DOI: 10.1590/2317-1782/20152014162

Original Article

Artigo Original

Orofacial functions and quality of life in oral health in subjects with dentofacial deformity

Funções orofaciais e qualidade de vida em saúde oral em indivíduos com deformidade dentofacial

Renata Resina Migliorucci[1]
Silmara Regina Pavani Sovinski[1]
Dannyelle Christinny Bezerra de Oliveira Freitas Passos[1]
Ana Carolina Bucci[2]
Manoel Henrique Salgado[3]
Hugo Nary Filho[4]
Dagma Venturini Marques Abramides[1]
Giédre Berretin-Felix[1]

Keywords

Speech, Language and Hearing Sciences
Malocclusion
Stomatognathic System
Mastication
Respiration
Quality of Life

ABSTRACT

Purpose: To investigate the influence of the facial pattern in orofacial functions (OFFs) and quality of life (QoL), and their relationship in individuals with dentofacial deformities (DFD). **Methods:** As approved by the Research Ethics Committee, 36 subjects, aged between 18 and 40 years, divided into three groups of seven female and five male participants, i.e., facial pattern I (n=12), pattern II (n=12) and pattern III (n=12), participated in this study. The OFFs were assessed using the MBGR protocol and QoL by the Oral Health Impact Profile (OHIP-14) questionnaire. Comparisons between OFFs and facial patterns were made using the Kruskal-Wallis test, and the correlation between the facial pattern and QoL by means of Spearman's test, considering a 5% significance level. **Results:** A significant difference ($p<0.05$) was observed when comparing patterns I and II, and patterns I and III, with no difference between patterns II and III, neither in the OHIP-14 nor in the MBGR. A significant linear correlation ($r=0.666$; $p<0.05$) was verified between the MBGR and the OHIP-14, showing that the worse the OFFs, the worse the QoL. **Conclusion:** The facial pattern influenced the performance of the OFFs and the QoL in individuals presenting DFD, with a greater occurrence of changes for patterns II and III, and the worse the OFFs, the worse the QoL in cases with DFD.

Descritores

Fonoaudiologia
Má Oclusão
Sistema Estomatognático
Mastigação
Respiração
Qualidade de Vida

RESUMO

Objetivo: Verificar a influência do Padrão Facial nas funções orofaciais (FOF) e na qualidade de vida (QV), e a relação entre elas em indivíduos com deformidades dentofaciais (DDF). **Métodos:** Aprovado pelo Comitê de Ética em Pesquisa. Participaram 36 indivíduos entre 18 e 40 anos de idade, distribuídos em 3 grupos: Padrão I (n=12), Padrão II (n=12) e Padrão III (n=12), sendo 7 mulheres e 5 homens. As FOF foram avaliadas pelo protocolo MBGR e a QV foi aplicado o questionário *Oral Health Impact Profile* (OHIP-14). Para as comparações entre as FOF e os Padrões Faciais, foi aplicado o teste de Kruskal-Wallis, e para a correlação entre Padrão Facial e QV, o coeficiente de correlação de Spearman, considerando nível de significância de 5%. **Resultados:** Houve diferença significativa ($p<0,05$) ao comparar os Padrões Faciais I e II, e os Padrões I e III, não tendo sido encontrada diferença entre os Padrões II e III, tanto para o OHIP-14 como para o MBGR. Verificou-se correlação linear significativa ($r=0,666$; $p<0,05$) entre o MBGR e o OHIP-14, demonstrando que quanto piores as FOF, pior também a QV. **Conclusão:** O Padrão Facial influenciou o desempenho das FOF e a QV em indivíduos com DDF, com maior ocorrência de alterações para os Padrões Faciais II e III.

Correspondence address:
Renata Resina Migliorucci
Faculdade de Odontologia de Bauru. Departamento de Fonoaudiologia
Alameda Octávio Pinheiro Brisola, 9-75, Bauru (SP), Brasil, CEP: 17012-901.
E-mail: reresina@uol.com.br

Received on: 05/09/2014

Accepted on: 17/12/2014

Study carried out at the Graduate Program in Speech Language Pathology and Audiology, from the Speech Language Pathology and Audiology Department from the School of Dentistry of Bauru, Universidade de São Paulo – USP – Bauru (SP), Brazil. This paper was presented at the 21st Brazilian Congress of Speech Language Pathology and Audiology and at the 2nd Ibero-American Congress of Speech Language Pathology and Audiology, in 2013.
(1) Graduate Program in Speech Language Pathology and Audiology, School of Dentistry of Bauru, Universidade de São Paulo – USP – Bauru (SP), Brazil.
(2) Department of Speech Language Pathology and Audiology, School of Dentistry of Bauru, Universidade de São Paulo – USP – Bauru (SP), Brazil.
(3) Department of Production Engineering, Universidade Estadual Paulista "Júlio de Mesquita Filho" – UNESP – Bauru (SP), Brazil.
(4) Department of Bucomaxillofacial Surgery and Traumatology, Universidade do Sagrado Coração – USC – Bauru (SP), Brazil.
Financial support: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES.
Conflict of interests: nothing to declare.

INTRODUCTION

Individuals with dentofacial deformities (DFD) have myofunctional characteristics that vary according to the type of disproportion they present[1], because there are adaptations in the stomatognathic system as to its morphology and functionality. Throughout life, these individuals develop adaptations and compensations for the performance of orofacial functions (OFFs)[2-5]. In a literature review, it was observed that people with prognathism and retrognathism present adaptations in all functions performed by the motor oral system, in the pre-orthognathic surgery period[6].

In Facial Pattern II, regarding the OFFs, we could find oral breathing through the convex facial profile[1,5]. One study observed that 90.9% individuals with skeletal class II malocclusions present chronic unilateral chewing pattern[7], chewing with anterior mandibular slide, in the intention to increase the intraoral space, and in rapid and reduced chewing cycles[2]; the swallowing process is very adapted, with anterior mandibular slide, posteroanterior tongue movement, tongue interposition and participation of perioral muscles[2,6], and becomes more difficult by the lack of lip seal[8]; speech with adaptation to sibilant or fricative phonemes, which are accompanied by excessive and articulated mandibular slide, and the tongue is projected between the teeth[9]. It is also possible to present slurred speech as a consequence of the decreased general muscle activity and of the inadequate use of the "resonance box," thus leading to hyponasal resonance[10].

The OFFs in individuals with Facial Pattern III may present respiratory changes, usually oral or oronasal alteratiosn, justified by the concave profile and the long face, which is common in prognathism[6]. Chewing is the most adapted function, being characterized by vertical movements using the dorsum of the tongue to smash the food; chewing muscles are little used[1,5,6]. Researchers published that 63.6% of the subjects with skeletal class III presented chronic unilateral chewing pattern[7]; swallowing usually takes place with several adaptations, such as tongue interposition, perioral musculature, forward head posture, and incoordination between the swallowing and breathing processes[2], which becomes more difficult due to the lack of lip seal and anterior mandibular slide[2]; speech can manifest changes regarding sound articulation, such as distortion during the production of the /s/ phoneme; the sigmatism of sibilants is the most common speech disorder[11].

Besides the functional repercussions, changes in facial harmony and aesthetics also stand out, and can cause psychological, social, and professional implications for the patients; consequently, they can interfere in the quality of life (QoL)[6]. Some researchers indicate DFD as being the most severe one due to its physical, economic, social, and psychological consequences, thus possibly affecting the QoL of these people[12].

On the basis of a literature review about the impact of malocclusion on QoL, researchers observed that malocclusion and its treatment can affect the physical health in terms of pain (temporomandibular disorder, dental and gum trauma), speech and chewing[13]. When it comes to psychological health, there are losses regarding self-concept and, socially, it can affect the attractiveness perceived by others, as well as social and intellectual acceptance[14,15]. Some authors concluded that there are controversies regarding the impact of malocclusion and its treatment on QoL; therefore, it is necessary to conduct a more rigorous evaluation using standardized, validated, and reliable instruments[13].

According to the researchers, instruments used to assess QoL regarding general and oral health are useful to determine such changes during treatment[16]. One study showed decreasing tendency in scores considering the preoperative results in comparison to postsurgery results, in which individuals had reported high impact on the QoL measured by the Oral Health Impact Profile (OHIP-14) before the orthognathic surgery[17].

Therefore, literature has contemplated the orofacial myofunctional characteristics of individuals with DFD, as well as the perception of patients regarding oral health to understand their needs. However, no studies were found that related the performance of OFFs to the oral health-related QoL in this population, once most published studies refer to the results obtained after orthognathic surgery. Therefore, the objective of this study was to verify the influence of Facial Pattern on OFFs and on QoL, as well as the relationship between orofacial myofunctional conditions and oral health-related QoL among individuals with DFD.

METHODS

The documents of participants who were part of the sample in the research project "*Efeito da cirurgia ortognática sobre o sistema miofuncional orofacial e cervical*" were analyzed. This research project was approved by the Human Research Ethics Committee at the Educational Institution where the project was carried out, process n. 049/2009. The recruited individuals expressly agreed to participate and signed the informed consent.

Inclusion criteria were the following: individuals aged between 18 and 40 years, presenting DFD diagnosed by the surgeon as being bucomaxilofacial, and being on preparatory dental treatment for orthognathic surgery. Exclusion criteria were the following: having been submitted to other orthognathic surgeries, presenting phenotypic signs of syndromes, history of neurological and psychiatric problems, and insufficient understanding to answer the questionnaires. These data were obtained by a focused interview about these aspects.

Thirty-six individuals participated in the study, aged between 18 and 40 years (mean=27.22), distributed into three groups according to the Facial Pattern classification[18]: Pattern I (n=12), Pattern II (n=12), and Pattern III (n=12), being seven female and five male participants in each group.

The data in this study were collected from medical records, photographic and recorded documentation of the study participants. The following aspects were considered: clinical history, orofacial myofunctional examination, and photographic and recorded records of the tasks proposed in the MBGR protocol[19]; data were collected by a researcher and speech language pathologist who were properly trained and calibrated to execute the procedures.

For the analysis of the OFFs, the opinions of three other speech language pathologists were required. They were experts in Orofacial Motricity and had a minimum of three years of experience in the field. These professionals were asked to analyze the pictures and films of the individuals, which were stored in a CD-ROM and accompanied by a list of orientations, as well as a Microsoft Excel® file; there all aspects of the MBGR protocol were contemplated, including the response possibilities and their respective attributed scores. The analyses were conducted separately by each specialist, and the result was considered when at least two of them agreed on it. When there was no agreement between the three evaluators, they analyzed it together and reached a consensual result.

The OFFs were assessed based on tasks established by the MBGR protocol[19], and scores were specified in the protocol, considering zero to be adequate and higher values as altered. The higher the score, the worse the performance. In breathing (scores 0–9), mode and type were observed; in chewing (scores 0–10), chewing pattern was verified (bilateral simultaneous or alternate, preferential unilateral, or chronic unilateral patterns), presence or absence of unexpected muscle contractions; in swallowing (scores 0–17), there was the directed liquid and solid swallowing, considering lip seal, tongue posture, lower lip posture, food containment, orbicular and mentalis muscle contraction, head movement, and swallowing coordination; in speech (scores 0–6), by the spontaneous speech sample, counting numbers from 0 to 20 and naming pictures, the following were analyzed: mouth opening, lip and mandibular movement, and joint precision.

To verify QoL, a translated and adapted Brazilian Portuguese version of the research instrument OHIP-14[20] was used, composed of 14 questions that measure the individual's perception regarding the impact of oral conditions on well-being in the past few months. The total score corresponded to the sum of scores in all questions, and the maximum individual response was represented by 56 points. The higher the scores, the worse the OFFs and QoL.

The obtained results were transcribed and organized in Microsoft Excel® spreadsheets. Comparisons between groups regarding OFFs and Facial Patterns were verified using the Kruskal-Wallis test. For the correlation between the scores in the MBGR protocol and the OHIP-14, the Spearman correlation test was used and considered a 5% significance level.

RESULTS

For all of the studied OFFs and aspects of QoL that were considered, there was a significant difference ($p<0.05$) in the comparison between Facial Patterns I and II, as well as Patterns I and III; no significant differences were found between Patterns II and III (Table 1). Regarding the OFFs, it was possible to observe oral or oronasal breathing in both Patterns II and III, whereas most individuals with Pattern I presented nasal breathing; for individuals in Patterns II and III, chewing was chronic unilateral or preferential unilateral; the swallowing process was adapted, by pressuring the tongue onto the teeth or bringing the tongue forward, associated head movement, excessive mentalis muscle contraction, lip orbicular, and perioral muscles. As to speech, phonetic disorders were found, as well as the presence of mandibular deviation and accumulation of saliva in lip commissures. For Pattern I group, chewing, swallowing, and speech functions were adequate.

Table 1. Distribution of results regarding mean, standard deviation, and p-values obtained for individuals with the different Facial Patterns analyzed, in relation to the scores of orofacial functions in the MBGR protocol and scores of quality of life in the Oral Health Impact Profile protocol

Variables	Facial Pattern I	Facial Pattern II	Facial Pattern III	p-value*
Breathing	0.00±0.00b	1.66±0.77a	0.87±0.57a	0.00
Chewing	0.75±0.96b	1.75±1.13a	1.91±0.99a	0.024
Swallowing	2.25±2.17b	11.58±3.53a	8.83±2.75a	0.00
Speech	0.33±0.88b	5.83±3.56a	1.50±1.62a	0.00
OHIP-14	1.08±1.92b	16.50±10.68a	17.67±10.71a	0.00

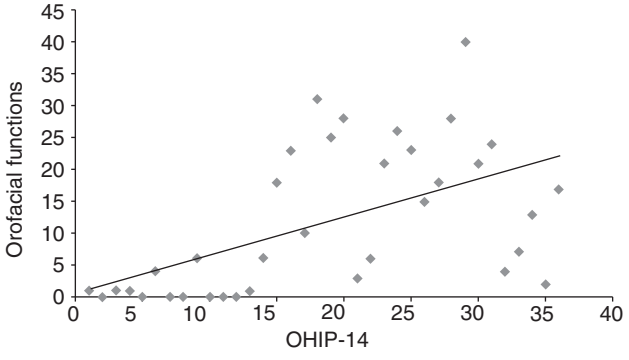
Different letters show significant difference between Facial Patterns
*p≤0.05 (statistically significant)
Caption: OHIP-14 = *Oral Health Impact Profile*

The DFD group was mostly characterized by feelings of embarrassment, discomfort, and high level of stress in relation to their condition. Therefore, these aspects can be indicators of QoL problems. In terms of score, such problems were followed by those related to difficulties to eat, speak, and relax, besides irritability and pain in the mouth.

A significant linear correlation was observed ($r=0.666$; $p<0.05$) between the scores obtained by the assessment of OFFs in the MBGR protocol and in oral health-related QoL with the OHIP-14 protocol, which shows that the worse the OFFs, the worse the QoL (Figure 1).

DISCUSSION

This study showed that individuals in Patterns II and III presented significantly higher scores as to the presence of changes in breathing, chewing, swallowing, and speech scores, as well as impact on QoL in comparison to Pattern I. There was a significant difference between Patterns I and II, and also between Patterns I and III. There are a few studies in the literature that compare facial patterns associated with OFFs, and, especially, to QoL; findings are usually descriptive.



Caption: OHIP-14 = *Oral Health Impact Profile*
Figure 1. Correlation between orofacial functions and quality of life

The search for causal factors for morphological facial changes has been widely described in literature, and oral breathing has been an important aspect to be considered[21,23]. In this study, breathing was oral or oronasal in Patterns II and III, corroborating other analyses[1,6].

Chronic unilateral chewing patterns were observed, followed by preferential unilateral in Patterns II and III, with excessive mentalis and perioral muscle contraction; at the same time, in Pattern I there was bilateral alternate or preferential unilateral chewing. Chewing damage can be related to the decreased strength in jaw elevator muscles in the period before surgery. The reduced number of occlusal contacts in these patients can damage the bite force and chewing performance[24]. A study described that people with retrognathism present anterior mandibular slide to increase intraoral space; besides, chewing cycles are faster and reduced[6], and that is a result of adaptations to the skeletal possibilities[25].

The swallowing process was adapted, and the tongue came forward and was pressured on the teeth, with associated head movement, especially in Pattern II; in Pattern III, orbicular, mentalis, and perioral muscles were more frequently contracted, followed by the forward tongue posture, corroborating other studies[2,5,6]. Videofluoroscopy in skeletal class III individuals showed the usual tongue position, the physiological characteristics of the chewing and swallowing functions, and observed changes in movements of the tongue and the soft palate, as well as in pharyngeal clearance during the swallowing process[26]. Even though this study did not use instrumental examinations, clinical evaluation showed adaptations in the tongue, lip, and mentalis muscle functions, allowing the characterization of individuals with DFD in this study.

The statistical analysis showed that individuals in Pattern II presented higher occurrence of speech changes, both in comparison to Pattern I and Pattern III; however, they were not significant. Corroborating this study, an analysis showed little occurrence of mandibular slide in skeletal class III individuals. Speech changes, such as forward jaw posture and anterior or lateral mandibular slide, besides tongue projection in skeletal class II, were different from those among class I individuals[27].

In the assessment of QoL, it was observed that results obtained by Facial Patterns I, II, and III presented statistically significant differences in comparison to OHIP-14, and individuals with DFD had more impact on QoL than those without DFD, corroborating other findings[12,28,30]. It is reasonable to assume that feelings of embarrassment arise in dialogues, and, therefore, individuals with DFD can experience high levels of stress and psychological discomfort in interpersonal and interlocution relationships. Besides, the eating process is also affected for these people, and it can prevent them from participating in social activities that involve this function. Therefore, eating and speaking are both processes that are part of the social domain.

No studies were found in literature that could correlate the severity of orofacial myofunctional disorders with protocols of oral health-related QoL; therefore, it was impossible to make comparisons with this study. In clinical practice it is possible to observe this relationship through changes in facial aesthetics, in OFFs, and in the patients' reports referring to difficulties and the impact caused on QoL. Usually, the patient claims not to participate in social events due to chewing difficulties, or to facial pain; some even do not expose themselves at work for feeling embarrassed of their facial condition, which causes social, emotional, and professional problems, among others.

It is worth to mention that this study is an important contribution to understand the relationship between OFFs and oral health-related QoL in patients with DFD; however, it is important to consider the limitations of the research regarding the reduced number of participants in the sample, as well as the non-use of instrumental examinations for the objective assessment of breathing, chewing, swallowing, and speech processes; so, further studies are necessary. Finally, investigating the changes involved in these aspects after surgical dental treatment will lead to the understanding about the impact of dental treatment and the need for speech language intervention in the field of orofacial motricity for this population.

CONCLUSION

The Facial Pattern influenced the performance of OFFs and QoL in individuals with DFD. There was higher occurrence of changes for Facial Patterns II and III, when compared to Pattern I. There was a relationship between scores in protocols MBGR and OHIP-14, showing that the worse the OFFs, the worse the QoL in cases of DFD.

**RRM was in charge of data collection and tabulation, as well as the stages of execution and elaboration of the manuscript; SRPS and DCBOP collaborated with data collection and tabulation; MHS participated in the execution of statistics and orientation of results; HNF collaborated with orientations regarding surgical treatment, helping in the understanding of the treatment as a whole, as well as patient follow-up; DVMA collaborated with data analysis and orientation of the manuscript; GBF was in charge of the project and study design and for the general orientation of the stages of execution and elaboration of the manuscript.*

REFERENCES

1. Pereira AC, Jorge TM, Ribeiro Júnior PD, Berretin-Felix G. Características das funções orais de indivíduos com má oclusão Classe III e diferentes tipos faciais. Rev Dent Press Ortodon Ortopedi Facial. 2005;10(6):111-9.
2. Marchesan IQ, Bianchini EMG. A fonoaudiologia e a cirurgia ortognática. In: Araújo MCA. Cirurgia ortognática. São Paulo: Livraria Santos Editora; 1999.
3. Egermark I, Blomqvist JE, Cromvik U, Isaksson S. Temporomandibular dysfunction in patients treated with orthodontics in combination with orthognathic surgery. Eur J Orthod. 2000;22:537-44.
4. Berretin-Felix G, Jorge TM, Genaro KF. Intervenção fonoaudiológica em pacientes submetidos à cirurgia ortognática. In: Ferreira LP, Befi-Lopes DM, Limongi SCO. Tratado de fonoaudiologia. São Paulo: Roca; 2004.
5. Kasai RCB, Portella MQ. Intervenção fonoaudiológica em pacientes submetidos ao tratamento ortodôntico-cirúrgico. Rev Dent Press Ortodon Ortopedi Maxilar. 2001;6(2):79-84.
6. Coutinho TA, Abath MB, Campos GJL, Antunes AZ, Carvalho RWF. Adaptações do sistema estomatognático em indivíduos com desproporções maxilo-mandibulares: revisão da literatura. Rev Soc Bras Fonoaudiol. 2009;14(2):257-9.

7. Trawitzki LVV, Dantas RO, Mello-Filho FV, Marques Jr W. Effect of treatment of dentofacial deformities on the electromyographic activity of masticatory muscles. Int J Oral Maxillofac Surg. 2006;35:170-3.
8. Toledo González NZ, Lopes LD. Fonoaudiologia e ortopedia maxilar na reabilitação orofacial: tratamento precoce e preventivo terapia miofuncional. São Paulo: Livraria Santos Editora; 2000.
9. Felício CM, Mazzetto MO, Bortolin JB. Julgamentos de pronunciabilidade e dor em condições orais variadas. In: 1ª Jornada de Fonoaudiologia da Unaerp; 1999; Ribeirão Preto, Brasil. Anais. p. 25-6.
10. Campiotto AR. Fonoaudiologia. In: Souza LCM, et al, editores. Cirurgia Craniofacial e Ortodontia. São Paulo: Livraria Santos Editora; 1998. p. 19-30.
11. Santos IF, Pereira SAA. A prevalência de alterações de fala em indivíduos portadores de classe III. Fono Atual. 2001;4(15):16-21.
12. Rusanen J, Lahti Tolvanen M, Pirttiniemi P. Quality of life in patients with severe malocclusion before treatment. Eur J Orthod. 2009;32(1):43-8.
13. Alanko OME, Stromvedström-Oristo AL, Tuomisto MT. Patients' perceptions of orthognathic treatment, well-being, and psychological or psychiatric status: a systematic review. Acta Odontol Scand. 2010;68(5):249-60.
14. Nardi P, Guarducci M, Cervino M. Orthognathic surgery. Study of nerve injuries. Minerva Stomatol. 2002;51(11-12):461-71.
15. Rispoli A, Acocella A, Pavone I, Tedesco A, Giacomelli E, Ortiz L, et al. Psychoemotional assessment changes in patients treated with orthognathic surgery: pre- and postsurgery report. World J Orthod. 2004;5(1):48-53.
16. 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 Pathol Oral Radiol Endod. 2010;109(1):46-51.
17. Esperão PT, de Oliveira BH, de Oliveira Almeida MA, Kiyak HA, Miguel JA. Oral health-related quality of life in orthognathic surgery patients. Am J Orthod Dentofacial Orthop. 2010;137(6):790-5.
18. 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 Ortodon Ortop Facial. 2004;9(6):39-47.
19. Genaro KF, Berretin-Félix G, Rehder MIBC, Marchesan IQ. Avaliação miofuncional orofacial protocolo MBGR. Rev CEFAC. 2009;11(2):237-55.
20. Oliveira BH, Nadanovsky P. Psychometric properties of the Brazilian version of the Oral Health Impact Profile-short form. Community Dent Oral Epidemiol. 2005;33(4):307-14.
21. Maciel CTV, Barbosa MH, Toldo CA, Faza FCB, Chiappetta ALML. Disfunções orofaciais nos pacientes em tratamento ortodôntico. Rev CEFAC. 2006;8(4):456-66.
22. Bianchini AP, Guedes ZCF, Vieira MM. Estudo da relação entre a respiração oral e o tipo facial. Rev Bras Otorrinolaringol. 2007;73(4):500-5.
23. 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.
24. Tate GS, Throckmorton GS, Ellis E 3rd, Sinn DP, Blackwood DJ. Estimated masticatory forces in patients before orthognathic surgery. J Oral Maxillofac Surg. 1994;52(2):130-6.
25. Bianchini EMG. Avaliação fonoaudiológica da motricidade oral: distúrbios miofuncionais orofaciais ou situações adaptativas. R Dental Press Ortodon Ortop Facial. 2001;6(3):73-82.
26. Sígolo C, Campiotto AR, Sotelo MB. Posição habitual de língua e padrão de deglutição em indivíduo com oclusão classe III, pré e pós-cirurgia ortognática. Rev CEFAC. 2009;11(2):256-60.
27. Mezzomo CL, Machado PG, Pacheco AB, Gonçalves BFT, Hoffmann CF. As implicações da classe II de angle e da desproporção esquelética tipo classe II no aspecto miofuncional. Rev CEFAC. 2011;13(4):728-34.
28. Lee S, McGrath C, Samman N. Quality of life in patients with dentofacial deformity: a comparison of measurement approaches. Int J Oral Maxillofac Surg. 2007;36(6):488-92.
29. Trovik TA, Wisth PJ, Tornes K, Bøe OE, Moen K. Patients' perceptions of improvements after bilateral sagittal split osteotomy advancement surgery: 10 to 14 years of follow-up. Am J Orthod Dentofacial Orthop. 2012 Feb;141(2):204-12.
30. Silvola AS, Varimo M, Tolvanen M, Rusanen J, Lahti S, Pirttiniemi P. Dental esthetics and quality of life in adults with severe malocclusion before and after treatment. Angle Orthod. 2014;84(4):594-9.