. A Western® digital caliper, resolution 0.01mm and precision ± 0.02mm, was the instrument used to obtain the measures. In order to obtain the measure of facial width, 8.25cm metal extensions were adapted to the instrument nozzles for external measurement[6].

During the assessment, the subject remained in front of the examiner, in sitting position, the feet flat on the ground, natural head position, lips enclosed and the teeth in centric occlusion without pressure[5,7,8].

Subsequently, to identify the precise localization, the craniofacial spots were palpated and marked in the skin with dermographic pencil. The anthropometric measurements were performed without pressing the caliper ends against the skin surface, because that could alter the results. All the measurements were performed twice for greater reliability. The result on each measurement was achieved through the average of two collections in milimeters[5,7,8].

The anthropometric measurements were collected as follows:

- middle third of the face: distance from the glabella to the subnasal (g-sn);
- lower third of the face: distance from the subnasal to the gnathion (sn-gn);
- facial height: distance from the glabella to the gnathion (g-gn);
- facial width: distance between the prominence of the zygomatic arches (zy-zy);
- right side: distance from the outside corner of the right eye to the right labial commissure (ex-ch);
- left side: distance from the outside corner of the left eye to the left labial commissure (ex-ch);
- upper lip height: distance from the subnasal to the lowest point of the upper lip (sn-sto);
- lower lip height: distance from the highest point of the lower lip to the gnathion (sto-gn).

For data analysis, the Kolmogov-Smirnov test was used to verify the normality of the facial anthropometric measures distribution. Aiming to compare the anthropometric measures according to the breathing mode and gender, the Student's t-test was used. To assess the association of the variables 'breathing mode and gender' with the facial anthropometric measurements, the Pearson's Correlation test was used. The statistical analyses were performed by the SPSS (Statistical Package for Social Science, version 20) software, considering the significance level of 5%.

RESULTS

Through the results analysis, it was verified that all the averages of the vertical anthropometric measures (middle third, lower third, facial height, upper lip and lower lip) were significantly higher in mouth-breathing subjects than in nasal breathers (Table 1). It was also possible to observe a moderate positive correlation between the breathing mode and the measures of the lower third, facial height and lower lip, as well as a weak positive correlation between the breathing mode and the measures of the middle third and upper lip (Table 3).

On the other hand, no correlation or differences were found in the averages of cross-sectional (sides of the face) e horizontal (facial width) measures between the nasal and mouth breathers (Tables 1 and 3).

In gender comparison, it became evident that all averages of facial anthropometric measures were significantly higher in males (Table 2). Additionally, all facial anthropometric measures displayed positive correlation with the variable 'gender', with a weak correlation with facial width and a moderate correlation with other measures (Table 3).

Table 1 – Comparison of facial anthropometric measures in breathing mode

Facial anthropometric measures	Breathing mode		p
	NB n=46	MB n=36	
	average±SD	average±SD	
Middle third	61.16±4.95	63.89±5.16	0.017*
Lower third	57.65±4.49	61.86±7.47	0.002*
Facial height	118.19±7.79	126.42±10.36	<0.001*
Facial width	127.89±5.35	129.68±8,45	0.298
Right side	70.02±3,78	71.54±3,94	0.081
Left side	70.02±4.51	70.61±3.86	0.536
Upper lip	20.05±2.33	21.17±2.59	0.043*
Lower lip	37.83±3.86	41.86±5.46	<0.001*

Legend: NB=nasal breathing; MB=mouth breathing; SD=standard deviation; (*)=significance in Student's t-test (p<0.05).

Table 2 – Comparison of facial anthropometric measures according to gender

Facial anthropometric measures	Gender		p
	Female n=59 (72%)	Male n=23 (28%)	
	average±SD	average±SD	
Middle third	60.85±4.33	66.24±5.29	<0.001*
Lower third	57.61±4.20	64.33±8.11	<0.001*
Facial height	118.65±7.93	129.88±9.80	<0.001*
Facial width	127.51±6.21	131.47±8.22	0.028*
Right side	69.05±2.57	74.89±3.61	<0.001*
Left side	68.56±2.99	74.69±3.72	<0.001*
Upper lip	19.89±2.04	22.20±2.81	<0.001*
Lower lip	38.42±4.44	42.63±5.25	<0.001*

Legend: SD=standard deviation; (*)=significance in Student's t-test (p<0.05).

Table 3 – Correlation of breathing mode and gender with orofacial anthropometric measures

Facial anthropometric measures	Breathing mode		Gender	
	Correlation	p	Correlation	p
Middle third	0.26	0.017*	0.47	<0.001*
Lower third	0.33	0.002*	0.48	<0.001*
Facial height	0.42	<0.001*	0.52	<0.001*
Facial width	0.13	0.298	0.26	0.028*
Right side	0.19	0.081	0.68	<0.001*
Left side	0.07	0.536	0.65	<0.001*
Upper lip	0.22	0.043*	0.42	<0.001*
Lower lip	0.40	<0.001*	0.38	<0.001*

Legend: (*)=significance in Pearson's Correlation Coefficient (p<0.05).

DISCUSSION

The present study aimed to assess the impact of breathing mode on craniofacial morphology in adult subjects, based on the comparison of anthropometric measurements in nasal and mouth breathers. No studies were found regarding anthropometric assessment in adult mouth breathers, which justifies the comparison of some findings with studies carried out with children. Facial anthropometric measurements were also compared between genders, since several studies have demonstrated differences in facial anthropometric measures between males and females[9-13].

Through the comparison of facial measures between breathing modes, it was verified that all vertical measures (middle third, lower third, facial height, upper lip and lower lip) were significantly higher in mouth breathers, with a positive, weak to moderate correlation between these variables.

The literature reports that mouth-breathing patients frequently exhibit the habitual tongue position on the floor of the mouth[14,15], open or half-open lips[15,16], which favors the posteroinferior rotation of the mandible[17], an increase in the mandibular plane[17] and the antigonic incisura[18], characterizing a predominantly vertical craniofacial growth, dolichofacial type. This can explain the findings of the present study, confirming the influence of breathing mode on the increase of all measurements performed in the vertical plane.

The findings in this study partially support results of other authors[19], who compared the facial anthropometric measures among children with no speech-language complaints, and mouth-breathing children aged seven to 11. The authors verified a statistically significant difference in the measures of the upper lip, lower lip, lower third and the right and left side of the face, and no significant differences were evident in the averages of the middle third in none of the age groups studied.

On the other hand, it became evident that the measures of the sides of the face and facial height correlate only with gender (Table 3), the averages being higher in males (Table 2), with no association with the breathing mode verified.

Regarding the averages obtained, it can be observed that the middle third and lower third of the face are close to the values suggested by the literature on adult patients (55 to 65 mm)[20]. An aspect that draws attention are the higher values of the middle thirds than those in the lower thirds, which is in accordance with only one study selected, that have found the middle third significantly higher in adult nipo-brazilian women when compared with black and white women, whose lower third was higher[12]. These results differ from other studies that verified that the middle third was lower than the lower third[8,11,21,22]. Despite the fact that only leukoderma subjects have been included, the ample racial miscegenation in Brazil, found especially in the state of Rio Grande do Sul, have probably influenced this outcome, since most of the studies with other samples of Brazilians showed that the middle third is lower than the lower third.

Another interesting finding refers to the average value of the upper lip measure, which was significantly higher in mouth-breathing subjects than in nasal breathers. Although some studies mention the shortened upper lip as one of the clinical characteristics of the mouth breather[23,24], as well as in other research carried out with children[8,19], this characteristic was not found in the anthropometric assessment. This probably occurs due to the solicitation of labial closure during the assessment, which may generate a muscular effort that is able to compensate the aspect of the shortened upper lip[8]. In other study, a statistically significant difference

was verified in the measure of the upper lip by analyzing the variable 'habitual resting position' with and without labial closure, which was higher in the first situation[25].

In the analysis of facial measurements according to the variable 'gender', it was verified that all the anthropometric measures performed were significantly higher in males than in females (Table 2), which is in accordance with the literature[10,11,13]. This study confirmed the hypothesis that there is a sexual dysmorphism in facial measurements in adults, since all the anthropometric measurements showed an association with the variable 'gender' in Pearson's Correlation test (Table 3). This finding confirms the need to take into account this variable when designing studies involving facial anthropometric measurements.

On the basis of the aforementioned, it was possible to verify that the variable 'breathing mode' is associated with the anthropometric measurements performed in the vertical plane in adult subjects; on the other hand, the variable 'gender' is associated with all the anthropometric measures obtained. However, other independent variables that have not been studied, such as race/ethnicity[9,11,26-28] and facial typology[10,29], may also impact the facial anthropometric measures, as demonstrated in previous studies. Accordingly, it is recommended further research that applies a similar analysis model, taking into account other variables that may impact the facial anthropometric measures.

In this study, it was possible to detect that mouth-breathing subjects showed a predominantly vertical pattern of growth, confirming therefore the influence of the breathing mode alteration on craniofacial morphology. For this reason, it must be stressed the need of multidisciplinary follow-up and treatment of mouth breathing mode during childhood, to minimize the negative effects before the period of craniofacial growth spurt.

CONCLUSION

The facial anthropometric measures of the vertical plane were higher in mouth breathers, suggesting a more elongated facial pattern of growth in these subjects.

Sexual dimorphism was observed in all the measures obtained (vertical, horizontal and cross-sectional plane), with all the measures being higher in males.

RESUMO

Objetivo: comparar as medidas antropométricas faciais de adultos segundo o modo respiratório e o sexo. **Métodos:** a amostra do estudo foi constituída por 82 sujeitos adultos, na faixa etária entre 18 e 35 anos, 59 do sexo feminino e 23 do sexo masculino. A partir das avaliações fonoaudiológica e otorrinolaringológica, foram diagnosticados 46 respiradores nasais e 36 respiradores orais. As medidas faciais foram obtidas com paquímetro e comparadas segundo diagnóstico do modo respiratório e sexo dos sujeitos, utilizando-se o teste t de Student e da Correlação de Pearson, com nível de significância de 5%. **Resultados:** as medidas antropométricas verticais (terço médio, terço inferior, altura facial, lábio superior e lábio inferior) foram significantemente maiores nos respiradores orais e apresentaram correlação positiva com o modo respiratório. Todas as medidas faciais realizadas foram maiores no sexo masculino e mostraram correlação positiva com a variável sexo. **Conclusões:** as medidas antropométricas faciais do plano vertical foram maiores nos respiradores orais, sugerindo padrão de crescimento facial mais alongado nesses sujeitos. Todas as medidas antropométricas faciais obtidas nos planos vertical, horizontal e transversal foram maiores nos sujeitos do sexo masculino.

DESCRITORES: Face; Medidas; Antropometria; Respiração Bucal; Adulto

REFERENCES

1. Marchesan IQ, Krakauer LR. The importance of respiratory activity in myofunctional therapy. Int J Orofacial Myology. 1996;22:23-7.

2. Berwig LC, Silva AM, Côrrea EC, Moraes AB, Montenegro MM, Ritzel RA. Hard palate dimensions in nasal and mouth breathers from different etiologies. J Soc Bras Fonoaudiol. 2011;23(4):308-14.

3. Genaro KF, Berretin-Felix G, Rehder MIBC, Marchesan IQ. Orofacial myofunctional evaluation: MBGR protocol. Rev CEFAC. 2009;11(2):237-55.

4. Marchesan IQ, Berretin-Félix G, Genaro KF. MBGR protocol of orofacial myofunctional evaluation with scores. Int J Orofacial Myology. 2012;38:38-77.

5. Bolzan GdP, Berwig LC, Prade LS, Weinmann ARM, Moraes ABd, Silva AMTd. Agreement between Anthropometry and cephalometry methods in classification of the facial type. Rev CEFAC. 2014;16(1):222-7.

6. Bolzan GdP, Souza JA, Boton LdM, Silva AMTd, Corrêa ECR. Facial type and head posture of nasal and mouth-breathing children. J Soc Bras Fonoaudiol. 2011;23(4):315-20.

7. Cattoni DM, Fernandes FDM, Di Francesco RC, Latorre MdRDdO. Anthropometric orofacial measurements and proportions in mouth breathing children. Rev Soc Bras Fonoaudiol. 2008;13(2):119-26.

8. Bolzan GdP, Silva AMTd, Boton LdM, Corrêa ECR. Study of anthropometric measurements and orofacial proportions of nasal- and mouth-breathing children from different etiologies. Rev Soc Bras Fonoaudiol. 2011;16(1):85-91.

9. Zhuang Z, Landsittel D, Benson S, Roberge R, Shaffer R. Facial anthropometric differences among gender, ethnicity, and age groups. Ann Occup Hyg. 2010;54(4):391-402.

10. Ramires RR, Ferreira LP, Marchesan IQ, Cattoni DM, Andrada e Silva MAd. Adult facial anthropometric measurements according to facial type and gender. Rev CEFAC. 2011;13(2):245-52.

11. Nascimento WV, Cassiani ReA, Dantas RO. Effect of gender, height and race on orofacial measurements. Codas. 2013;25(2):149-53.

12. Sá TBFd, Cattoni DM, Nemr K. Nipobrazilians orofacial measurements after pubertal growth. Rev CEFAC. 2013;15(2):411-9.

13. Jeremić D, Kocić S, Vulović M, Sazdanović M, Sazdanović P, Jovanović B et al. Anthropometric study of the facial index in the population of central Serbia. Arch. Biol. Sci. 2013;65(3):1163-8.

14. Cattoni DM, Fernandes FD, Di Francesco RC, Latorre MoR. Characteristics of the stomatognathic system of mouth breathing children: anthroposcopic approach. Pró-Fono R Atual. Cient. 2007;19(4):347-51.

15. Andrada e Silva MAd, Marchesan IQ, Ferreira LP, Schmidt R, Ramires RR. Posture, lips and tongue tone and mobility of mouth breathing children. Rev CEFAC. 2012;14(5):853-60.

16. Pacheco AdB, Silva AMTd, Mezzomo CL, Berwig LC, Neu AP. Relation between oral breathing and nonnutritive sucking habits and stomatognathic system alterations. Rev CEFAC. 2012;14(2):281-9.

17. Lessa FCR, Enoki C, Feres MFN, Valera FCP, Lima WTA, Matsumoto MAN. Breathing mode influence in craniofacial development. Rev Bras Otorrinolaringol. 2005;71(2):156-60.

18. Cotrim-Ferreira F, Valle-Corotti KMd, Lopes PdML, Junqueira TH, Stocco JR. Associação entre o padrão respiratório e a morfologia mandibular. Rev odontol Univ Cid São Paulo. 2009;21(1):18-23.

19. Cattoni DM, Fernandes FD, Di Francesco RC, De Latorre MoR. Quantitative evaluation of the orofacial morphology: anthropometric measurements in healthy and mouth-breathing children. Int J Orofacial Myology. 2009;35:44-54.

20. Suguino R, Ramos AL, Terada HH, Furquin LZ, Maeda L, Silva Filho OGd. Análise facial. Rev dent press ortodon ortop maxilar;. 1996;1(1):86-107.

21. Cattoni DM, Fernandes FD. Facial measurements and proportions in children: contributions to orofacial myofunctional evaluation. Pró-Fono R Atual. Cient. 2004;16(1):7-18.

22. Cattoni DM, Fernandes FDM, Andrade CRFd, Larorre MdRDdOL. Estudo sobre as medidas faciais em crianças: correlações com alteração de mordida e uso de aparelho ortodôntico. Rev Soc Bras Fonoaudiol. 2005;10(1):1-6.

23. Di Francesco RC, Passerotii G, Paulucci B, Miniti A. Mouth breathing in children: different repercussions according to the diagnosis. Rev Bras Otorrinolaringol. 2004;70(5):665-70.

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

25. Daenecke S, Bianchini EM, da Silva AP. Anthropometrical measurements of the height of the upper lip and length of the philtrum. Pró-Fono R Atual. Cient. 2006;18(3):249-58.

26. Porter JP, Olson KL. Anthropometric facial analysis of the African American woman. Arch Facial Plast Surg. 2001;3(3):191-7.

27. Parro FM, Toledo MRd, Gomes ICD, Marchesan IQ. Diferenças antropométricas entre mulheres brancas e negras após crescimento puberal. Rev CEFAC. 2005;7(4):459-65.

28. Salah M, Higzi MA, Ali RW, Naini FB. The Sudanese female face: Normative craniofacial measurements and comparison with African-American and North American White females. J Craniomaxillofac Surg. 2014;42(8):1704-9.

29. Guedes SPdC, Teixeira BV, Cattoni DM. Orofacial measurements in teenagers from Rio de Janeiro State according to facial typology. Rev CEFAC. 2010;12(1):68-74.

http://dx.doi.org/10.1590/1982-021620151765215
Received on: April 14, 2015
Accepted on: July 08, 2015

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