DENTOFACIAL DEFORMITIES: OROFACIAL MYOFUNCTIONAL CHARACTERISTICS

Deformidades Dentofaciais: características miofuncionais orofaciais

Janayna de Aguiar Trench [1], Roberto Paulo Correia de Araújo [1]

ABSTRACT

Purpose: to analyze and describe the performance of the stomatognathic functions according to the different types of dentofacial deformities and compare the characteristics of these functions in subjects with dentofacial deformities and subjects without changing of the facial skeleton. **Methods:** this descriptive, analytical and transversal study comprised 50 patients with dentofacial deformities. The control group consisted of 46 healthy individuals. Data collection occurred between the months of July and September 2013, and the orofacial myofunctional analysis was performed by the application of the Marchesan, Berrentin-Felix, Genaro, Rehder protocol. The statistical protocol was based on descriptive data analysis. **Results:** all dentofacial deformities studied had some change in the implementation of the stomatognathic functions and these changes varied according to the type of dentofacial deformities. **Conclusion**: different types of dentofacial deformities are related to changes detected in the performance of the stomatognathic functions.

KEYWORDS: Craniofacial Abnormalities; Masseter Muscle; Temporal Muscle; Dental Occlusion

INTRODUCTION

Human mandibular growth is characterized by great variations that determine the vertical and sagittal dimensions of the craniofacial complex. Cephalometric analyses have shown that variations in craniofacial growth are related to the direction of mandibular condyle growth[1].

Dentofacial deformities (DFD) can be defined as conditions in which the facial skeleton diverges from normality; additionally, there is malocclusion, and the facial appearance is affected. These deformities may be minimal, such as a slight projection of the chin, or extreme, such as a severe vertical maxillary excess or hemifacial microsomia[2]. This condition may be evident at birth or appear during growth and development, creating functional, degenerative, aesthetic and psychosocial problems. The time of surgical intervention can be critical and should occur during or after complete growth[3,4].

One or both jawbones could be altered in the vertical, horizontal and transverse planes, either in isolation or combination, leading to different types of deformities[5].

Serious problems of dental and skeletal malocclusion require combined treatment with orthodontics and orthognathic surgery. This treatment aims to achieve facial, dental and functional harmony[6].

The intimate relationship between the hard and soft tissues and the need to perform stomatognathic functions for survival lead to the occurrence of functional adaptations that enable the performance of these functions regardless of existing changes[7].

To quantify the function of the masticatory system, many parameters are being studied, including chewing efficiency, maximum bite force, electromyographic activity of masticatory muscles and range of mandibular movement[8].

Knowing how stomatognathic functions occur on the normality and how performance is modified according to the placement of bone and tooth bases is essential for the speech therapist to be able to plan the myofunctional treatment, before and after orthognathic surgery, according to the possibilities and therapeutic limitations provided by DFD. Thus the aim of this study was to analyze and describe the

[1] Instituto de Ciências da Saúde, Universidade Federal da Bahia, Salvador, Bahia, Brasil.

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stomatognathic functions according to the different types of dentofacial deformities and confront the characteristics of these functions in subjects with DFD and subjects without changes of the facial skeleton.

METHODS

This study was approved by the Ethics Committee of the School of Dentistry at the Federal University of Bahia under Protocol # 301.251. Patients were informed about the aims of the present study, and permission was voluntarily granted by signing an informed consent form.

Individuals of both sexes participated in this study, including patients with DFD who were 16 to 55 years of age and with indication for orthognathic surgery from the Division of Oral and Maxillofacial Surgery and Treatment in the School of Dentistry at the Federal University of Bahia; the Division of Speech Therapy of the Professor Edgar Santos University Hospital Complex; and the Orthodontics staff at the Center for Dental Studies (CENO) between July and September 2013.

Exclusion criteria people who have dental flaws or wearing dentures and or dental implants. Was provided to all participants the right to withdraw at any predetermined stage of the research, despite having signed the informed consent form. These criteria also apply to the control group.

The stomatognathic functions of breathing, swallowing, speech and chewing were evaluated in all volunteers. Therefore, the MBGR (Marchesan, Berrentin-Felix, Genaro and Rehder) protocol[9] was used as an investigative tool along with the following materials: French bread, water, disposable cup, examination gloves, Altmann graph mirror and disposable tongue depressor.

The characteristics of masticatory function were assessed by examining the ability to chew French bread by each individual, who was instructed to proceed as usual with daily life. The performance of this function was filmed with a SONY DSC – W 620 digital camera; the obtained results were evaluated by counting the number of chewing cycles, and the vertical or lateral mandibular movements were analyzed. Bilateral chewing was defined as occurring when 50-60% of cycles occurred on one side, and alternating was defined to be when lateral and vertical movements of the jaw occurred. Simultaneous bilateral chewing was defined to be only when the vertical jaw movements predominated[10], while unilateral chewing was detected when more than 60% of cycles occurred on a single side[11]. The following parameters were evaluated for functional analyses: chewing efficiency, lip closure, chewing speed, atypical muscle contractions and pain or noise in the temporomandibular joint (TMJ).

Three tests were applied to evaluate swallowing, as follows: swallowing of solids, habitual swallowing of liquid and directed swallowing of liquid. The first test (swallowing solids) was analyzed by filming chewing. For the second test (habitual swallowing of liquid), the participant was instructed to drink 200 mL of water as usual. For the third test (directed swallowing), the subject was instructed to take and keep a sip of water in the mouth and swallow only after requested by the evaluator. The presence of tongue interposition, hyperfunction of the perioral muscles and remains were evaluated after swallowing.

The speech evaluation was performed through five tests. In the first test, the subject was instructed to count from zero to twenty (0-20) and say the days of the week followed by the months of the year. In the second test, a board was used with phonetically balanced figures, and the volunteer was asked to name those figures. The third test was aimed as assessing the motor coordination of speech. In this test, the subject was instructed to articulate the syllables /pa/ /ta/ /ka/, first separately and, then, in sequence. The fourth test evaluated spontaneous speech, with the participant being asked to articulate their full name, age and talk about their job/profession or describe a trip or outing that they experienced. The fifth test was only conducted with patients who had some type of phonetic alteration. In this case, the subject was instructed to repeat the altered phoneme and add the vowel e, for example, if the altered phoneme was /s/, the subject was then asked to repeat it. The following criteria were evaluated: the presence of saliva, lip movement, presence of articulatory imprecision, speech rate and pneumo-phono-articulatory coordination.

The respiratory mode was evaluated using an Altmann graph mirror, which is a metal plate that is mirrored on both sides with a graph on the upper side, through which was observed the air route (oral, nasal and oronasal). Mouth breathing was defined as when the route was only through the oral cavity. Nasal breathing occurred when respiration was performed only through the nose, and oronasal took place when the route was mixed, i.e. nasal and oral cavities.

As this is a sample plan to the entire target population and that was performed through a procedure of choice for patients which did not allow the use of random mechanisms on its selection (raffle), since they were included as they were being presented consecutively to the clinic, in order to prevent the use of the assumptions of the theory of statistical estimation, which allow to obtain

an adequate measure of the standard error and therefore the performance of statistical inference, no inferential statistics (statistical test of hypothesis or confidence interval) was used, as they are completely inadequate to the context of inferential statistics theory and theories of probability that support them, which will not be seen in this study[12-16]. Therefore the statistical analysis was performed using descriptive statistics. For the variables measured in qualitative scale (DFD, functional characeristics), respective measurements of proportion were obtained.

Analyses were performed in the R statistical package version[17].

RESULTS

Fifty individuals, including 26 women and 24 men, with a mean age of 26.7 years comprised the group with Dentofacial Deformities (DFD). The control group (CG) consisted of 46 subjects, including 25 men and 21 women, with a mean age of 25.3 years.

The DFD group included individuals with different types of deformities, as follows: 11 patients with a skeletal Class II deformity; 21 patients with a skeletal Class III deformity; 7 with skeletal biprotrusion; 6 with skeletal anterior open bite; and 5 with skeletal posterior crossbite (Table 1).

Table 1 – Characterization of dentofacial deformity group

Dentofacial deformity	N	%
Skeletal class II	11	22
Skeletal class III	21	42
Skeletal biprotrusion	7	14
Skeletal anterior open bite	6	12
Skeletal bilateral posterior crossbite	5	10

Myofunctinoal orofacial features

The data will be described according to the type of DFD because each type features specific myofunctional behaviors.

Control group

The alternating bilateral chewing pattern was present in 80.4% of subjects in this group, followed by simultaneous bilateral (8.7%), unilateral right (6.5%) and unilateral left (4.3%). Cutting into food was performed with the front teeth by 87% of subjects evaluated, with efficient chewing and an adequate chewing rate in 91.3% of cases. All subjects in this group exhibited systematic lip closure during chewing, without atypical muscle contractions. Pain or noise in the TMJ was absent in 93.5% of subjects evaluated (Table 2).

Table 2 – Distribuition based on occurence of chewing characteristics of control group

Chewing	N	%
Alternate bilateral standard	37	80,4
Simultaneous bilateral standard	04	8,7
Left unilateral standard	02	4,3
Right unilateral standard	03	6,5
Anterior incision	40	87
Lateral incision	06	13
No incision performed	00	0,0
Efficient grinding	42	91,3
Inneficient grinding	04	8,7
Systematic lip closure	46	100
Unsystematic lip closure	00	0,0
Absent lip closure	00	0,0
Adequate masticatory speed	42	91,3
Increased masticatory speed	02	4,3
Reduced masticatory speed	02	4,3
Absent atypical muscle contractions	46	100
Present atypical muscle contractions	00	0,0
Pain in present TMJ	03	6,5
Pain in absent TMJ	43	93,5
Noise in present TMJ	03	6,5
Noise in absent TMJ	43	93,5

Speech articulation occurred with saliva being swallowed, lip motion and adequate speech rate in 93.5% of the CG. The pneumo-phono-articulatory coordination was adequate in 97.8% of cases evaluated. Precise speech articulation without phonetic distortions was observed in 100% of subjects in this group.

Swallowing occurred without tongue interposition or remains after the food was swallowed. Only 4.3% of subjects without DFD exhibited hyperfunction of the perioral muscles during swallowing.

The nasal respiratory mode was observed in 93.5% of the control group subjects, which was followed by oronasal (6.5%). There were mouth breathers in this group.

Group with dentofacial deformities

1. SKELETAL CLASS II

The left unilateral chewing pattern was present in 54.5% of subjects with skeletal Class II DFD, which was followed by unilateral right (36.4%) and simultaneous bilateral (9.1%). Cutting into food was performed with the front teeth in 63.2% of cases, and chewing was inefficient in 72.7%. Lip closure was exhibited by all patients; however, it occurred unsystematically in 63.2% of subjects evaluated. Atypical muscle contractions were not common and observed in only 36.4% of subjects. The chewing speed was faster in 72.7% of patients with this type of deformity. While performing masticatory function, pain and noise in the TMJ were present in only 9.1% and 18.2% of participants in this group, respectively.

During the evaluation of speech articulation, an accumulation of saliva at the labial commissure was observed in 54.5% of the subjects, and lip movement was adequate in most participants. The speech articulation was unsystematically inaccurate in 45.5% of cases. The speech rate was adequate in 90.9% of subjects. The pneumo-phono-articulatory coordination was altered in 63.6% of patients with skeletal Class II DFD. Most of these individuals had some type of phonetic distortion (Table 3).

Table 3 – Distribuition of ocurrence of phono-articulatory characteristics on the bearers of skeletal class II dentofacial deformity

Phono-articulation	N	%
Swallowed saliva	04	36,4
Accumulation of saliva in labial commissure	06	54,5
Accumulation of saliva in lower lip	01	9,1
Adequate lip movement	08	72,7
Exaggerated lip movement	03	27,3
Reduced lip movement	00	0,0
Absent articulatory imprecision	03	27,3
Unsystematic articulatory imprecision	05	45,5
Systematic articulatory imprecision	03	27,3
Adequate speech speed	10	90,9
Increased speech speed	01	9,1
Reduced speech speed	00	0,0
Adequate pneumo-phono-articulatory coordination	04	36,4
Altered pneumo-phono-articulatory coordination	07	63,6
Present phonetic distortion	08	72,7
Absent phonetic distortion	03	27,3

Swallowing function with tongue interposition occurred in 45.5% of subjects; hyperfunction of the perioral muscles was seen in 81.8%, and the presence of food remains after swallowing was observed in 27.3% of cases.

The oral respiratory pattern was the most common among patients with this type of DFD, observed in 81.8% of cases.

2. SKELETAL CLASS III

In individuals with skeletal Class III deformities, the bilateral simultaneous chewing pattern was observed in 90.5% of subjects, versus the unilateral right and left that was observed in 4.8% of cases. Cutting was performed using the front teeth by 54.5% of participants, while the remaining participants did not cut into the food (47.6%). The chewing of the food was ineffective in 71.4% of subjects. Lip closure occurred, but in an unsystematic way, in 71.4% of cases. Atypical muscle contractions were present in 52.4% of those evaluated. The chewing rate results in patients with this type of DFD were balanced between an adequate rate (38.1%), faster rate (23.8%) and slower rate (38.1%). Pain and noise in the TMJ were reported by 23.8% and 33.3% of subjects, respectively (Table 4).

Accumulation of saliva in the labial commissure during speech articulation was observed in 33.3% of subjects with this type of DFD, while 66.7% of these exhibited swallowing of saliva during speech production, thereby preventing it from accumulating in the oral cavity. The lip movement, speech rate and pneumo-phono-articulatory coordination were adequate in 66.7%, 85.7% and 76.2%, respectively, of the cases evaluated. Articulatory imprecision was absent in 71.4% of participants. Some type of phonetic distortion was present in 90.5% of subjects.

The interposition of the tongue during swallowing occurred in 81% of cases, and hyperfunction of the perioral muscles was seen in 72.2%. Remains after swallowing was observed in 19% of subjects evaluated.

The oronasal respiratory mode was present in 47.4% of participants, followed by oral (28.6%) and nasal (23.8%).

Table 4 – Distribuition based on occurence of masticatory characteristics on the bearers of skeletal class III dentofacial deformity

Chewing	N	%
Alternate bilateral standard	00	0,0
Simultaneous bilateral standard	19	90,5
Left unilateral standard	01	4,8
Right unilateral standard	01	4,8
Anterior incision	11	54,5
Lateral incision	00	0,0
No incision performed	10	47,6
Efficient grinding	06	28,6
Inneficient grinding	15	71,4
Systematic lip closure	04	19
Unsystematic lip closure	15	71,4
Absent lip closure	02	9,5
Adequate masticatory speed	08	38,1
Increased masticatory speed	05	23,8
Reduced masticatory speed	08	38,1
Absent atypical muscle contractions	10	47,6
Present atypical muscle contractions	11	52,4
Pain in present TMJ	05	23,8
Pain in absent TMJ	16	76,2
Noise in present TMJ	07	33,3
Noise in absent TMJ	14	66,7

3. SKELETAL BIPROTRUSION

In the skeletal biprotrusion DFD, the unilateral left chewing pattern occurred in 71.4% of cases, followed by unilateral right (14.3%) and simultaneous bilateral (14.3%). The cutting into food was performed using the front teeth by 100% of participants in this group, and the chewing of the food was inefficient, with a faster chewing speed in 57.1% of subjects evaluated. Of patients with the skeletal biprotrusion type of DFD, 71.4% exhibited unsystematic lip closure, and there was an absence of atypical muscle contractions. The presence of noise in the TMJ was not reported by any of the participants during masticatory function; however, 14.3% of this population reported pain in the TMJ during chewing.

Regarding the evaluation of speech articulation, 42.9% of the subjects had accumulation of saliva in the labial commissure. The movement of the lips during speech production was adequate in 85.7% of cases evaluated. Articulatory imprecision was not observed, and the speech rate was adequate in 85.7% of participants evaluated. The pneumo-phono-articulatory coordination was also adequate in 71.4% of cases. Phonetic distortion was observed in 85.7% of subjects.

The interposition of the tongue during swallowing was present in 42.9% of subjects evaluated, while hyperfunction of the perioral muscles was observed in 71.4% of cases (Table 5).

Among patients with skeletal biprotrusion, the oronasal respiratory mode was present in 42.9% of subjects, which was followed by nasal (28.6%) and oral (28.6%) (Table 5).

Table 5 – Distribuition based on occurrence of swallowing and breathing characteristics of bearers of skeletal biprotrusion dentofacial deformity

Swallowing	N	%
Tongue interposition presence	03	42,9
Perioral muscle hyperfunction	05	71,4
Presence of residues after swallowing	00	0,0
Breathing		
Oral	02	28,6
Nasal	02	28,6
Oronasal	03	42,9

4. SKELETAL ANTERIOR OPEN BITE

Anterior open bite led to the unilateral right chewing pattern in 50% of subjects, followed by simultaneous bilateral (33.3%) and unilateral left (14.3%). None of these subjects performed anterior incision, and 50% cut into food using the lateral teeth, with the other half not cutting. All patients with this DFD exhibited inefficient chewing. Additionally, 66.7% performed masticatory function without lip closure, while 33.3% performed masticatory function with unsystematic lip closure. The chewing rate was faster in 83.3% of subjects. Atypical muscle contractions were observed in 50% of the cases evaluated. Noises in the TMJ were reported by only 33.3% of participants. None of the patients with anterior open bite DFD reported TMJ pain during chewing.

During the speech of these individuals, saliva was observed to accumulate in the labial commissure and the lower lip and to be swallowed at the same proportion, i.e., in 33.3% of cases. The speech articulation featured exaggerated lip movement in 66.7% of participants. The speech rate was adequate in 66.7%; however, the pneumo-phono-articulatory coordination was altered at the same proportion as patients evaluated (66.7%). Articulatory imprecision was absent in most cases. All patients with anterior open bite had some type of phonetic distortion (Table 6).

Table 6 – Distribuition based on occurrence of phono-articulatory characteristics of bearers of skeletal anterior open bite dentofacial deformity

Phono-articulation	N	%
Swallowed saliva	02	33,3
Accumulation of saliva in labial commissure	02	33,3
Accumulation of saliva in lower lip	02	33,3
Adequate lip movement	02	33,3
Exaggerated lip movement	04	66,7
Reduced lip movement	00	0,0
Absent articulatory imprecision	04	66,7
Unsystematic articulatory imprecision	01	16,7
Systematic articulatory imprecision	01	16,7
Adequate speech speed	04	66,7
Increased speech speed	01	16,7
Reduced speech speed	01	16,7
Adequate pneumo-phono-articulatory coordination	02	33,3
Altered pneumo-phono-articulatory coordination	04	66,7
Present phonetic distortion	06	100
Absent phonetic distortion	00	0,0

Swallowing with the tongue interposition was present in all participants with skeletal anterior open bite. Hyperfunction of the perioral muscles did not occur at a great frequency but was present in 50% of cases evaluated. The oral respiratory mode was observed in 100% of subjects with anterior open bite (Table 7).

Table 7 – Distribution based on occurrence of characteristics of swallowing and breathing of bearers of skeletal anterior open bite dentofacial deformity

Swallowing	**N**	**%**
Tongue interposition presence	06	100
Perioral muscle hyperfunction	03	50
Presence of residues after swallowing	00	00
Breathing		
Oral	06	100
Nasal	00	0,0
Oronasal	00	0,0

5. SKELETAL BILATERAL POSTERIOR CROSS BITE

In patients with skeletal bilateral posterior cross bite DFD, the unilateral left chewing pattern was observed in 80% of subjects, which was followed by unilateral right (20%). The cutting into food was performed using the front teeth in 100% of cases evaluated. During mastication, the rate was adequate, with systematic lip closure, and without atypical muscle contractions in 60% of participants; however, there was inefficient chewing in 80% of subjects evaluated. Noise in the TMJ was not reported by any of the participants, but painful symptoms were reported by 40% of patients with bilateral posterior cross bite DFD (Table 8).

During the evaluation of speech articulation, 80% of individuals swallowed saliva, thus preventing it from accumulating in the oral cavity, while accumulation in the labial commissure was observed in the remaining 20% of participants. The lip movement was adequate in 80% of cases evaluated. The speech rate and pneumo-phono-articulatory coordination were adequate in all subjects. Only 20% of patients with bilateral posterior crossbite exhibited some type of phonetic distortion, and imprecise speech was evident, albeit in an unsystematic way, in 40% of subjects.

The only swallowing disorders exhibited by patients with bilateral posterior crossbite remained after the act of swallowing, which was observed in 60% of these individuals.

The nasal respiratory mode was exhibited by 60% of participants, which was followed by oronasal (40%). None of the patients with skeletal bilateral crossbite exhibited oral breathing.

Table 8 – Distribuition based on occurrence of masticatory characteristics of bearers of skeletal bilateral posterior crossbite dentofacial deformity

Chewing	N	%
Alternate bilateral standard	00	0,0
Simultaneous bilateral standard	00	0,0
Left unilateral standard	04	80
Right unilateral standard	01	20
Anterior incision	05	100
Lateral incision	00	0,0
No incision performed	00	0,0
Efficient grinding	01	20
Inneficient grinding	04	80
Systematic lip closure	03	60
Unsystematic lip closure	02	40
Absent lip closure	00	0,0
Adequate masticatory speed	03	60
Increased masticatory speed	02	40
Reduced masticatory speed	00	0,0
Absent atypical muscle contractions	03	60
Present atypical muscle contractions	02	40
Pain in present TMJ	02	40
Pain in absent TMJ	03	60
Noise in present TMJ	00	0,0
Noise in absent TMJ	05	100

DISCUSSION

For the most part, participants in the control group showed no significant myofunctional changes, and those present were limited to isolated and temporary situations. The chewing pattern most commonly observed in this group was bilateral alternating, which is the ideal mastication pattern because it allows the load to be distributed evenly, alternating the effort and rest of the muscles and joints[18,19].

Patients with DFD have myofunctional features that vary according to the type of deformity. The musculature adapts so that the stomatognathic functions can be performed. These adaptations occur according to the pattern of the maxillofacial skeleton jawbones.

Regarding patients with skeletal Class II DFD, the present study found masticatory changes such as unilateral chewing, faster chewing rate and inefficient chewing. The literature[20] shows that the states that chewing occurs in these individuals with rapid and shorter cycles that directly influence the food grinding and chewing rate. The difficulty with the maximal intercuspidation associated with the mandibular movement used in chewing can guide functional adaptations such as unilateral chewing to facilitate the chewing process[21,22].

The lip closure during chewing occurred unsystematically in most cases evaluated. Reports addressing that topic during chewing were not found; however, studies were found that show the change in the lip closure at rest. These findings reveal the occurrence of parted lips at rest and closing with difficulty, which involved the chin muscles.

Phonetic distortion was the phono-articulatory change that occurred most in skeletal Class II DFD, which is consistent with the scientific literature[20-23]. Articulatory imprecision also occurred, although unsystematically, that can be explained by the accumulation of saliva in the labial commissure. As an attempt to contain the saliva in the oral cavity, the individual results in impaired speech articulation as a whole. Altered pneumo-phono-articulatory coordination, which was present in more than half of individuals, may also have contributed to the unsystematic articulatory imprecision; however, this did not affect the speech rate.

Hyperfunction of the perioral muscles during swallowing was found in most of the cases evaluated. Studies show that the hyperfunction of

the perioral muscles is the hallmark of swallowing in patients with skeletal Class II DFD[20,24].

Regarding this respiratory mode in patients with skeletal Class II DFD, there was a higher prevalence of oral breathing, which is consistent with reports in the literature[20,24].

In patients with skeletal Class III DFD, the masticatory alterations found most commonly were the simultaneous bilateral chewing pattern, inefficient chewing of food, unsystematic lip closure and atypical muscle contractions. The literature showed that chewing in these individuals occurs with the presence of vertical mandibular movements, without lateralization of the jaw and through inefficient grinding due to the loss of tone in the elevator muscles of the mandible, buccinator and lips[20,25].

The main change in speech articulation was phonetic distortion, which is similar to the data reported in the literature on this topic. Phonetic distortion occurs mainly by hyperfunction of the upper lip so that the articulation points of some phonemes, such as bilabials and fricatives, are produced using inverse lip movements[20,25]. To compensate for the structural and functional changes, patients with this DFD exhibit changes in articulation points of phonemes; however, this condition did not affect the accuracy of speech articulation in the patients in question because only a few participants showed articulatory imprecision, while the majority showed this phenomenon unsystematically as reported in the literature[25,26].

The function of swallowing led to the key features of tongue interposition and hyperfunction of the perioral muscles, as reported in the findings of other research[20,25]. Remains after swallowing were found in a small number of patients evaluated. This type of swallowing is a consequence of the loss of tone and consequent function of the buccinator muscle during mastication and is responsible for returning the foods that fall into the vestibule to the occlusal surfaces of teeth[27]. When this does not happen, the remains are observed to be lodged in the oral cavity after swallowing, especially in the region of the vestibule. The literature shows that the chewing by patients with skeletal Class III occurs with little or no activity of the buccinator muscle[20].

Regarding respiration, the results obtained suggest a higher incidence of the oral and oronasal respiratory modes among individuals with skeletal Class III DFD, which is in agreement with reports in the scientific literature[20,25,28].

In patients with skeletal biprotrusion DFD, the most commonly observed chewing pattern was unilateral, but clinical assessments that could be verified were not found. The chewing of food was inefficient, and the lip closure was unsystematic. This phenomenon may be due to the ability to seal the lip becoming difficult due to an increase in the vertical dimension. Phonetic distortion in speech articulation occurred in most individuals with this type of DFD, which can be explained by the advancement of the maxilla and mandible, allowing forward movement of the tongue and a change in lip tone[4]. The interposition of the tongue was found during swallowing, as well as hyperfunction of the perioral muscles, which may have contributed to the emergence of phonetic changes in speech.

The most common respiratory mode for individuals with skeletal biprotrusion was oronasal. No published data were found to confirm this finding, but it can be explained by the difficulty of maintaining the lip seal because there is an advance of two jawbones, the maxilla and mandible, which is a condition that makes it possible to breathe through both routes, oral and nasal.

For the anterior open bite DFD, the most common chewing pattern was unilateral with a faster chewing rate. These data are similar to the results of a recent study[29] in which the authors claim that individuals with an anterior open bite chew with shorter cycles, which increases the rate of the masticatory process and reduces the function efficiency. Most participants of the present study did not exhibit lip closure during mastication, and it was unsystematic in those who did. This result can occur due to the loss of tone and strength of the orbicularis oris muscle. This element also explains the fact that half of the individuals exhibited atypical muscle contractions during this function because it is not only the orbicularis oris that has less tone but the buccinator and elevator muscles of the mandible[4]. Therefore, it is necessary for the individual to use other muscle groups or for the contraction of these muscles to be stronger to provide greater control of food during chewing.

All subjects with an open bite had some type of phonetic distortion. Moreover, an exaggerated lip movement was observed during speech. The literature states that the tongue can interpose during the production of some phonemes, such as sibilants[4]. Furthermore, with the reduced lip tone, the individual can increase the lip movements in an attempt to better articulate the speech sounds, but these changes do not affect the accuracy of articulation in the individuals. However, the pneumo-phono-articulatory coordination was altered in most individuals, which can be explained by exclusive oral breathing.

Swallowing was performed with tongue interposition by all patients with skeletal anterior open bite DFD. The literature suggests that this is the most common alteration in this type of DFD, while hyperfunction of the perioral muscles can be explained by the loss of lip muscle tone[7].

The oral respiratory mode was found in all of the subjects with anterior open bite. The literature reports that open bite is one of the main characteristics of mouth breathers[30,31].

The bilateral posterior cross bite DFD featured a unilateral chewing pattern and inefficient food chewing by most individuals. The relationship between the unilateral chewing and the presence of a posterior cross bite can be explained by the decrease of vertical space and the impossibility of performing the rocking motion, thus causing the individual to chew on the opposing side[32]. In the present study, the posterior cross bite evaluated was bilateral; however, the only masticatory pattern found was unilateral, and most individuals chewed on the left side. Taking into account the reasoning above and even with a crossbite on both sides, there may be one side with smaller vertical dimensions, which would be the chewing side.

Additionally, regarding the chewing in patients with bilateral posterior crossbite, it was found that the chewing rate was adequate, and the lip closure during this chewing was systematic in more than half of the cases evaluated. The symptom "pain" was reported by approximately half of the individuals. However, no results that could explain these findings were obtained, although the scientific literature relates the occurrence of skeletal posterior crossbite with temporomandibular disorders[33,34]. It would be a mistake to consider only reports of painful symptoms during chewing as reliable data to ensure the diagnosis of this disorder.

Speech articulation in the presence of a bilateral posterior cross bite was not significantly different, appearing normal in almost all aspects evaluated. However, it was found that articulatory imprecision was present unsystematically in almost half of the cases evaluated. This finding is explained by a reduction of the internal horizontal space that could make the articulation relatively imprecise.

The function of swallowing was performed inefficiently by over half of these individuals, with remains observed after swallowing. This finding runs opposite to the results presented in the literature[35] that reported that 87.5% of the subjects showed no remains after swallowing. Those authors claim that the buccinator muscle is stronger on the chewing side; however, the study cited was conducted on individuals with unilateral posterior crossbite, while in the present study we evaluated the bilateral DFD.

CONCLUSION

The different types of facial skeleton interfere in a particular way in the performance of stomatognathic functions, being these changes related to the position of bone and tooth base and the insertion of orofacial and chewing muscles on those bases. Chewing functions, speech articulation, swallowing and breathing, are altered according to the variation in the positioning of bone and tooth bases. Therefore, a detailed evaluation of the functional aspects must be performed so that the treatment can be planned more individually as possible.

RESUMO

Objetivo: analisar e descrever as funções estomatognáticas de acordo com os diferentes tipos de deformidades dentofaciais e confrontar as características dessas funções em sujeitos com deformidade dentofacial e sujeitos sem alterações do esqueleto facial. **Métodos:** trata-se de um estudo descritivo, analítico e de caráter transversal, envolvendo uma amostra de 50 indivíduos portadores de deformidades dentofaciais frente ao grupo controle constituído por 46 indivíduos saudáveis. A coleta de dados aconteceu entre os meses de julho a setembro de 2013, foi realizada a avaliação miofuncional orofacial, mediante a aplicação do protocolo Marchesan, Berrentin-Felix, Genaro, Rehder. O protocolo estatístico fundamentou-se na análise descritiva dos dados. **Resultados:** todos os sujeitos portadores de deformidades dentofaciais avaliados apresentaram alterações na execução das funções estomatognáticas sendo que tais alterações variaram de acordo com o tipo de deformidades dentofaciais apresentada. **Conclusão:** os diferentes tipos de deformidades dentofaciais estão relacionados às alterações detectadas no desempenho das funções estomatognáticas.

DESCRITORES: Anormalidades Craniofaciais; Músculo Masseter; Músculo Temporal; Oclusão Dentária

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Mailing address:
Janayna de Aguiar Trench
Institute of Health Sciences,
Federal University of Bahia
Av. Reitor Miguel Calmon, s/n, sala 400, Canela
Salvador BA – Brasil
CEP: 40110-912
E-mail: janatrench_fono@yahoo.com.br