Original articles

Aesthetic face evaluation in individuals with Dentofacial Deformities

Avaliação estética da face em indivíduos com deformidades dentofaciais

Silmara Regina Pavani Sovinski[1]
Katia Flores Genaro[2]
Renata Resina Migliorucci[3]
Dannyelle Cristinny Bezerra de Oliveira Freitas Passos[2]
Giédre Berretin-Felix[2]

[1] Forma e Função Clínica de Motricidade Orofacial- Maringá (PR), Brasil.

[2] Faculdade de Odontologia de Bauru - Universidade de São Paulo - USP- Bauru (SP)-Brasil.

[3] Instituto HNARY - Bauru (SP)-Brasil.

Work made at Departamento de Fonoaudiologia da Faculdade de Odontologia de Bauru – Universidade de São Paulo, Bauru- SP, Brasil.

ABSTRACT

Purpose: to analyze the face aesthetic features of individuals with dentofacial deformities (DDF) and the possible aspects related to skin features such as wrinkles and grooves.

Methods: we evaluated 36 young adults (average 27.22 years), in three groups, DDF standard II, III and control group (CG). Facial analysis was performed using the Orofacial Myofunctional Evaluation – MBGR Protocol. We developed a facial aesthetic evaluation protocol from validated analyzes for wrinkle classification, marionette lines and grooves in the orbicularis eye area. The relevant statistical tests were performed.

Results: individuals with DDF and 50% of the control group showed changes regarding facial asymmetry and nasolabial angle, with a statistically significant difference between DDF-II, III and DDF-GC. Individuals with DDF presented a greater frequency of changes to the vertical grooves in the lips area as well as marionette lines, with no differences between groups. There was a positive correlation between procerus grooves and vertical lip grooves, grooves in the orbicularis eye region with nasolabial folds and marionette lines. The nasolabial angle was correlated with forehead grooves. Age correlated with nasolabial folds, grooves in the procerus area, marionette lines and lip grooves in the orbicular area.

Conclusion: individuals with DDF presented alterations in their facial symmetry, nasolabial angle and skin regarding wrinkles. Facial aesthetic aspects correlated with each other as well as the nasolabial angle with forehead grooves. Age also showed a correlation with facial aesthetics.

Keywords: Aesthetics; Face; Maxillofacial Abnormalities

RESUMO

Objetivo: analisar as características estéticas da face em indivíduos com deformidades dentofaciais (DDF) e os possíveis aspectos que se relacionam com aspectos da pele quanto às rugas e sulcos.

Métodos: avaliou-se 36 adultos jovens (média de 27,22 anos), em três grupos, DDF padrão II, III e grupo controle (GC). Realizou-se análise facial utilizando o Protocolo de Avaliação Miofuncional Orofacial MBGR. Elaborou-se um protocolo de avaliação estético facial a partir das análises validadas para a classificação de rugas, linhas de marionete e sulcos na região orbicular dos olhos. Aplicaram-se testes estatísticos pertinentes.

Resultados: indivíduos com DDF e 50% do GC apresentaram alteração quanto à assimetria facial e ângulo nasolabial, com diferença estatisticamente significante entre DDF-II, DDF-III e GC. Indivíduos com DDF mostraram maior frequência de alteração para os sulcos verticais na região dos lábios e linhas de marionete, sem diferenças entre os grupos. Houve correlação positiva entre sulco na região do prócero e os sulcos verticais nos lábios, sulco na região do orbicular dos olhos com o sulco nasogeniano e com as linhas de marionete. O ângulo nasolabial correlacionou-se com sulco na região da testa. A idade correlacionou-se com sulco nasogeniano, sulco na região do prócero, linhas de marionete e sulcos na região do orbicular dos lábios.

Conclusão: indivíduos com DDF apresentaram alteração de simetria facial, ângulo nasolabial e da pele quanto às rugas. Aspectos estéticos da face correlacionaram-se entre si, bem como ângulo nasolabial com sulcos na testa. A idade também demonstrou relação com a estética facial.

Descritores: Estética; Face; Anormalidade Maxilofacial

INTRODUCTION

Cosmetic surgery and dermatology use photo-grammetric and anthropometric facial analyzes to grade facial characteristics and choose procedures[1-3]. Literature shows that dentistry uses cephalometric analyzes, numerical and subjective facial analysis to verify bone, dental and muscular harmony, as well as the pleasantness and attractiveness of the smile[4-7]. Such aspects are compromised in individuals with dento-facial deformity (DFD), which may impair self-esteem[8,9].

Speech therapy uses myofunctional evaluation proposals for the diagnosis, conduct and therapeutic prognosis to understand the functional and aesthetic balance of the stomatognathic system. To do so, we analyze the face observing the skeletal, dental and muscular relationship[10,11].

As for facial aesthetics and the presence of wrinkles and skin grooves, some papers, using different study methods, have demonstrated the effectiveness of myofunctional treatment for this purpose[12-16]. In this context, the suggested evaluations involved subjective analysis before and after the speech-language intervention[12,14-16]. Two of these studies analyzed the aesthetic appearance of the nasolabial grooves, measuring them by the distance between anthropometric points[12,14]. Another, on the other hand, compared the sides of the face in relation specifically to the eyes orbicularis muscles[15]. Finally, two others demonstrated the myofunctional and aesthetic evaluation more thoroughly, observing wrinkles in various parts of the face, and on both sides, but they also observed them qualitatively[16,17]. However, we have not found any evaluation proposals grading changes, specifically in cutaneous tissue, in relation to wrinkles and grooves on the entire face, as well as their localization and the difference between both sides.

The DFD population deserves attention on the facial aspect since DFD causes functional changes[18], and these morphofunctional changes can accentuate expression wrinkles[19]. It is expected that individuals with DFD and a consequent soft tissue change, due to their own structural and functional condition, overload their facial muscular activities in a compensatory and adaptive way, predisposing the appearance of wrinkles and signs of aging.

Thus, the present study aims to analyze facial aesthetic aspects of soft tissues in individuals with DFD comparing them to a control group.

METHODS

After the approval of the Research Ethics Committee of the Faculty of Dentistry of Bauru - FDB/USP (No. 142/2011), 36 individuals paired according to gender and age (mean = 27.22 years) and facial pattern were selected and divided into three groups: 12 with DFD type II (DFD-II); 12 with type III (DDF-III), and 12 control subjects (CG).

All participants signed the Informed Consent Term.

The photographic documentation of the partici-pants' faces consisted of frontal and right side images, taken while participants were seated 1m away from a camera (Sony Cyber-shot DSC-H9) positioned on a tripod placed in front of them.

The subjective facial analysis that grades the facial pattern was used in the present study, performed according to Capelozza Filho et al. (2004) [20]. It assesses the individual in frontal and lateral norms and is recommended in the Orofacial Miofunctional Evaluation Protocol MBGR (GENARO et al., 2009) [10]. Thus, subjective facial analysis was carried out in the frontal norm for facial symmetry of the following regions: infra-orbital plane, zygomatic region, cheeks, nasolabial grooves, upper and lower lip, lips and chin commissure, as well as the mandible body and ramus. We analyzed the individuals' hemifaces, verifying if they were similar (symmetric) or different (asymmetric). The lateral norm analyzes individuals regarding their nasolabial angle, which suggests the relation between the maxilla and mandible.

We also developed an additional protocol to analyze the facial aesthetics regarding skin aspects, such as wrinkles and grooves. This protocol establishes the aesthetic analysis of nasogenian grooves, vertical ridges in the lips area and the orbicularis eye region, procerus and forehead, as well as the appearance of marionette lines, as shown in Figure 1.

The above-mentioned protocol used Glogau's wrinkle classification[21] and the validated scales for classifying marionette lines[22] and grooves in the orbicularis[23]. Duly authorized by Richard Glogau and Merz Pharmaceuticals – the copyright holders of the Validation Scales for Marionette Lines and Crow's feet described by Carruthers et al. (2008a, 2008b)[22, 23] – a protocol was developed for the analysis of facial aesthetics regarding skin aspects, by analyzing skin wrinkles and grooves in these regions and also in other areas susceptible to groove formation during facial expressions and orofacial functions.

Wrinkles were classified into types I, II, III or IV [21], as shown in Figure 2. Five types of marionette lines were investigated and classified as follows: Type Zero for absence of skin folds and visible solid lines; Type 1, type 2, type 3 and type 4, as the severity of the folds increased[22], as shown in Figure 3. Five types of wrinkles were established in the analysis of the orbicularis lines, both at rest and smiling, ranging from Zero to 4, gradually [23], according to their severity (Figure 4).

Facial Aesthetics Analysis

Nasogenian grooves [   ] (*Glogau's analysis, 1996*)

Right:	(0) type I	(1) type II	(2) type III	(3) type IV
Left:	(0) type I	(1) type II	(2) type III	(3) type IV
Symmetry:	(0) present	(1) absent	❒ > to the right	❒ > to the left

Vertical grooves in the lips region [   ] (*Glogau's analysis, 1996*)

Upper lip:	(0) type I	(1) type II	(2) type III	(3) type IV
Lower lip:	(0) type I	(1) type II	(2) type III	(3) type IV

Grooves in the procerus region [   ]

(0) absent	(1) present

Forehead lines [   ]

(0) absent	(1) present

Marionette lines [   ] (*Carruthers et al. analysis, 2008c*)

Right:	(0) type zero	(1) type 1	(2) type 2	(3) type 3	(4) type 4
Left:	(0) type zero	(1) type 1	(2) type 2	(4) type 3	(4) type 4
Symmetry:	(0) present	(1) absent	❒ > to the right	❒ > to the left	

Grooves in the orbicularis eye region [   ] (*Carruthers et al. analysis, 2008b*)

Right:	(0) type zero	(1) type 1	(2) type 2	(3) type 3	(4) type 4
Left:	(0) type zero	(1) type 1	(2) type 2	(4) type 3	(4) type 4
Symmetry:	(0) present	(1) absent	❒ > to the right	❒ > to the left	

Figure 1. Protocol of facial aesthetics analysis for skin characteristics

Adapted Glogau's scale (1996)

	Type I "no wrinkles" - Minimal wrinkles - Patient's age: 20 or 30 years old
	Type II "Wrinkles in motion - Smile lines begin to appear - Patient's age: late 30's to 40's
	Type III "wrinkles at rest" - Wrinkles even when the face is at rest - Patient's age: 50's or older
	Type IV "only wrinkles" - Wrinkles throughout, no normal skin - Patient's age: 60's or 70's

Figure 2. Adapted Glogau's scale to assess the skin aesthetical aspects.

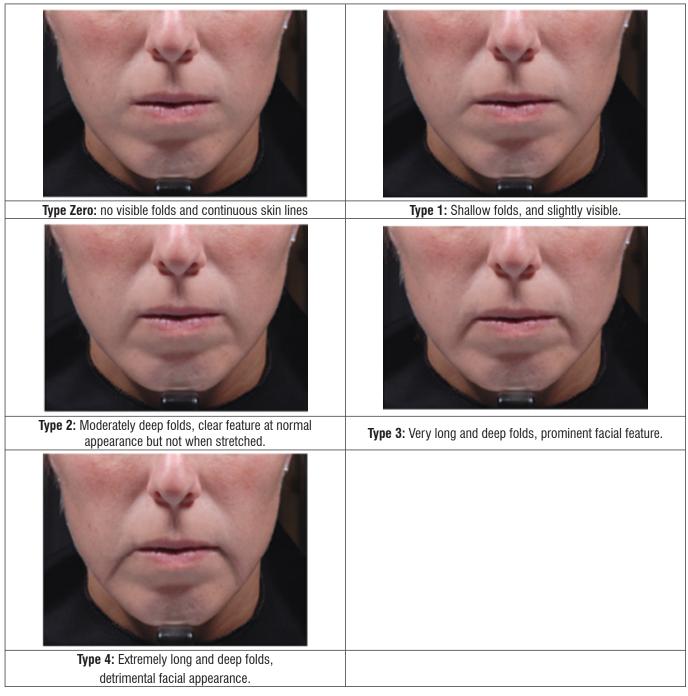## Validated grading scale for Marionette lines – Carruthers et al. (2008a)

Type Zero: no visible folds and continuous skin lines	**Type 1:** Shallow folds, and slightly visible.
Type 2: Moderately deep folds, clear feature at normal appearance but not when stretched.	**Type 3:** Very long and deep folds, prominent facial feature.
Type 4: Extremely long and deep folds, detrimental facial appearance.	

Figure 3. Validated grading scale for marionette lines.

Validated grading scale for "crow's feet" lines. Carruthers et al. (2008b)

Type Zero: no wrinkles	Type 1: Very thin wrinkles	Type 2: Thin wrinkles	Type 3: Moderate wrinkles	Type 4: Severe wrinkles
Type Zero: no wrinkles	Type 1: Very thin wrinkles	Type 2: Thin wrinkles	Type 3: Moderate wrinkles	Type 4: Severe wrinkles

Figure 4. Validated grading scale for the orbicularis eye lines.

We compared the images of the individuals in our study to those found in the reference literature[21-23]. The score zero was always standardized as the best condition for each of the evaluated aspects. The analyzes were carried out by three examiners, all specialists in Orofacial Motricity, who received a letter explaining the procedures and assigned a score according to the aesthetic condition of each item investigated. The agreement between at least two examiners was considered as a response. For the aspects in which the three evaluators assigned a different score, a joint analysis and discussion were carried out, in order to reach a consensus.

The comparison between the groups occurred through the Kruskal-Wallis and Miller tests with significant values of $p < 0.05$. Spearman correlation test was used for the analysis of the aesthetic aspects correlating with each other and with age; the significant correlation values for R (0.10-0.30=weak correlation, 0.40-0.60=moderate correlation, and 0.70-1=strong correlation). p significant values were $p < 0.05$.

RESULTS

Table 1 shows the occurrence of asymmetry for all individuals belonging to DFD groups, 50% of individuals with dentofacial balance, type I. Table 1 also shows a predominance of changes in the nasolabial angle in individuals with DFD types II and III, although they were compatible with each type of deformity. It was observed, too, that DFD-II and DFD-III groups presented a statistically significant difference in relation to the presence of symmetry and to nasolabial angle characteristics, when compared to the control ($p < 0.05$), as shown in Table 2.

Table 1. Occurrence of changes regarding the frontal facial analysis (symmetry) and lateral (nasolabial angle), for all groups

Facial Analysis	CG		DFD-II		DFD-III	
	Normal	Altered	Normal	Altered	Normal	Altered
Frontal norm: symmetry	6(50%)	6(50%)	0(0%)	12(100%)	0(0%)	12(100%)
Lateral norm: nasolabial angle	12(100%)	0(0%)	0(0%)	12(100%)	3(25%)	9 (75%)

CG= control group; DFD-II= dentofacial deformity type II; DFD-III= dentofacial deformity type III

Table 2. Kruskal Wallis and Miller tests results comparing all groups for the facial analysis regarding symmetry and nasolabial angle

Aspect	Comparison	p* value
Symmetry	GC ≠ DDF-II	<0,05
	GC ≠ DDF-III	
Nasolabial angle	GC ≠ DDF-II	<0,05
	GC ≠ DDF-III	

CG= control group; DFD-II= dentofacial deformity type II; DFD-III= dentofacial deformity type III
*Significant values- (p<0,05) Tests Kruskal- Wallis and Miller

The results obtained from the protocol of facial aesthetic evaluation showed a change in the aspects investigated in all groups. DFD groups presented a higher prevalence of vertical grooves in the lips region as well as marionette lines, but no significant differences among them (Table 3).

The data of facial analysis did not show a correlation with those analyzing facial aesthetics, except for grooves in the forehead region that presented a relation with the nasolabial angle (p = 0.03). Thus, there was a correlation between facial aesthetic aspects and the skin.

We observed a correlation between the grooves in the procerus region and the vertical grooves of the lips, as well as between the grooves in the eyes orbicularis region and the nasogenian grooves and the marionette lines. There was also a relationship between the individuals' age and their skin grooves, as shown in Table 4. This factor was significant for grooves in the nasogenian, the procerus region, orbicularis region and puppet lines.

Table 3. Frequency of changes regarding facial aesthetics features and comparison of results among all groups

Aesthetics aspect	CG		DFD-II		DFD-III		Result of statistical analysis*
	Absent	Present	Absent	Present	Absent	Present	
Nasogenian grooves	83%(n=10)	17%(n=2)	100%(n=12)	0%(n=0)	83%(n=10)	17%(n=2)	p<0,05
Vertical grooves in the lips region	75%(n=9)	25%(n=3)	58%(n=7)	42%(n=5)	58%(n=7)	42%(n=5)	p<0,05
Grooves in the procerus region	100%(n=12)	0%(n=0)	100%(n=12)	0%(n=0)	92%(n=11)	8%(n=1)	p<0,05
Forehead lines	83%(n=10)	17%(n=2)	100%(n=12)	0%(n=0)	92%(n=11)	8%(n=1)	p<0,05
Marionette lines	75%(n=9)	25%(n=3)	75%(n=9)	25%(n=3)	58%(n=7)	42%(n=5)	p<0,05
Grooves in the eyes orbicularis region	42%(n=5)	58%(n=7)	42%(n=5)	58%(n=7)	42%(n=5)	58%(n=7)	p<0,05

CG= control group; DFD-II= dentofacial deformity type II; DFD-III= dentofacial deformity type III
*Significant values- (p<0.05) Tests Kruskal-Wallis and Miller

Table 4. Results of correlation analysis between the facial aesthetics analysis variables and the results between age x facial aesthetics analysis variables

Comparison	Value for R*	p** value
Procerus grooves X lips vertical grooves	0.70	0.001
Groove in the orbicularis eye region X nasogenian groove	0.,45	0.006
Groove in the orbicularis eye region X marionette lines	0.43	0.010
Age X nasogenian groove	0.39	0.01
Age X procerus grooves	0.35	0.04
Age X marionete lines	0.39	0.02
Age X Groove in the orbicularis eye region	0.67	<0.001

* Values for R (correlation: 0.10-0.30= weak; 0.40-0.60-moderate; 0,70-1,0=strong).
** Significant values (p<0.05) – Spearman's correlation coefficient.

DISCUSSION

The face fundamentally represents the human physical appearance; its beauty and attractiveness depends on the judgment, the look and the individual preferences of those evaluating it[24]. Beauty is influenced by culture, education and the media; the interest in the pursuit of a balance has increased even in terms of other aspects such as those representing youthfulness. This factor looks for good relations of space, form, proportion, structure, movement and harmony[25].

Some of the aspects mentioned in the literature as important criteria to compose facial aesthetics are: the face outline, maxillary and mandibular balance, nasolabial folds, nasolabial angle, chin angle, neck/chin line, infra-orbital line, nose, eyes, eyebrows, thickness and shape of the lips, smile line, dental exposure, skin, wrinkles in all facial thirds, asymmetries and lip closure[24-29].

As for facial asymmetry in frontal norm, our results showed the occurrence of facial asymmetry both in individuals with DFD-II and DFD-III. Another study, performed in the pre-operative period, also found that 11 of the 17 subjects with DFD were asymmetric; however, the authors did not mention if these asymmetries were concentrated in a particular facial pattern[30].

Still considering the facial symmetry aspect, we observed a statistically significant difference between the control and DDF-II and III groups, with a greater occurrence of changes in the DFD groups, as compared to the control. Several factors may be related to asymmetries, such as genetic-congenital malformations, traumas or habits/functional deviations, the latter of which may result from individual growth or compensations[31]. The literature points out, specifically for individuals with DFD type III, six causes for asymmetry: discrepancies in the jaw height, in the mandibular length, and mandibular inclination, as well as discrepancies in the mandibular body length and height[32]. Another study also found asymmetry of the mandibular ramus in DFD type III individuals III in the pre-surgical period[33]. All these studies corroborate with our work regarding the presence of asymmetries in the pre-surgical period for individuals with DFD types II and III. However, they differ from the facial analysis used in the present study, since they used other assessment methods, such as hard tissue analysis, through radiographs, cephalometry and three-dimensional analysis.

For the lateral norm assessment, we considered the analysis of the nasolabial angle, which measures the nasal base in relation to the upper lip[20]. The analysis performed in this study was a subjective one. The statistical analysis results showed that the nasolabial angle was different between the control (type I) and the DFD-II and III groups. This corroborates with data found in the literature, which assessed only type I individuals to study the facial profile of Brazilian individuals with normal occlusal characteristics, considering that they differ from those with types II and III, particularly in the aesthetic issue. The nasolabial angle analysis allows the estimation of the discrepancy of the maxillary position observed in lateral norm in cases of DFD II and III[24,34]. As for individuals with facial types I, II and III with slight discrepancies, the literature shows that the facial profile is counterbalanced, not compromising the facial aesthetics. These authors did not find an association between the profile aesthetics and the nasolabial angle[27]. It is worth considering that our study assessed cases with maxillomandibular discrepancies of skeletal order and surgical indication.

In the speech-language facial aesthetics evaluation regarding wrinkles and grooves, the analysis occurs in a subjective and qualitative way[19]. The literature has

pointed to the need to quantify these changes[12,14-16], but no proposal of facial aesthetic evaluation with scores for changes has been found to analyze them quantitatively. In this sense, the proposal, hereby presented, specifies the grooves formation regions and can grade the severity of the aesthetic condition, according to the presented aspect.

The proposed evaluation aimed at investigating the regions predisposing the formation of grooves and proved to be complementary to the proposals of myofunctional orofacial examinations[10,11]. The analyzes found in the literature to classify the lips vertical grooves and the nasogenian grooves[21], the puppet lines[22] and the eyes orbicularis grooves[23], although classifying the evaluated aspects, do not assign them scores.

Facial aesthetic changes were observed in DFD individuals regarding wrinkles and skin grooves, corroborating with the literature[19.] Structural alterations can generate tensions and the formation of wrinkles, a fact observed in relation to the grooves and puppet lines in the lips region for DFD groups, which can be justified by compensations and lip adaptations during the orofacial functions[18].

Although the highest frequencies of changes were found in DFD groups, no significant differences were seen among them. Thus, the possibility of differences exists, but we could not confirm it, due to the size of our sample. We suggest a new study with a larger sample to confirm this trend. In addition, the literature does not show a relationship between DFD and expression wrinkles; however, researches have shown that DFD individuals had difficulties to perform facial mimics in the preoperative period[35,36].

The results obtained through the nasolabial angle analysis were also compared to those of facial aesthetics regarding wrinkles and grooves considered in this study. We only found a statistical significance when the nasolabial angle was correlated to the presence of forehead grooves. Considering that the nasolabial angle expresses the position of the anteriorized or retruded maxilla, muscular adaptations and adjustments are expected in the presence of maxillomandibular imbalance for chewing, swallowing and speech functions, as well as facial expression and mimicry. If the conditions of the face´s lower third are not balanced, both in function and in tone, there may be a compensation of the musculature in the upper third, since a facial expression needs a joint action between the lips and the entire musculature of the face, for example, smiling[37]. However, we expected to find more aesthetic aspects compromised in the DFD individuals studied, owing to their orofacial myofunctional characteristics.

Significant results for some of the aspects analyzed were observed when we correlated the aesthetic aspects. These relationships refer to the face upper and lower thirds, showing possible muscular compensations due to the structural and functional imbalance present in DFD II and III, since facial muscles function as a coordinated group and most of the expressions result from combined actions among them[38].

Therefore, the suggested proposal assesses all thirds of the face, allowing the observation of the relationship between them and assigning them numerical values. We carried out an age analysis, even though we were studying young adults, because this variable directly influences facial aesthetics, and very thin lines can be observed from 30 years of age on[10]. Surprisingly, we observed a correlation in four of the aspects analyzed: nasogenian grooves, procerus grooves, puppet lines and eyes orbicularis grooves, in other words, at a younger age than reported by the literature, considering that the average age of the subjects in our study was 27.22 years old. This result may also be attributed to the compensations performed by DFD individuals and, in this sense, the protocol of facial aesthetics analysis for skin aspects was able to classify grooves in their initial phase.

Our results showed that it is possible to grade skin changes in different regions of the face using characteristics of facial aesthetic aspects, giving them scores. Thus, this proposal can be used in the orofacial myofunctional examination to identify alterations, as well as to prove the efficacy of orofacial myofunctional therapy regarding facial aesthetics and wrinkles, and not only in DFD individuals. Its contribution can undoubtedly be directed to the entire orofacial motricity, although further studies are needed to develop all the validation steps related to the proposed protocol.

Finally, it is worth considering the methodological differences between other works described in the literature and this research, since we used a validated protocol for wrinkle analysis, along with a specific protocol for marionette lines and grooves in the eyes orbicularis region[21, 22, 23]. However, the comparison between the protocol parameters and the individuals with DFD types II and III was still subjective, using the examiners' experience and subjectivity to analyze such data.

CONCLUSION

DFD individuals presented aesthetic alterations regarding facial symmetry, nasolabial angle, and skin aesthetic aspects such as wrinkles and grooves. There was a relation between the aesthetic aspects regarding the skin, as well as the nasolabial angle with the presence of forehead grooves. Age was an important factor correlating with nasogenian grooves, procerus grooves, puppet lines and the lips orbicularis grooves.

REFERENCES

1. Gomes RS. Frontal and glabellarmyotomy: single short frontal sear approach.Rev Bras Cir Plast. 2011;26(3):446-52.

2. Pawar SS, Garcia GJM, Kinbell JS, Rhee JS. Objective measures in Aesthetic and Functional nasal Surgery – Perspectives on nasal Form and Function.FacialPlast Surg. 2010;26(4):320-7.

3. Brand VC, Souza RCA, Pedrini H, Lima HC. Avaliação da intensidade das rugas periorbitais por processamento digital de imagens: um estudo de validação. Surg. CosmeticDermatol. 2009;1(1):15-20.

4. Delalíbero HVC, Mariliane C, Pascotto RC, Terada HH, Terada RSS. Avaliação estética de pacientes submetidos a tratamento ortodôntico. Acta sci, Health sci. 2010;32(1):93-100.

5. Oliveira SR. Má Oclusão Classe III, com mordida cruzada posterior unilateral e assimetria facial. Dental Press J.Orthod. 2010;15(5):182-91.

6. Morihisa O, Machado AW, Bittencourt AL. Avaliação comparativa entre agradabilidade facial e análise subjetiva do padrão facial. Rev Dental Press OrtodOrtop Facial. 2009;14(6):46.e1-9 .

7. Morosini IAC, Peron APLM, Correia KR, Moresca R. Study of face pleasantness using facial analysis in standardized. Dental Press J Orthod. 2012;17(5):24-34.

8. Tournieux TT, Aguiar LFS, Almeida MWR, Prado LFAM, Radwanski HN, Pitanguy I. Estudo prospectivo da avaliação da qualidade de vida e aspectos psicossociais em cirurgia plástica estética RevBrasCirPlást. 2009;24(3):357-61.

9. Yoshida MM, Câmara PRP, Goldenberg DC, Alonso N. Padronização da avaliação em cirurgia ortognática. RevSocBrasCirCraniomaxilofac. 2007;10(4):125-32.

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

11. Felício CM, Folha GA, Ferreira CL, Medeiros AP. Expanded protocol of orofacialmyofuncional evaluation with scores: validity and reliability. Int J PediatrOtorhinolaryngol. 2010;74(11):1230-9.

12. Paes C, Toledo PN, Silva HJ. Fonoaudiogia e estética facial: estudo de casos. Rev. CEFAC. 2007;9(2):213-20.

13. Takacs AP, Valdrighi V, Assencio-Ferreira VJ. Fonoaudiologia e estética: unidas a favor da beleza facial. Rev. CEFAC. 2002;4:111-6.

14. Oliveira AC, Anjos CAL, Silva EHAA, Menezes PL. Aspectos indicativos de envelhecimento facial precoce em respiradores orais adultos.Pró-Fono R Atual Cient. 2007;19(3):305-12.

15. Lana e Silva N, Vieira VS, Motta AR. Eficácia de duas técnicas fonoaudiológicas da Estética Facial no músculo orbicular dos olhos: Estudo Piloto. Rev. CEFAC.2010;12(4):102-9.

16. Arizola HGA, Brescovici SM, Delgado SE, Ruschel CK. Modificações faciais em clientes submetidos a tratamento fonoaudiológico da face em clínica escola de fonoaudiologia. Rev. CEFAC. 2012;14(6):1167-83.

17. Pierotti SR Atuação fonoaudiológica na estética facial In Comitê de Motricidade Orofacial. Motricidade Orofacial- SBFa -Como atuam os especialistas. São Jose dos Campos- Pulso 2004.281 -287 303-309

18. Coutinho TA, Abath MB, Campos GJL, Antunes AA, Carvalho RWF. Adaptações do sistema estomatognático em indivíduos com desproporções maxilo-mandibulares: revisão de literatura. RevSocBrasFonoaudiol. 2009;14(2):275-9

19. Frazão Y, Manzi SB. Eficácia da intervenção fonoaudiológica para atenuar o envelhecimento facial.Rev.CEFAC.2012;14(4):755-62.

20. Capelozza Filho L, Souza SLMC, Cavassan AO, Ozawa TO. A altura facial anterior inferior nas más oclusões do padrão II, deficiência mandibular. Rev Dent Press OrtodonOrtop Facial. 2004;9(6):39-47.

21. Glogau RG. Aesthetic and anatomic analysis of the aging skin. SeminCutan Med Surg. 1996;15(3):134-8.

22. Carruthers A, Carruthers J, Hardas B, Kaur M, Goertelmeyer R, Jones D et al. A validated grading scale for marionette lines. Dermatol Surg. 2008a;34(Suppl 2):S167-72.

23. Carruthers A, Carruthers J, Hardas B, Kaur M, Goertelmeyer R, Jones D et al. A validated grading scale for crow's feet. Dermatol Surg. 2008b;34(Suppl 2):S173-8.

24. Reis SAB, Abrão J, Capelozza Filho L, Claro CAA. Análise facial subjetiva. RevDent Press OrtodonOrtop Facial. 2006;11(5):159-72.

25. Peck S, Peck L. Selected aspects of the art and science of facial esthetics. SeminOrthod. 1995;1(2):105-26.

26. Pascotto RC, Moreira M. A integração da odontologia estética com a cirurgia plástica facial. RevAssoc Paul CirDent. 2004;58(2):118-23.

27. Reis SAB, Abrão J, Claro CAA, Capelozza Filho L. Avaliação dos fatores determinantes da estética do perfil facial. Dental Press J Orthod. 2011;16(1):57-67.

28. De Maio M, OfenböckMagri I, Narvaes Bello C. Toxina botulínica: relación entre tipo de paciente y duración del efecto. CirplástIberolatinoam. 2008;34(1):19-26.

29. Feres MFN, Hitos SF, Sousa HIP, Matsumoto MAN. Comparação das dimensões de tecido mole entre padrões faciais distintos. Dental Press J Orthod. 2010;15(4):84-93.

30. Choi WS, Lee S, McGrath C, Samman N. Change in quality of life after combined orthodontic-surgical treatment of dentofacial deformities. Oral Surg Oral Med Oral PatholRadiolEndod. 2010;109(1):46-51.

31. Hwang HS, Youn IS, Lee KH, Lim HJ. Classification of facial asymmetry by cluster analysis. Am J OrthodDentofacialOrthop. 2007;132(3):279.el6.

32. Hwang HS, Hwang CH, Ki-Heon Lee KH, Kang BC. Maxillofacial 3-dimensional image analysis forthe diagnosis of facial asymmetry. Am J OrthodDentofacialOrthop. 2006;130(6):779-85.

33. Ueki K, Marukawa K, Shimada M, Nakagawa K, Yamamoto E, Niizawa S. Changes in the chewing path of patients in skeletal class III with and without asymmetry before and after orthognathic surgery. J Oral Maxillofac Surg. 2005;63(4):442-8.

34. Trevisan F, Gil CTLA. Análise fotogramétrica e subjetiva do perfil facial de indivíduos com oclusão normal. Rev Dent Press OrtodonOrtop Facial. 2006;11(4):24-35.

35. Nooreyazdan M, Trotman CA, Faraway JJ. Modeling facial movement: II. A dynamic analysis of differences caused by orthognathic surgery. J Oral MaxillofacSurg. 2004;62(11):1380-6.

36. Nafziger YJ. A study of patient facial expressivity in relation to orthodontic/surgical treatment. Am J OrthodDentofacialOrthop. 1994;106(3):227-37.

37. Sovinski SRP. Planejamento terapêutico da fonoaudiologia e estética da face. In: Pernambuco LA, Silva HJ, Souza LBR, Magalhães Jr HV, Cavalcanti RVA, organizadores. Atualidades em motricidade orofacial. Rio de Janeiro: Revinter; 2012. p. 187-97.

38. Warburton MA. Physically-based facial modelling and animation with wrinkles: 6 month report. [homepage on the internet]. Department of Computer Science University of Sheffield; Apr 2011[cited 2012 Jan. 15]. Available from:http://www.dcs.shef.ac.uk/people/M.Warburton/pdf/research/6MonRep.pdf.