Myofunctional characteristics of obese mouth and nose breathers

Características miofuncionais de obesos respiradores orais e nasais

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ABSTRACT

Purpose: To investigate the myofunctional characteristics of nasal and oral breathing in obese individuals. **Methods:** Participants were 24 obese individuals with ages between 8 and 15 years, who participated in the Obesity Group of the Ambulatory of Pediatrics of an University Hospital, and were selected by convenience. The myofunctional characteristics were assessed using the Orofacial Myofunctional Assessment with Scales (Avaliação Miofuncional Orofacial com Escalas – AMIOFE) protocol. **Results:** Oral breathing was present in 62.5%, and nasal breathing in 37.5% of the population studied. In the oral breathing group, 40% of the subjects presented lips tension during occlusion and 80% showed a narrow palate, while almost all nasal breathers had normal palate and lips posture ($p<0.05$). Interposition of the tongue in the dental arches occurred in 47% of oral breathers and none of the nasal breathers. Oral breathers showed the tendency not to repeat the swallowing of the same bolus. No difference was found between groups regarding face appearance, jaw posture, cheeks, and chewing function. **Conclusion:** Oral breathing in obese children and adolescents was accompanied by myofunctional alterations of the stomatognathic system, represented by narrow palate, interposition of the tongue in the dental arches, occlusion of the lips with tension, and swallowing disorders.

Keywords: Obesity; Mouth breathing; Stomatognathic system; Child; Adolescent

INTRODUCTION

Breathing, as a vital and innate function, allows the survival of human beings. Nasal breathing is characterized as the physiological and appropriate mode of breathing, that is performed when there are anatomical and functional integrities of the upper airway[1]. If there is some kind of obstruction, it generates conditions for the onset of oral breathing, which, consequently, can cause significant changes in the stomatognathic system structures, such as impairment in dentofacial growth, breathing, sucking, chewing, swallowing, and speech[1-3].

The main alterations found in orofacial mouth breathers are: forward head, long and narrow face, dry open or partially open lips, short hypofunctioning upper lip, labioverted and bulky and hypotonic tongue lowered. The maxilla is atresic, with ogival palate, open bite and cross hypotonic orofacial muscles, flat nose with small nostrils, protruding upper teeth and clockwise rotation of the mandible[4].

The occurrence of oral breathing has increased in recent years and has been associated with increased prevalence of obesity in young people. A possible pathophysiological mechanism for this association includes the pharyngeal tonsils, whose cause may be linked to hormonal changes and inflammatory responses, which in turn leads to local and/or somatic growth that was observed in obese children[5]. In similar context, an association between obesity in children and sleep apnea syndrome has been reported. A recent study showed that obese children have a fourfold increased risk of sleep apnea[6] when compared to non-obese children.

The change in body weight of the mouth breathing individual still has just a few explanations. Some of them are related to changes in the masticatory process and difficulty in

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swallowing, caused by pharyngeal, nasal or palate obstruction, another one refers to the reduction of smell by chronic nasal obstruction, which changes the taste. It should be borne in mind that smell and taste are reduced in mouth breathers and thus the choice of type of food is not made by the appetite, but for consistency and ease of intake, allowing the patient to continue breathing through the mouth while chewing[7].

Thus, the mouth breather may undergo changes that can lead to reduction and/or increase in appetite due to decreased taste and smell. This can lead to loss of appetite or, alternatively, can cause rapid mastication, which in turn can lead to increased food intake, favoring the extra weight[8].

Based on the above, and because there are only a few national studies about the changes involving the stomatognathic system in obese patients in the pediatric population, this study had the aim to investigate the myofunctional characteristics of obese children and adolescents who are mouth and nose breathers.

METHODS

This descriptive and cross-sectional study was conducted with a convenience sample of 24 obese individuals, aged between 8 and 15 years, participants of the Group of Obesity in the Ambulatory of Pediatrics of the Hospital Universitário de Santa Maria (HUSM), in the period from March to August 2010. The study was approved by the Ethics Committee of Universidade Federal de Santa Maria (UFSM) under number 01120243000-10. Obese children and adolescents who had their free and informed consent term signed, in accordance with the provisions of the standard 196/1996 of the Brazilian Ministry of Health, were included. Individuals who showed signs of neurological impairment, who had undergone orthodontic treatment, speech therapy, facial surgery, or those with craniofacial malformations were not included, and these data were obtained through medical records. After inclusion in the study, participants were classified as mouth breathers (MB) and nasal breathers (NB) by means of clinical speech assessment, in which facial features and alterations of the stomatognathic system were evaluated, commonly found in oral breathers[9,10].

Nutritional status was evaluated in the medical consultation, by means of anthropometric parameters of weight and height, which were measured with a digital scale accurate to 100 g, Model Leader® and a stadiometer, model Tonelli®, fixed to wall with no baseboard. Children and adolescents were assessed with a minimum of clothes, barefoot and without props in the head[11]. The classification of nutritional status was made using the Body Mass Index (BMI) using reference curves of the World Health Organization (WHO)[12], from which it was established as obese individuals the ones who were in a percentile higher or equal to 95.

The myofunctional characteristics were evaluated using the protocol with Myofunctional Rating Scales (AMIOFE)[13], from which visual inspection was made by a speech therapist, properly trained and experienced in its application. The subjects were assessed individually, remaining seated in a chair with back, with feet flat on the floor. The evaluation of the stomatognathic system included: appearance of the face, palate, postural condition/position of the lips, jaw, cheeks and tongue, mobility and performance in the functions of chewing, swallowing liquid and solid bolus.

To check the appearance of the face it was considered symmetry between the right and left sides, mild or severe asymmetry. For the appearance of the palate it was considered normal, decreased width (narrow mild/severe). For the postural condition of the lips, it was considered: normal posture, occlusion of teeth without the freeway space, open mouth with mild dysfunction and excessive mouth opening and severe dysfunction. The vertical position of the mandible was classified as: normal posture, occlusion of teeth without the freeway space, excessive mouth opening with severe dysfunction. For appearance of the cheek, the criteria were: normal, increased volume or sagging/curved mild or severe. For the position of the tongue it was observed if it is contained in the oral cavity, brought to the dental arches with adaptation or dysfunction and brought to the dental arches with protrusion in excess.

To evaluate the mobility of the stomatognathic system, lip movements (protrusion, stretching, lateroprotrusion to the right and to the left), tongue (protrusion, right laterality, lateralization to the left, lifting, lowering and ability to keep the tongue in stable protrusion for five seconds), and mandible (protruding, lowering, raising, lateralization to the right and left) were required.

In the analysis, isolated movements of each component, accurately and without tremor were considered normal. Lack of precision in movement, tremor, movement associated with other components (for example: lips which accompany the movements of the tongue) and in addition, the inability to perform the movement were considered as changes. The examiner assigned scores on a scale of points according to AMIOFE: 3 = normal, 2 = poor ability, and 1 = no skill to perform the task or did not perform the task. Relating to mandibular movements, measures of extent and symmetry/asymmetry during the mouth opening and closing, the right and left laterality and protrusion were also considered. In swallowing, it was considered a normal pattern when the subject had his tongue contained in the oral cavity, contraction of the elevator muscles, and anterior sealing of the oral cavity without effort.

In mastication, the subject was asked to chew a biscuit filled Bono®, in the usual manner, demonstrating the grinding, the presence of associated body movements and if there was food exhaust. The following aspects were considered: crushing: if AC was bilateral, simultaneous bilateral, chronic unilateral (95% of the time on the same side of the oral cavity), unilateral chewing preference (66% of the time on the same side), or earlier, and the total time for food consumption. The timer was always started after placing the food in the oral cavity and the beginning of grinding, being paralyzed when there was the final swallowing of each portion. Subsequently, according to the protocol, scores were assigned.

For the data analysis procedures descriptive statistics were applied. We calculated the average and standard deviation of the variables with normal distribution. To compare the groups, we used the Fischer's test and ANOVA, taking as significant when $p<0.05$.

RESULTS

Among the 24 subjects selected for the study, 15 were assessed as mouth breathers (62.5%) and 9 as nasal breathers (37.5%). There was no significant difference between groups regarding gender, average age, BMI and waist circumference (Tables 1 and 2).

The characteristics of the appearance of the face and palate and postural condition of the lips, jaw, cheeks and tongue, show that there was no difference between groups in the aspects of assessing the condition of the lips posture and appearance of the palate (p<0.05) (Table 3). While 100% of nasal breathers had normal posture of the lips, 40% of obese patients with mouth breathing had closure with tension and increased activity of the lips and chin muscle. Regarding the appearance of the palate 78% of nasal breathers had unchanged appearance of the palate and 80% of the obese patients had altered appearance of the palate.

During swallowing, it was observed that 74% of the MB and 67% of the NB exhibited normal occlusion of the lips (p=0.913) (Table 4). As for the behavior of the tongue, 47% of the MB had lodged with the dental arches adaptation or dysfunction, while all infants had the tongue contained in the oral cavity, with no difference between groups (p=0.027). Complementary to the variable efficiency of the solid bolus, and liquid bolus, in MB it was not observed repeated swallowing of the same bolus for both solids and liquid, however, 22% of the NB performed the task with repetition of the solid bolus (p=0.057) . Other possible behaviors and signs of change during swallowing were also investigated, such as head movements, facial muscle tension and escape of food, in which changes were observed.

The chewing function was performed by all subjects, being the case that 13 (87%) MB and NB 7 (78%) chewed the food bilaterally, with no statistical difference between groups. When

Table 1. Distribution of obese individuals evaluated according to gender and breathing pattern

Gênero	Breathing pattern		p-value
	Oral	Nasal	
	n (%)	n (%)	
Male	8 (53)	3 (33)	0.341
Female	7 (47)	6 (67)	

Fischer's Exact test (p<0.05)

Table 2. General characteristics of obese individuals evaluated according to the breathing pattern

Variables	Breathing pattern		p-value
	Oral	Nasal	
	Mean (SD)	Mean (SD)	
IMC	28.2 (±3.8)	29.1 (±3.0)	0.563
Age	11.4 (±1.4)	12.8 (±1.7)	0.180
Abdominal circumference	91.7 (±9.8)	98.2 (11.0)	0.148

ANOVA (p<0,05)
Note: SD = standard deviation

Table 3. Myofunctional characteristics of obese patients evaluated according to the breathing pattern

Variables	Breathing pattern		p-value
	Oral	Nasal	
	n (%)	n (%)	
Postural condition of the lips			
Normal occlusion	9 (60)	9 (100)	0.028*
Occlusion with tension/increased activity of the lips and chin muscle	6 (40)	0 (0)	
Vertical posture of the mandible			
normal posture	14 (94)	9 (100)	0.625
Occlusion of the teeth without the freeway space	1 (6)	0 (0)	
Appearance of the cheeks			
Normal	5 (34)	4 (45)	
Slightly increased volume or sagging/arcuate	7 (46)	4 (45)	0.795
Severely increased volume or sagging/arcuate	3 (20)	1 (10)	
Appearance of the palate			
Normal	3 (20)	7 (78)	
Slightly reduced width (narrow)	7 (47)	1 (11)	0.031*
Severely diminished width (narrow)	5 (33)	1 (11)	
Appearance of the face			
Symmetry between the right and left sides	7 (47)	5 (56)	
Slight asymmetry	7 (47)	4 (44)	0.706
Severe asymmetry	1 (6)	0 (0)	
Increased side of the face			
Right	3 (20)	2 (22)	
Left	2 (13)	2 (22)	0.862
No change	10 (67)	5 (56)	
Position of the tongue			
Contained in the oral cavity	6 (40)	7 (78)	0.084
Brought to the dental arches/adaptation or dysfunction	9 (60)	2 (22)	

* Significant values (p<0.05) – Fischer's Exact test

Table 4. Myofunctional characteristics of swallowing of the obese individuals evaluated according to the breathing pattern

Swallow	Breathing pattern		p-value
	Oral n (%)	Nasal n (%)	
Behavior of the lips			
Normal occlusion of the lips	11 (74)	6 (67)	0.913
Normal occlusion of the lips with mild effort	3 (20)	2 (23)	
Normal occlusion of the lips with moderate effort	1 (6)	1 (10)	
Behavior of the tongue			
Contained in the oral cavity	7 (47)	9 (100)	0.027*
Brought to the dental arches/adaptation or dysfunction	7 (47)	0 (0)	
Brought to the dental arches/ excessively protruding	1 (6)	0 (0)	
Efficiency - solid bolus			
Does not repeat the swallowing of the same bolus	15 (100)	7 (78)	0.057
One repeat	0 (0)	2 (22)	
Efficiency - liquid bolus			
Does not repeat the swallowing of the same bolus	15 (100)	9 (100)	1.000

* Significant values (p<0.05) – Fischer's Exact test

evaluated in relation to other signs and changes during mastication, all subjects showed the absence of head movements, posture and escape of food (Table 5).

Table 5. Myofunctional characteristics of chewing function of obese individuals evaluated according to respiratory pattern

Mastication	MB n (%)	NB n (%)	p-value
Bilateral alternating	13 (87)	7 (78)	0.486
Preferential (66% on the same side)	2 (13)	2 (22)	

Fischer's Exact test (p<0.05)
Note: MB = mouth breathers; NB = nasal breathers

DISCUSSION

Mouth breathing, when present in childhood, a phase of intense muscle and skeletal growth of the face, promotes adaptation and specialization of the pathological structures of the stomatognathic system, rather than the harmonious growth of these morphological and functional structures, provided by nasal breathing[14]. From this perspective, we evaluated the myofunctional characteristics of obese children and adolescents, mouth and nose breathers, at the age of transition between childhood and adolescence.

The development of the pharyngeal tonsils usually occurs in childhood and can cause marked respiratory symptoms, fairly frequent between 2 and 12 years of age[15]. Already during adolescence, the pharyngeal tonsils downsize, along with the growth of the nasopharynx, which decreases the probability of finding oral breathing in this age group. Researches based on teleradiographs demonstrated that the pharyngeal tonsils reach their maximum size between 9 and 15 years of age. After this age, the adenoidal mass appears to decrease and nasopharyngeal airway seems to increase. However, this development cycle can be altered by hypertrophic reactions related to allergies and infections of the nasopharynx[16,17].

Changes and/or adaptations that occur in the stomatognathic system, according to the presence or absence of mouth breathing in children and adolescents, are already well known, however, none of the studies sought to relate these findings with excess body weight, a fact now so present in the pediatric population. Among these adaptations tongue with improper posture on the oral floor or priorly interposed between the dental arches, and thick lower lip eversion, mentalis muscle hyperfunction, flaccid lips, tongue and swallowing disorders, distorted speech, face asymmetry, open mouth posture and narrow palate stand out, among others[1,2].

Postural changes of the condition of the lips, accompanied by tension or occlusion with increased activity of the lips and chin muscle are quite common in mouth breathers. These findings were observed in the obese population with mouth breathing of this study. The constant open mouth posture, to facilitate the breathing process, makes no opposition to lateral forces made by the buccinator muscles, which leads to an increase in the height of the palate. When the hard palate is too high it can invade the inner space of the nasal cavities, thus becoming a mechanical obstacle that hinders the nasal breathing. In mouth breathing, it is common to find the hard palate narrow, a fact that was observed in this study[14-18]. In assessing the behavior of the tongue, it was observed that, generally, it is brought to the dental arches with adaptation or dysfunction in mouth breathers, which was observed in obese individuals.

In mouth breathing, given the numerous structural changes, functional changes also occur such as the adapted swallowing. This can be characterized by the lip action, chin muscle action and tongue thrust, which occurs due to muscle tone decrease and posture of the lowered tongue. In an attempt to correct these changes, the perioral muscles, including orbicular, oral and chin muscles, act more actively aiming to restore the lip sealing necessary for adequacy of breathing[19-25]. In the present study, we found a higher percentage of changes of the swallowing function / behavior of the tongue among the

mouth breathers when compared to nasal breathers, indicating that they arise from changes caused by airflow obstruction or even facial typology[16,26,27], probably not related to excess body weight.

With regard to chewing, it was observed in most obese studied individuals, alternate bilateral mastication. These findings were expected, since the chewing process undergoes maturation as a result of aging, and together with a fully established dentition, it allows appropriate chewing[25].

CONCLUSION

The results indicate that there is a high prevalence of oral breathing in obese patients, aged from 8 to 15 years of age. Mouth breathing in obese children and adolescents is accompanied by myofunctional alterations of the stomatognathic system. The main changes found are the decrease of the width of the palate, tongue interposition to dental arches, the occlusion of the lips with tension and swallowing disorders.

RESUMO

Objetivo: Investigar as características miofuncionais de obesos respiradores orais e nasais. **Métodos**: Foram selecionados por conveniência 24 obesos, com idades entre 8 e 15 anos, pertencentes ao Grupo de Obesidade do Ambulatório de Pediatria de um Hospital Universitário. As características miofuncionais foram avaliadas por meio do protocolo de Avaliação Miofuncional Orofacial com Escalas (AMIOFE). **Resultados:** Foi observada respiração oral em 62,5%, e respiração nasal em 37,5% da população estudada. No grupo de respiradores orais, 40% apresentaram oclusão com tensão dos lábios e 80% palato com largura diminuída, enquanto que quase todos os respiradores nasais tinham palato e lábios com postura normal. Interposição da língua nos arcos dentários ocorreu em 47% dos respiradores orais e em nenhum dos respiradores nasais. Os respiradores orais mostraram tendência em não repetir a deglutição de um mesmo bolo alimentar. A aparência da face, condição postural da mandíbula, bochechas e função de mastigação foram semelhantes nos dois grupos. **Conclusão:** A respiração oral em crianças e adolescentes obesos foi acompanhada de alterações miofuncionais do sistema estomatognático, representadas por diminuição da largura do palato, interposição da língua aos arcos dentários, oclusão dos lábios com tensão e alteração da deglutição.

Descritores: Obesidade; Respiração bucal; Sistema estomatognático; Criança; Adolescente

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