Skeletal and occlusal characteristics in mouth-breathing pre-school children

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This study verified the influence of chronic mouth breathing on dentofacial growth and developmental in pre-school children. The study evaluated 73 children, both sexes, ranging from 3 to 6 years of age. After the otorhinolaryngological breathing diagnosis, 44 mouth-breathing children and 29 nasal-breathing children were compared according to facial and occlusal characteristics. The skeletal pattern measurements SN.GoGn, BaN.PtGn, PP.PM, Ar-Go, S-Go indicated a tendency to mouth-breathing children presenting a dolicofacial pattern. According to occlusal characteristics, only the intermolar distance showed a significant correlation with a narrow maxillary arch in mouth-breathing subjects. Based on the results of this study, mouth-breathing can influence craniofacial and occlusal development early in childhood.
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INTRODUCTION

Nasal breathing enables adequate growth and development of the craniofacial morphology, which interacts with other functions such as chewing and swallowing.[1] Any restriction to the passage of air through the upper airways can cause nasal obstruction, which induces the patient to breath through the mouth. During mouth-breathing, several changes take place in the posterior relationship of the involved structures.[2] Alterations in the soft tissues have been attributed to mouth-breathing, more specifically modification in muscle functions, as well as modifications in the hard tissue morphology, including facial bones and dental arches.[3]

During the growth phase, the child with chronic mouth breathing, whether caused by nasal obstruction or not, develops several morphological alterations, that lead to an undesirable development of the dentofacial complex morphology.[4,7] As the obstruction of the upper airways is actually an important variable that can initiate these skeletal alterations, early recognition and treatment of pathological conditions that cause the obstruction of the airways have been recommended.[8] Thus, it is important to research the effect of mouth breathing on dentofacial growth and development in young children.

The purpose of this study is verify the effect of chronic mouth breathing on dentofacial growth and development in pre-school children evaluating the facial and the occlusal characteristics.

MATERIALS AND METHODS

The research project was approved by the Ethics Committee on Research of the Dental School of Ribeirao Preto, University of Sao Paulo (Process # 2000.1.483.58.5). A total of 73 children ranging from 3 to 6 years old were selected. According to breathing pattern diagnosis, the experimental group had 44 mouth-breathing children, with a high degree of airway obstruction (hypertrophy of the palate and/or pharynx tonsils). The control group had 29 nasal-breathing children. Neither group had a previous history of surgery for nasal breathing morphology or orthodontic treatment. The patients were of both sexes and from both black and white backgrounds.

The otorhinolaryngological evaluation was performed by a doctor from the Otorhinolaryngological Services of the School of Medicine of Ribeirao Preto, University of Sao Paulo. The clinical evaluation included: oroscopy for evaluation of tonsil hypertrophy using the Brodsky and Kock criteria,[9] anterior rhinoscopy, otoscopy,

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Table 1. Means and standard deviations (SD) of angular cephalometric measurements in the nasal breathers (NB) and mouth breathers (MB), average difference and tests for uniformity of average and variance.

Orthodontic Measure	Statistics	Type of Breather		Ave. Distance	Test	P
		MB (44)	NB (29)			
SNGoGn	Mean	40.330	36.638	3.692	t=3.231	0.002*
	SD	4.778	4.773		X^2=0.000	0.995
SNA	Mean	82.398	82.707	-0.309	t=0.315	0.753
	SD	3.839	4.477		X^2=0.804	0.369
SNB	Mean	76.534	77.310	-0.776	t=0.849	0.398
	SD	2.804	4.990		X^2=11.399	0.000
ANB	Mean	5.864	5.431	0.433	t=0.764	0.447
	SD	2.864	1.845		X^2=4.089	0.043
SNPP	Mean	6.386	6.241	0.145	t=0.102	0.918
	SD	7.000	3.575		X^2=12.969	0.000
PP.MP	Mean	37.045	32.517	4.528	t=3.433	0.001*
	SD	5.481	5.564		X^2=0.007	0.931
ArGo.GoMe	Mean	132.805	133.897	-0.779	t=0.720	0.473
	SD	3.923	5.345		X^2=3.172	0.074
SN.Gn	Mean	74.193	74.397	-0.203	t=0.218	0.827
	SD	2.963	4.981		X^2=9.278	0.002
BaN.PGn	Mean	84.682	88.069	-3.387	t=3.791	0.000*
	SD	3.927	3.419		X^2=0.626	0.428

* Statistically significant differences (P<0.005)
T test for uniformity of averages of the two groups
Bartlett's hi-square test for uniformity of variances of the two groups

lateral skull radiography for evaluating the aerial column and the hypertrophy of the pharynx tonsils using the Cohen and Konak criteria.[10] The orthodontic evaluation of the 73 cases in this study was done using medical history, the analysis of orthodontic study models and lateral cephalometric radiography. Parents or those responsible for the children were interviewed so that the medical history form could be filled out. For the study cast, impressions of superior and inferior dental arches of all patients were made, using irreversible hydrocolloid impression material (Jeltrate-Dentsply Industry and Bussiness - Rio de Janeiro - Brazil).

The impressions were poured with type III stone with the water/powder ratio recommended by the manufacturer. The bite recording in habitual occlusion was made using a number 7 pink wax. The study casts were evaluated according to the following occlusal characteristics: anterior-posterior relation of the deciduous canine teeth; terminal plane of deciduous second molars; presence or absence of posterior crossbite; presence or absence of anterior openbite; overbite; overjet; intercanine distance; intermolar distance.

The lateral cephalometric radiographs were taken by one technician only, and a lead apron was used for the protection of the patients. The patients held a relaxed posture, teeth in central occlusion, lips in a natural position and head parallel to the floor. The following angular and linear cephalometric measurements were obtained from the cephalometric tracings: SNA, SNB, ANB, SN.GoGn, SN.PP, PP.MP. ArGo. GoMe, SNGn, and BaN.PtGn angles; N-Me, N-ANS, ANS-Me. S-Go, S-Ar, and Ar-Go linear measurements.

The data obtained in the medical history, analysis of the study casts and in the cephalometric evaluation of two samples were submitted to statistical analysis to verify if there were differences in the occlusal characteristics and morphological pattern of children with mouth and nasal breathing. The following statistical tests were used for this study using the STATA program: ANOVA, Student's T test. Wilcoxon test, adjustment and analysis of linear pattern variance, chi-square test, and Bartlett's chi-square.

RESULTS

The statistical results refer to the comparison of the means of the cephalometric measurements in the mouth- and nasal-breathing children. There was a significant statistical difference among the means for the SN.GoGn, PP.MP BaN.PtGn, Ar-Go and S-Go values. The evaluation of the dental measurements showed that there was a significant statistical difference

Table 2. Means and standard deviation (SD) of linear cephalometric measurements in the nasal breathers (NB) and mouth breathers (MB), average difference and tests for uniformity of average and variance.

Orthodontic Measure	Statistics	Type of Breather		Ave. Distance	Test	P
		MB (44)	NB (29)			
N-Me	Mean	99.227	99.379	-0.152	t=0.126	0.899
	SD	5.242	4.661		X^2=0.453	0.500
N-ANS	Mean	42.341	43.483	-1.142	t=1.596	0.114
	SD	3.078	2.849		X^2=0.198	0.656
ANS-Me	Mean	59.909	58.966	0.944	t=1.083	0.282
	SD	3.929	3.145		X^2=1.591	0.207
S-Go	Mean	58.273	60.724	-2.451	t=2.716	0.008*
	SD	3.433	4.242		X^2=1.530	0.216
S-Ar	Mean	27.068	28.214	-1.146	t=1.517	0.133
	SD	2.895	3.457		X^2=1.054	0.304
Ar-G0	Mean	33.852	36.052	-2.199	t=2.560	0.012*
	SD	3.265	4.041		X^2=1.555	0.212

* Statistically significant differences (P<0.005)
T test for uniformity of averages of the two groups
Bartlett's hi-square test for uniformity of variances of the two groups

in the means of the intermolar distance only, and this difference was smaller in the mouth-breathing group.

DISCUSSION

The SN.GoGn angle was greater in the mouth breathing group, showing more accentuated inclination of the mandibular plane in these patients, which is in accordance with the results obtained by others,[11-15] who evaluated children between the ages of 6 and 12.

On the other hand, the SNGn variable did not show any difference between groups, indicating that up to the age group studied, there is no difference in the direction of the face growth of mouth-breathing patients compared to nasal-breathing patients. However, Harvold *et al.*,[16] while studying animals, and Solow *et al.*[17] found that mouth breathing promotes posterior rotation of the mandible. Faria[14] also observed greater SNGn values in mouth breathers.

The morphological pattern measured by the BaN.PtGn angle was statistically correlated with the type of breathing, because the mouth-breathing patients showed a tendency towards the dolicofacial pattern, while a majority of nasal-breathing patients were mesofacial. These results are in accordance with other studies.[2,13,15,18-20] Linder-Aronson[6] observed that the nasal obstruction due to hypertrophy of the pharynx tonsils occurs more frequently in dolicocephalic children and in children with smaller nasopharynx. However, Vig *et al.*[21] reported that, when breathing patterns and facial types (normal and long faces) were compared, there were no significant differences. The height of the mandibular ramus (Ar-Go) was greater in the nasal-breathing group. This significant statistical difference was not observed in the studies of Bresolin *et al.*[12,22]

The cephalometric measurements taken in the anteroposterior plane - SNA, SNB, and ANB – were not statistically different between the two groups, reinforcing the concept that the type of breathing does not influence the growth pattern in the maxillary horizontal plane.[6,23,24]

With reference to the dimensions of the maxillary arch, it has been observed that the intermolar distance was statistically smaller in mouth-breathing patients when compared to that of nasal breathers, which indicates a larger narrowing of the maxillary arch in the second deciduous molar area. This difference was not verified in the canine teeth area. These results are consistent with those obtained by others.[6,12,22,24-27]

The predominance of posterior crossbite in this group was not significantly greater in the nasal breathers, which supports the reports by Ung *et al.*[28] Perhaps this result is due to the fact that the children studied were very young, the majority less than 6 years old, when the transversal growth of the maxillary arch reaches an almost definitive dimension. Probably, if these samples had been of an older age group, a different amount of crossbite would have been found in mouth breathers as observed by Linder-Aronson,[6,24,29] Cheng *et al.*[30] and Bresolin *et al.*,[12] who evaluated children from different age groups (6-8 years old and 9-12 years old) and by Melsen *et al.*,[31] who reported a greater prevalence of posterior crossbite in mouth-breathing children between 13 and 14 years of age.

Confirming the result obtained in the caphalometric evaluation of the antero-posterior position between the maxillae (ANB), no overjet differences were observed between the two groups. However, Bresolin *et al*.[12,22] and Paul and Nanda[27] observed that overjet was significantly greater in mouth breathers.

The ArGo.GoMe, N-Me, N-ANS, ANS-Me and S-Ar cephalometric measurements were not statistically different in the two evaluated groups. These findings were not in accordance with reports by Bresolin *et al*.,[12 22] Ung *et al*.[28] and Ricketts,[26] who found the goniac angle more obtuse (ArGo.GoMe) in mouth-breathing patients.

The posterior facial height (Ar-Go) was smaller in mouth breathers, which supports the findings of Santos-Pinto *et al*.,[32] who found the posterior facial height significantly reduced in patients between ages 8 and 14.

CONCLUSIONS

The results of this study showed in relation to skeletal pattern that there were some differences between the two groups studied. The mouth-breathing children presented greater inclination of the palatal and mandibular planes, dolicofacial morphological type and reduced posterior facial height and a narrow maxillary arch in molar area. Based on the results of this study, mouth-breathing can influence craniofacial and occlusal development early in childhood. The re-establishment of a breathing pattern with a nasal predominance is suggested as soon as any type of alteration in the respiratory function is diagnosed.

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