

FACIAL MEASUREMENTS IN ADULTS WITH NO OROFACIAL COMPLAINTS: COMPATIBILITY BETWEEN ANTHROPOMETRIC MEASUREMENTS AND FACIAL PERCEPTION

Medidas faciais em indivíduos adultos sem queixas orofaciais: compatibilidade entre medidas antropométricas e percepção facial

Karoline Weber dos Santos ⁽¹⁾, Deisi Cristina Gollo Marques Vidor ⁽²⁾

ABSTRACT

Purpose: to verify the compatibility between findings of facial measurements by caliper and perception of facial features made subjectively by an experienced evaluator. **Methods:** 24 female and 24 male subjects, paired for sex and age, without morphological and functional complaints of the stomatognathic system were evaluated. Aspects of symmetry between the middle and lower thirds, height and width of the face, and outer corner of the right and left eyes to the corners of the right and left respectively lip were evaluated. Each measurement was performed three times by a digital caliper to consider the average of these values, considering asymmetric comparisons with differences more than 4 millimeters. The width of the face was obtained through digital caliper fitted with extension 10 centimeters. The evaluation of the perception of facial features was performed by a blinded evaluator as to the digital caliper measurements that should point symmetries and asymmetries in these same evaluative aspects. **Results:** through the agreement Kappa and Chi- square test, it was possible to verify proper compatibility between the assessments, demonstrating the reliability of the methods used. Furthermore, it was found that there is a relationship between symmetry thirds of the face and assignment of facial typology on the perceptual evaluation, observing symmetry in medium and short faces and absence of a decisive standard for long faces. **Conclusion:** the characterization of facial symmetry by a digital caliper has a good compatibility with the subjective perception of an experienced evaluator.

KEYWORDS: Anthropometry; Face; Stomatognathic System; Perception

■ INTRODUCTION

Aspects of facial symmetry cover a range of features that concomitantly act to create its concept. Implicitly, they contribute to form the concept of beauty as well as assimilation of familiarity between individuals¹. Nowadays, these aspects have been

used to help to recognize individuals in many areas, contributing to better identify subjects. Specifically in the health area, it becomes very important in the characterization of musculoskeletal face disorders².

Much has been discussed in the literature regarding the best methods to measure facial symmetry. It is known that small aspects of facial asymmetry may not become relevant and do not generate a significant impact in functional and aesthetic terms. However, facial asymmetry caused by genetic syndromes, craniocerebral trauma, as well as dental malocclusion and respiratory changes can be functionally striking³.

Considering these cases, which often require surgery for reconstruction of face segments,

⁽¹⁾ Universidade Federal de Ciências da Saúde de Porto Alegre/ UFCSPA – Porto Alegre/RS – Brasil.

⁽²⁾ Departamento de Fonoaudiologia na Universidade Federal de Ciências da Saúde de Porto Alegre/ UFCSPA – Porto Alegre/RS – Brasil.

Conflict of interest: non-existent

symmetry is an aspect that should be calculated accurately. Besides the aesthetic issue, it is necessary to measure the impact of facial symmetry in the functions of the stomatognathic system. Thus, in addition to the visual perception of the surgeon, graphical models are also used to calculate the distance between the principal points, looking for a positive relationship between the regions of the face⁴.

Thinking about the speech therapy clinic, the main objective of this analysis is to verify the impact of asymmetries in oral functions. In this context, techniques for clinical evaluation of the perception of symmetry are used; evaluations by photographs and radiographic images, using computer programs to measure the distance between points of the face; and also measurement of these points using caliper, digital or analog⁵. Within this perspective, the literature indicates that, for the measurement to be correctly performed, the main aspects that have to be considered are related to the establishment of fixed points of measurement that should be done by an appraiser with expertise in the evaluation⁶. Moreover, the interpretation of the findings must have a fixed standard to determine asymmetries by checking the difference between measures that are related, considering a difference greater than 4mm as an asymmetric pattern^{7,8}.

Although quantitative methods are increasingly present in the speech therapy clinic, clinical perception is the most used method. Mainly in aesthetic terms, the perception of the subject and the evaluator is what will effectively determine the satisfaction with facial symmetry^{1,3} and, consequently, the therapeutic approaches. Nevertheless, the clinical perception is commonly dismissed as too subjective, with few basements that justify it, confronting with objective measures.

Based on these data, the aim of this study is to verify the compatibility between the findings of facial measurements by caliper and the perception of facial features made subjectively by an experienced evaluator. Moreover, the study also aims to determine if the relationship between the thirds and hemi-faces measured by caliper influence the perception of face typology.

■ METHODS

This study is a prospective cross-sectional and comparative analysis, approved by the Ethics and Research Committee of the researchers origin institution under protocol 1375/11. All participants signed an informed consent after explanation of the objectives and procedures of the study.

Comprised the sample of this research, forty eight subjects who volunteered to participate after disclosure for sampling. For better distribution, was performed stratification of the sample using the pairing between individuals by sex and age. Four age groups were determined, subdivided into eighteen to twenty five, twenty six to forty, forty one to sixty and more than sixty one. In each age group, twelve subjects, six females and six males were evaluated.

In the study, were included subjects that were within the established age groups; healthy; with no diagnosis of neurodegenerative or systemic changes, salivary, orofacial anatomic; with no changes in the upper airway, in speech therapy, and no complaints of orofacial changes, such as pain or dysfunction.

Before the measurements, facial points were marked, with eyeliner, corresponding to the measures to be undertaken in order to standardize fixed points, including: glabella (g), subnasal (sn), gnathion (gn), prominences of the zygomatic arches, outer corner of the eyes (ex) and cheilion (ch). To obtain the data, was performed the measurement of each item of the protocol three times with digital caliper and considered the average of these values to obtain the final data. Measurements were performed by an expert evaluator. Were obtained the measurements of the middle (g-sn) and lower thirds (sn-gn), height (gn-g) and width (prominence of the zygomatic arches), outer corner of the eye to the lip commissure of the right and left sides (ex-ch right and ex-ch left), respectively, performed as described in the literature⁹. Face width was measured by digital caliper adapted to the extension of 10 inches.

To compare the quantitative values measured by caliper with categorical variables of perceptual evaluation, these measurements were compared and classified as symmetric or asymmetric according to the reference values of symmetry described in the literature, considering symmetric the differences of until 4 mm between the comparatives of thirds and hemi-faces^{7,8}. In the relationship between height and width, when the difference between the comparatives occurred positively, height greater than width by more than 4 mm, it was considered a long face; when it occurred until or equal to this value, with a positive or negative difference, medium face; and when it occurred in a negative way, height less than width with a difference of more than 4 mm, short face.

The perceptual evaluation of facial proportions was performed by a blinded judge in relation to the data measured by caliper, who described aspects of proportion between thirds of the face, ranking them

in balanced, the lower third greater or lower than the middle third; facial typology, ranking in medium, long or short face; and sorting the symmetry between facial sides in symmetrical or asymmetrical.

As the primary outcome, the compatibility between the two analyses was verified; and as the secondary, if the symmetry between the thirds and hemi-faces is related to the determination of face typology in the perceptual evaluation.

The data collected were analyzed using descriptive statistics and statistical tests. The Shapiro Wilk test was used for assessing normality of variables. We calculated the concordance analysis Kappa and Chi-square test to assess the relationship between tests of facial perception and caliper measurements. Results were considered significant with a maximum level of significance of 5% and the statistical software used for data analysis was SPSS version 20.0.

■ RESULTS

In total, 24 women with a mean age of 42.08 and 24 men with a mean age of 42.78 were evaluated, demonstrating the homogeneity of the sample. Table 1 shows the results of the Kappa agreement between the assessments test, observing a substantial relationship between the characterization of face

typology in the perceptual evaluation and caliper measurements for all face typologies.

Regarding Table 2, there is a relationship between the perception of symmetry between the hemi-faces and facial measurements by caliper. Through the results of the Kappa test, it is observed that there is a substantial agreement between the pattern of symmetry assigned in both tests.

By chi-square test, can be seen, in Table 3, a relationship between the characterization of symmetry of thirds of the face in the assessments, demonstrating that the balance between thirds is related to the symmetry measured by caliper, as well as the feature attributed to lower third lower than the middle third is related with the appearance of asymmetry, not having a specific feature of symmetry when the lower third is greater than the middle.

The data in Table 4 shows the relationship between the perception of facial typology with symmetry between the thirds and between the sides of the face measured by caliper. By chi-square test, it is found that the symmetry between the thirds is associated with medium and short faces, not verifying a pattern of symmetry and/or asymmetry in long faces. In relation to the sides of the face, it can be seen that this aspect is predominantly characterized symmetrical in all face typologies.

Table 1 – Compatibility between perception of facial type and measurement by caliper

		Facial Typology		
		Medium (n = 21)	Long (n = 22)	Short (N = 5)
SHW	Medium	16 (76,19%)		
	Long		22 (100%)	
	Short			3 (60%)

Legend: SHW – symmetry between height and width measured by caliper.
Kappa = 0,748 (p <0,00)

Table 2 – Compatibility between perceived symmetry of the hemi-faces and measurement by caliper

		Proportion sides of the face	
		Symmetric (n = 40)	Asymmetric (n = 8)
SS	Symmetric	39 (97,5%)	
	Asymmetric		6 (75%)

Legend: SS – symmetry between the sides of the face measured by caliper.
Kappa = 0,763 (p <0,00)

Table 3 – Compatibility between perceived symmetry between thirds of the face and measurement by caliper

		Proportion of thirds of the face		
		B (n = 31)	TIME (n = 6)	TIMA (n = 11)
ST	Symmetric	27 (87,09%)	1 (20%)	5 (45,45%)
	Asymmetric	4 (14,81%)	5 (80%)	6 (54,54%)

Legend: ST – symmetry between the thirds of the face measured by caliper; B – balanced; TIME – Lower third lowest.; TIMA – Lower third largest.

Chi-square = 15, 21 ($p < 0,00$)

Table 4 – Relationship between perception of facial typology and symmetry between the thirds and hemi-faces measured by caliper

		Facial Typology		
		Mediun (n = 21)	Long (n = 22)	Short (n = 5)
ST	Symmetric	18 (85,72%)	11 (50%)	4 (80%)
	Asymmetric	3 (14,28%)	11 (50%)	1 (20%)
SS	Symmetric	20 (95,23)	17 (77,27%)	4 (80%)
	Asymmetric	1 (4,76%)	5 (22,72%)	1 (20%)

Legend: ST – symmetry between thirds; SS – symmetry between the sides of the face.

Chi-Square ST X SS = 6,70 ($p < 0,035$)

Chi-Square SL X SS = 2,91 ($p < 0,023$)

■ DISCUSSION

In cases which there are a facial disorder, the main aspect to be evaluated is the face typology. In functional terms, the characterization of the face and the relationship between the parts that compose it allow predicting which aspects can be changed when a disharmony occurs, being possible to anticipate potential disorders associated with a certain face typology¹⁰. It is known that faces that have a disproportion relationship between vertical and horizontal plane, like the long and short types, are more predisposed to develop dental malocclusion and myofunctional disorders, since there is an imbalance of muscle loads, of which certain regions tend to have a backlog of work^{10,11}. Moreover, this characterization makes it possible to perform a comparative between the characteristics after some intervention¹².

Thinking about that, beyond the functional assessment of the facial muscles, it is necessary to characterize the face to establish a relationship between the structures and to determinate asymmetries that may contribute to the pathological functionality of the process. Data from this study helped confirm that the characterization of face typology through the use of an objective instrument,

the caliper, and perceptual evaluation, performed subjectively by an experienced evaluator, were substantially similar, indicating the reliability between the methods for this characterization. It is believed that this relationship occurs in a similar manner due to the fact that the disproportion between height and width of the face are easily detected by professionals who have experience on it, with the observation guided by the knowledge of numerous assessments. Furthermore, clinical evaluation also uses a set of information about other facial regions that contribute to characterize the face and are typically observed in certain face typologies, besides the relationship between height and width, especially on long faces, on which was observed greater compatibility between analyzes¹³.

This result may be related to the fact that the perceptual characterization of medium and short faces may have a difficulty to differentiate them, even by an experienced professional, due to the fact that not all individuals with short faces have classic features of this face typology, such as prominence of the masticatory muscles; and disproportions between segments do not occur so clearly as in the cases of long face¹⁴. Nevertheless, we observed a good compatibility between the perceptual analysis and the measurements by caliper, pointing the

reliability between the methods, as seen in a previous study¹².

Few studies in the literature describe methods that are trustworthy to characterize the face typology, since other facial segments contribute to this characterization¹⁵. Despite conflicts between studies in the literature that showed that there is not a direct relationship between the measurement by caliper and perceptual evaluation, it is important to note that different methods of objective assessment were used¹⁵⁻¹⁷, which changes the perspective of facial analysis that cannot be employed in the perceptual evaluation. Nevertheless, the relationship between the caliper measurements used in this study proved to be very accurate with the perception of face typology, as are numerical relations that are implicitly used to evaluate the perception of face typology, hypothesis confirmed according to the presented results. In many cases, this perception becomes the deciding factor for the characterization, since it is not always possible to obtain relations that correspond to the performances presented.

Besides the relationship between height and width allows inferences about the functional changes, the relationship between the hemi-faces also allows this characterization, especially being related to masticatory changes, parafunctional habits and disorders of the temporomandibular joint¹⁷. This evaluation also revealed a substantial relationship between analyzes performed, observing nearly a full compatibility between tests to determine symmetry. This relationship is due to the fact that the asymmetries between these regions have an impact very significant in the whole face, that may also cause distortion of the middle line and asymmetry in the horizontal plane. Nevertheless, it becomes a little harder to characterize the cases of asymmetry, since, as discussed above, it becomes necessary that the commitment of symmetry occurs more generally in order to be noticed, being the assessment by caliper more sensitive for detecting small asymmetries between the segments that may be contributing to the pathological functioning¹⁸.

The same situation occurs in the characterization of the relationship between thirds of the face, in which is observed a good reliability in establishing the balance between the thirds, being more favorable to the characterization of symmetry. It is observed that the perception of balance is related to the determination of symmetry, and a disproportion between the segments, an asymmetry. In these cases, it is observed that the lower third decreased compared to the middle third is more easily perceived as being asymmetric; when the reverse occurs, it becomes more difficult to characterize the symmetry of the face. It is believed that this occurs due to the fact

that the middle third is the main center of the face, besides being composed by the nose, which gives a three-dimensional aspect of the region, being most noticeable in cases where this region is greater to the lower third^{12,13}. To characterize the increased lower third compared to the middle third, again it appears that for this feature to be assigned, it is necessary that the mandible presents other characteristics that favor this perception, as well as mandibular prominence, which would stand in relation to the middle third.

In addition, there was an association between thirds symmetry and assignment of medium and short faces, while it is not observed a typical pattern for long faces. It is known that the relationship between the facial thirds contributes to characterize the face typology, so the middle third increased demonstrates a vertical growth of the face, since it is the main growth center, carrying out the fusion of nearly all face bones. It is commonly observed this increased growth, and, consequently, this asymmetry between thirds in individuals with long faces, which develop the vertical growth most significantly compared to the horizontal plane¹⁹. Nevertheless, as observed in this study, there may not necessarily be a noticeable asymmetry between the thirds, noting that both segments may have an exaggerated increase in relation to the horizontal plane, with a disagreement in the literature regarding which third can be effectively increased in this face typology^{20,21}.

This aspect does not occur in the same way for medium and short faces, revealing an harmonic relationship between the thirds in most cases¹⁹. Moreover, in individuals with medium faces, despite showing disproportion between thirds, this aspect is not so exacerbated that can be characterized by the perceptual evaluation, as the relationship with the horizontal plane occurs in a harmonic way, allowing characterizing it as medium. In cases of short face, most individuals have balanced facial thirds, as demonstrated in the study, both being reduced in relation to the horizontal plane^{22,23}.

■ CONCLUSION

The present data from this study allowed the observation that perceptual evaluation shows good compatibility with measurements performed by caliper, being reliable to determinate face typology and the relationship between the thirds and hemi-faces in individuals without disorders in the stomatognathical system. Furthermore, it was found that, in an implicit way, the relationship between the facial thirds is used for assignment of the facial typology

Thus, it appears that the perceptual evaluation is a reliable method for facial characterization, when performed by a professional with experience. Nevertheless, it is suggested that the use of facial measurements become routine in the speech

therapy clinic to confirm the perception of the evaluator, providing further support for the practice and also allowing a comparative goal of therapeutic outcome.

RESUMO

Objetivo: verificar a compatibilidade entre os achados de medidas faciais mensuradas pelo paquímetro e a percepção das características faciais realizada subjetivamente por um avaliador experiente.

Métodos: foram avaliados 24 sujeitos do sexo feminino e 24 do sexo masculino, pareados por sexo e idade, sem queixas morfológicas e funcionais do sistema estomatognático. Foram avaliados os aspectos de simetria entre os terços médio e inferior, altura e largura da face, e canto externo dos olhos direito e esquerdo às comissuras do lábio direita e esquerda, respectivamente. Cada medida foi realizada três vezes por paquímetro digital para consideração da média entre estes valores, considerando-se assimétricas comparações com diferenças superiores à 4 milímetros. A largura da face foi obtida por meio do paquímetro digital adaptado com prolongamento de 10 centímetros. Já a avaliação da percepção das características faciais foi realizada por um avaliador cegado quanto às medidas obtidas, devendo assinalar simetrias e assimetrias nestes mesmos aspectos avaliativos.

Resultados: por meio do teste de concordância de Kappa e Qui-quadrado, pode-se verificar uma boa compatibilidade entre as avaliações realizadas, demonstrando-se a fidedignidade entre os métodos utilizados. Além disso, verificou-se que existe uma relação entre a simetria dos terços da face e a atribuição da tipologia facial na avaliação perceptiva, observando-se simetria em faces médias e curtas e ausência de um padrão determinante para faces longas. **Conclusão:** a caracterização da simetria facial por paquímetro apresenta uma boa compatibilidade com a percepção subjetiva de um avaliador experiente.

DESCRITORES: Antropometria; Face; Sistema Estomatognático; Percepção

■ REFERENCES

1. Tinio PP, Gerger G, Leder H. Birds of a feather... Generalization of facial structures following massive familiarization. *Acta Psychol (Amst)*. 2013;144(3):463-71.
2. Ramires RR, Ferreira LP, Marchesan IQ, Cattoni DM, Silva MAA. Proposta para determinação do tipo facial a partir da antropometria. *J Soc Bras Fonoaudiol*. 2011;23(3):195-200.
3. Dey JK, Ishii M, Boahene KD, Byrne PJ, Ishii LE. Changing perception: Facial reanimation surgery improves attractiveness and decreases negative facial perception. *Laryngoscope*. 2014;124(1):84-90.
4. Willing RT, Roumeliotis G, Jenkyn TR, Yazdani A. Development and evaluation of a semi-automatic technique for determining the bilateral symmetry plane of the facial skeleton. *Med Eng Phys*. 2013;35(12):1843-9.
5. Cattoni DM. O uso do paquímetro na avaliação da morfologia orofacial. *Rev. Soc. Bras. Fonoaudiol*. 2006;11(1):52-8.
6. Berlin NF, Berssenbrügge P, Runte C, Wermker K, Jung S, Kleinheinz J, et al. Quantification of facial asymmetry by 2D analysis – A comparison of recent approaches. *J Craniomaxillofac Surg*. 2014;42(3):265-71.
7. Kim SJ, Lee KJ, Lee SH, Baik HS. Morphologic relationship between the cranial base and the mandible in patients with facial asymmetry and mandibular prognathism. *Am J Orthod Dentofacial Orthop*. 2013;144(3):330-40.
8. Huang CS, Liu XQ, Chen YR. Facial asymmetry index in normal young adults. *Orthod Craniofac Res*. 2013;16:97-104.
9. Genaro KF, Berretin-Felix, Rehder MIBC, Marchesan IQ. Avaliação miofuncional orofacial – protocolo MBGR. *Rev CEFAC*. 2009;11(2):237-55.
10. Gomes SG, Custodio W, Faot F, Cury AA, Garcia RC. Chewing side, bite force symmetry, and occlusal contact area of subjects with different facial vertical patterns. *Braz Oral Res*. 2011;25(5):446-52.
11. Gomes SG, Custodio W, Faot F, Del Bel Cury AA, Garcia RC. Masticatory features, EMG activity

and muscle effort of subjects with different facial patterns. *J Oral Rehabil.* 2010;37(11):813-9.

12. Karavaka SM, Halazonetis DJ, Spyropoulos MN. Configuration of facial features influences subjective evaluation of facial type. *Am J Orthod Dentofacial Orthop.* 2008;133(2):277-82.

13. Remmelink HJ, Kuijpers-Jagtman AM. Facial analysis without cephalometric radiography. *Ned Tijdschr Tandheelkd.* 2000;107(4):141-4.

14. Ramires RR, Ferreira LP, Marchesan IQ, Cattoni DM, Silva MAA. Tipologia facial aplicada à Fonoaudiologia: revisão de literatura. *Rev Soc Bras Fonoaudiol.* 2010;15(1):140-5.

15. Ramires RR, Ferreira LP, Marchesan IQ, Cattoni DM, Silva MA. Proposal for facial type determination based on anthropometry. *J Soc Bras Fonoaudiol.* 2011;23(3):195-200.

16. Sies ML, Farias 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.

17. Bianchini AP, Guedes ZC, Vieira MM. Estudo da relação entre a respiração oral e o tipo facial. *Rev Bras Otorrinolaringol.* 2007;73(4):500-5.

18. Castelo PM, Pereira LJ, Andrade AS, Marquezin MC, Gavião MB. Evaluation of facial asymmetry and masticatory muscle thickness in children with normal occlusion and functional posterior crossbite. *Minerva Stomatol.* 2010;59(7-8):423-30.

19. Neby M, Ivar F. Ranking fluctuating asymmetry in a dot figure and the significant impact of imagining a face. *Perception.* 2013;42(3):321-9.

20. Brito HHA, Leite HR, Machado AW. Sobremordida exagerada: diagnóstico e estratégias de tratamento. *R Dental Press Ortodon Ortop Facial.* 2009;14(3):128-57.

21. Bianchini EMG, Silva APBV. Medidas antropométricas de comprimento de lábio superior e filtro. *Pró-Fono R Atual Cient.* 2006;18(3):249-58.

22. Suguino R, Ramos AL, Terada HH, Furquim LZ, Maeda L, Silva Filho OG. Análise Facial. *Rev. Dent. Press Ortodon. Ortop. Facial.* 1996;1(1):86-107.

23. Guedes SPC, Teixeira BV, Cattoni DM. Medidas orofaciais em adolescentes do estado do Rio de Janeiro segundo a tipologia facial. *Rev CEFAC.* 2010;12(1):68-74.

Received on: February 19, 2014

Accepted on: June 30, 2014

Mailing address:

Karoline Weber dos Santos

Rua José Grimberg, 70

Porto Alegre – RS – Brasil

CEP: 91180-650

E-mail: karolweber@gmail.com