Original Article

Artigo Original

Postural evaluation in children with atypical swallowing: radiographic study

Avaliação postural em crianças com deglutição atípica: estudo radiográfico

Almiro José Machado Júnior[1]
Agrício Nubiato Crespo[1]

Keywords

Deglutition
Posture
Skull
Stomatognathic system
Dentition, mixed

ABSTRACT

Purpose: To evaluate the cranial posture on lateral teleradiographs of children with atypical swallowing in mixed dentition. **Methods:** By using cephalometric analysis on lateral teleradiographs, the angles between the odontoid process and cranial base (CC1) and the odontoid process and Frankfurt plane (CC2) were measured in two groups: 55 teleradiographs from the experimental group (with atypical swallowing), and 55 lateral teleradiographs from the control group (normal swallowing). These angular measurements were subjected to statistical analysis. **Results:** The means of the variable CC1 were 99.95 degrees in the experimental group and 96.42 degrees in the control group, with significant difference between them. The means of the variable CC2 were 90.60 degrees in the experimental group and 86.35 degrees in the control group, which was also statistically significant. **Conclusion:** The angles CC1 and CC2 are increased in the group with atypical swallowing.

Descritores

Deglutição
Postura
Crânio
Sistema estomatognático
Dentição mista

RESUMO

Objetivo: Avaliar a postura craniana em telerradiografias laterais de crianças com deglutição atípica em dentição mista. **Métodos:** Por meio de análise cefalométrica em telerradiografias laterais, foram mensurados os ângulos entre processo odontóide e base do crânio (CC1) e processo odontóide e plano de Frankfurt (CC2) em dois grupos: 55 telerradiografias do grupo experimental (com deglutição atípica) e 55 telerradiografias do grupo controle (deglutição normal). Tais medidas angulares foram submetidas a análise estatística. **Resultados:** As médias da variável CC1 foram de 99,95 graus no grupo experimental e de 96,42 graus no grupo controle, havendo diferença entre elas. As médias da variável CC2 foram de 90,60 graus no grupo experimental e de 86,35 graus no grupo controle, também com diferença. **Conclusão:** Os ângulos CC1 e CC2 estão aumentados no grupo de deglutição atípica.

Correspondence address:
Almiro José Machado Júnior
R. Maria Monteiro, 841/11, Cambuí, Campinas (SP), Brazil, CEP: 13025-151.
E-mail: almirom@ig.com.br

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(1) Discipline of Otorhinolaryngology, School of Medical Sciences, Universidade Estadual de Campinas – UNICAMP – Campinas (SP), Brazil.
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INTRODUCTION

The mixed dentition stage is a phase of the development in which several alterations occur to the stomatognathic system. Studies have shown that in this stage a definite transition from the infant swallowing pattern to the adult one should occur[1-7], but, due to several reasons still unexplained, infant swallowing may remain beyond the replacement of the deciduous teeth, being classified as atypical swallowing[3,5,8]. Atypical swallowing has been attributed to suction with no nutritious purposes, use of baby bottles, oral breathing, alterations in the central nervous system, and anatomic alterations[5-9]. However, there is no consensus regarding its etiology.

Studies have shown that swallowing is an activity which is coordinated with other oral functions and require a strict interaction among different muscle groups. For the synchronization of suction and swallowing, it is necessary a strict relationship between the muscles of the oral region to generate suction pressure, to open and close the mouth, and of the tongue to make the bolus and its peristaltic transportation into the pharynx[10,11]. During oral feeding, the breathing mechanics involves the adequate activation of the diaphragm, intercostal muscles, and the muscles of the upper respiratory tract from the nose until the glottis[10,11]. Recent studies have noted that hyperplasia of the pharyngeal and palatine tonsils is the second most frequent cause of obstruction of the upper respiratory tract and, consequently, of oral breathing in children[11-15]. The relationship between oral breathing and atypical swallowing has already been studied[16-21], but it is still controversial.

Among the possible alterations evaluated in cephalometric studies with oral breathing children[14-17], it has been observed that there is alteration in head posture[10,17]. Studies have assessed head posture in different malocclusions[19-21], in different facial types[22,23] and oral malformations[24-26], and in the anatomy of the respiratory tract[27-28], without reaching consensus. However, studies that assessed head posture in children with atypical swallowing were not found. The knowledge of this fact may be useful in the objective diagnosis of atypical swallowing and also for its treatment, because if children with atypical swallowing present alterations in head posture, the rehabilitation of this dysfunction should not be limited only to orofacial structures, but should also include cervical structures. Hence, the purpose of this study was to assess head posture in teleradiographies of children with atypical swallowing in physiological mixed dentition.

METHODS

This transversal observational analytic retrospective study analyzed the teleradiographies in lateral norm obtained from the medical records of children from both genders in the stage of physiological mixed dentition, with ages from 7 to 11 years[1-3,5], who were candidates to functional orthodontic/orthopedic treatment at the Dental Clinic of the Updating Course in Functional Orthopedics of the Maxillas of the Sociedade de Odontologia Sistêmica de São Paulo. The mean age in the control group (normal swallowing) was 9.46 years (SD=1.83), and in the experimental group, 10.05 years (SD=1.92), with no difference between them.

The swallowing assessment was carried out, initially, only with saliva, observing, without touching the patient, a possible projection of the tongue and participation of perioral muscles, with contraction of the lips and mentalis muscle[14]. However, when signs and symptoms of swallowing irregularities were observed, the lips were separated (labial pressure technique) [1-3] to obtain the confirmed visualization of the posture of the tongue. This procedure was done simultaneously by three orthodontists and/or functional orthopedists, and the consensus of the swallowing assessment was written on the child's medical records: normal or atypical.

With these medical records, we selected lateral teleradiographies with the following characteristics: 18x24 cm, taken by a Siemens® machine for one second, 6 Kvp and 1.5 meters of focal distance, conducted with the children in natural head position[3-5]. After the selection of lateral teleradiographies, a cephalometric examination was conducted by the main researcher in a darkened room, using a negatoscope, overlapping a sheet of acetate over the teleradiography. The following anatomoradiographic measures were delimited: angle between the odontoid process and the base of the skull (CC1) (Figure 1) and the angle between the odontoid process and the Frankfurt plan (CC2) (Figure 2).

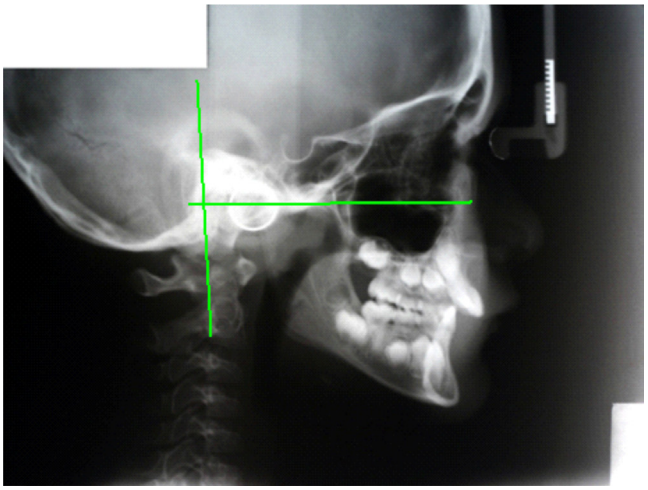

Figure 1. Cephalometric measurements CC1

The lateral teleradiographies without good visibility of the anatomic structures used in the cephalogram were excluded from the sample. The following teleradiographies were also excluded: of children with dental agenesis, congenital orofacial malformations, functional orthodontic and/or orthopedic treatment prior to the study, doubts and inaccuracies regarding the swallowing diagnosis.

The lateral teleradiographies of 20 children with clinical diagnosis of atypical swallowing and 20 with normal swallowing were selected. A pilot study was conducted with these teleradiographies to calculate the sample size: the standard deviation was calculated for the control group, as well as the difference between the means of the control and experimental groups. With a significance level of 0.05 and test power of

Table 1. Comparative analysis of the variable CC1

Swallowing	n	Mean	SD	Minimum	Median	Maximum	p-value
Normal	55	96.42	8.22	83.00	95.00	116.0	0.0131*
Atypical	55	99.95	6.92	87.00	99.00	115.0	

* Significant values (p<0.05) – Mann-Whitney test
Note: SD = standard deviation

Table 2. Comparative analysis of the variable CC2

Swallowing	n	Mean	SD	Minimum	Median	Maximum	p-value
Normal	55	86.35	6.89	76.00	86.00	105.0	0.0008*
Atypical	55	90.60	6.31	80.00	89.00	104.0	

* Significant values (p<0.05) – Mann-Whitney test
Note: SD = standard deviation

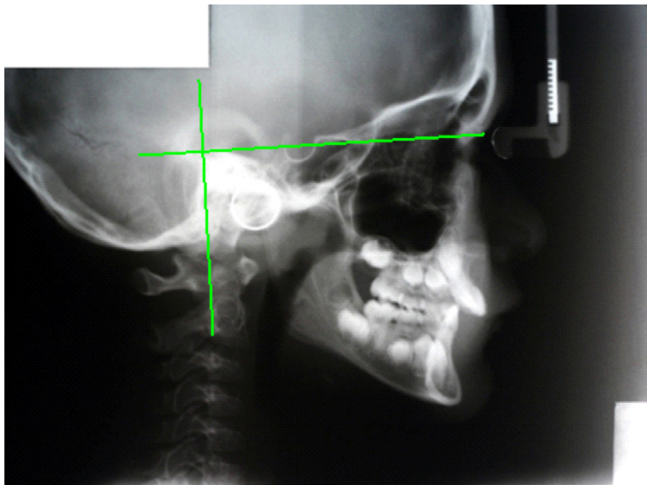

Figure 2. Cephalometric measurements CC2

0.10, the ideal sample size was obtained: 55 teleradiographies in each group. After calculating the sample size, the sample was selected using the same criteria of the pilot study. The final sample for this study was of 110 teleradiographies in lateral norm, belonging to a group of 52 female and 58 male patients, with no difference between groups.

The lateral teleradiographies of the experimental and control groups were ordered randomly and numbered in sequence. This procedure was done in order to avoid that the examiner who performed the manual measurements knew to which group the teleradiography belonged, to avoid bias. To minimize systematic error, the same examiner collected data in two different instances, with a 20-day interval.

To compare the variables under study between the two groups, the Mann-Whitney test was used, obtaining the mean, median, minimum and maximum measures, standard deviation and the values of the test, evaluating data significance. To verify the intra-examiner consistency, the Wilcoxon test for related samples was applied over the eventual difference of measurements in the two instances of data collection. The level of significance adopted for the statistical tests was 5%.

Because this is a retrospective study using information from medical records and lateral teleradiographies, the free and informed consent was not necessary, assuring that all measures would be taken to keep the confidentiality of personal information. The research protocol for this study was previously approved by the Research Ethics Committee of the School of Medical Sciences of UNICAMP, under number 619/2005.

RESULTS

To compare the measurements between the two groups, the Mann-Whitney test was used. The mean CC1 angle was 99.95 degrees in the experimental group and 96.42 degrees in the control group, and the difference between them was significant (p=0.0131) (Table 1). The mean CC2 angle was 90.60 degrees in the experimental group and 86.35 degrees in the control group, also with difference (p=0.0008) (Table 2). There was no difference in the assessment of intra-examiner consistency in the two moments the data were collected, as obtained by the Wilcoxon test for related samples.

DISCUSSION

The results of the present study have found differences between the groups. Therefore, the angles under study are increased in the group with atypical swallowing, when compared to the group with normal swallowing.

The interest in studying atypical swallowing was aroused by the existence of several gaps in literature. From simpler (such as swallowing classification and prevalence) to more complex questions (causes of atypical swallowing and its consequences, methods and diagnosis, starting age and ways of treatment) make it worth to deepen the studies on the subject.

Teleradiographies are standardized extraoral radiographies, used routinely for functional orthodontic/orthopedic diagnosis. They have been used in several studies about craniofacial growth[5,8,18]. In this method, the relationships between the cranium, vertebrae, maxilla, mandible and respiratory tract are observed. Studies have used teleradiographies taken in orthostatic position. A differential of the present study is the use of teleradiographies taken with the head in natural position. We believe that the alteration in the inclination of the head, when the orthostatic radiographic is taken, may possibly alter the measurement of craniofacial measurements. However, new

studies are necessary to evaluate this issue.

This study of radiographic anatomy assessed already existing measurement relations, which were used here in a new way, relating them to normal and altered swallowing. Besides studying a normal group, this research studied patients with atypical swallowing, a clinic condition very prevalent and with impact on orofacial, aesthetic and psychosocial development[5].

All data were collected in two moments, in an attempt to minimize systematic error. We evaluated whether data collected by the same examiner in two different moments could vary significantly. This was not observed, thus demonstrating intra-examiner consistency. Although the variables are measurable, a non-parametric statistical test was used, due to the abnormal data distribution in the sample.

The selection criteria of mixed dentition for the composition of the sample was based on the premise that maturation of the swallowing pattern should occur at this stage[1-3,5], and atypical swallowing is a common finding in this stage of dentition[5]. Although the age range under study (7 to 11 years old) is wide, our results do not show differences between groups regarding age.

Because this is a retrospective study, based on a teleradiographic analysis, it was not possible to evaluate if the measurements studied can be altered after correction of the swallowing disorder by means of different treatments. Further studies must be carried out to test this hypothesis. Because we did not evaluate the presence of dental malocclusions as well, we have no grounds to affirm if swallowing could also be adapted to eventual malocclusions already present.

It is a fact that the clinical test used in the definition of the type of swallowing, normal or atypical, has its limitations and that the final diagnosis of the type of swallowing has also been based on the experience of each examiner, evaluating the involvement of the muscles in the swallowing and other compensatory components[1,3]. Another limitation of this study is the fact that the examination of swallowing was carried out only by functional orthodontists/orthopedists. Multidisciplinary work is necessary, emphasizing the role of the speech-language pathologist, specialized in orofacial motricity, who must act from the assessment to the treatment and follow-up of this disorder.

We used in this study, as anatomic reference, the Frankfurt plane and the base of the cranium[27], believing that these are measurements that suffer the least external effects. Moreover, they are easily seen in the lateral teleradiography. We used the odontoid process as a reference because it is the anatomic structure responsible for the stabilization of the cervical spine in relation to the cranium[28].

Maybe the methodology proposed and used in this study can show new ways for the diagnosis of atypical swallowing, because it increases the possibilities of an objective diagnosis of this functional alteration. Moreover, this methodology may be used in other studies, favoring the diagnosis of alterations in growth and development of face bones due to functional deviations, which are unfavorable to the stomatognathic system (such as oral breathing and non-nutritive suction). Such alterations are closely related to those of atypical swallowing, and are encompassed in the deleterious oral habits[5-9].

CONCLUSION

The angles CC1 and CC2 are increased in the group with atypical swallowing when compared with the group with normal swallowing. Hence, there is posterior rotation of the head in children with atypical swallowing.

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