Research Article

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CEPHALOMETRIC EVALUATION IN CHILDREN PRESENTING ADAPTED SWALLOWING DURING MIXED DENTITION

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ABSTRACT

The tongue thrust and anterior projection through the dental arcades during swallowing is known as Adapted Swallowing (AS) and is a common finding during mixed dentition. The authors studied the morphologic dentofacial characteristics through cephalometric measures in 38 girls and 35 boys, aged seven to nine years, presenting AS, as determined by the speech therapist evaluation. Cephalometric evaluation was obtained by Radiocef 2.0 software. The measurements studied were the mandibular and maxillary relations to the cranial base, the nasolabial angle, and the upper airway patency, as proposed by McNamara Jr (1984), and the convexity and facial axis angles and maxillary height from Ricketts (1960; 1981). Results, analyzed in relation to sex and racial group, showed an association of Class II facial convexity with the African Brazilian children with dark black skin. This classification does not reflect an abnormality as all African Brazilians studied were classified as class II, due to the fact that the standard measurements are based in the white American population. These findings point to the need of specific racial normative standard for evaluating orofacial and dental structures.

Keywords: 1. Facial growth, 2. Swallowing, 3. Occlusion disharmony, 4. Cephalometric, 5. school children

INTRODUCTION

The tongue thrust and anterior projection through the dental arcades during swallowing is known as Adapted Swallowing (AS) and is a common finding during mixed dentition (Bertolini & Paschoal, 2001), but is also seen when orofacial myofunctional disturbances are present (Hanson, 1979; 1988). Orthodontists see AS as an important factor determining the final results in orofacial corrections (Straub, 1951/1961; Graber, 1958; Andersen, 1963; Brauer & Holt, 1965; Proffit & Norton, 1970; Garliner, 1974; Silva Filho, Freitas & Cavassan, 1986; Van der Linden, 1990; Henriques et al., 2000).

Swallowing patterns show physiologic variations related to age and dentofacial configurations and are due to the interrelation of form, posture and function of the structures involved in the physiologic process. The tongue anterior projection during swallowing accompanies the

morphologic and postural alterations of the cervical-cranio-facial segment. The same structures that participate in swallowing movements are also related to tongue resting position and are associated to other oral functions as suction, chewing, speech, and breathing.

Morphologic dental and skeletal alterations impair orofacial functions and result in functional adaptations, but functional adaptation, can itself be responsible in altering normal anatomical structures. It is well known that soft tissue pressure and traction influence bone growth (Moss, 1962; Silling, 1978). Functional adaptation during mixed dentition can be transitory, but if definitive, will need specialized intervention.

Eruption of the definitive incisors happens before craniofacial bone growth is finished, and the space left by the loss of teeth is commonly occupied by the tongue during swallowing, speech or rest. Dento-facial alterations and muscle malfunction that

occur during the dental transition period as a transitory functional adaptation can become permanent altering dental-skeletal configuration and function (Köhler, 1994). When the transitory functional adaptation doesn't disappear, altering dental-skeletal configuration, inadequate function will require intervention.

Cephalometric studies, used since 1931, when Broadbent in the United States and Hofrath (1931) in Germany developed the Cefalostat, are fundamental for the correct diagnosis of dental-skeletal relationship. The normal standards were proposed by several authors, for specific populations (Cotton, Takano & Wong, 1951; Chan, 1972; Garcia, 1975; Alexander, & Hitchcock, 1978; Jacobson, 1978; Moraes, Freitas & Henriques, 1988; Pinzan, 1994; Miyajima, 1996). The lateral craniofacial X-ray shows the relations that exist between dental-skeletal structures and the soft tissues structures (tongue, palate and pharyngeal tonsils, nose and lips).

The Speech Therapist evaluation of function and posture takes into consideration the craniofacial morphology. The cephalometric analysis is an important tool to help determine if the observed alterations are compromising harmonic development and function. In this work, the authors describe the cephalometric findings during mixed dentition in a group of school children presenting Adapted Swallowing.

MATERIAL AND METHODS

School children aged seven to nine years were randomly selected at the Children and Adolescents' Support Program (PRODECAD) of the State University of Campinas. From 81 children evaluated, 73 were diagnosed as having AS. Cephalometric studies were conducted on 38 girls and 35 boys. Racial group definition is very difficult in the highly racially miscigenated Brazilian population, so skin color was used in order to classify children. The group thus consisted of 30 white and

43 African Brazilians, the latter consisting of 25 children with dark black skin and 18 with light black skin. South American Indians and oriental descendents were not included. AS was diagnosed when at least two of three criteria were associated: tongue adapted rest position, tongue adapted swallowing position and perioral muscle hypercontraction. All children were evaluated by an otorhinolaryngologist.

Orthoceph 5 equipment and a cefalostat were used for obtaining the lateral cephalometric roentgenograms, in normal occlusion, as described by Broadbent (1937). Cephalometric tracings were done by a technician using Radiocef 2.0 software and a Hewlett Packard - HP/4C/T scanner, 12 to 2250 dpi, 45s/1.100 dpi digitation speed, with a transparency reader. The measurements studied were the mandible and maxillary relations to the cranial base, the nasolabial angle, and the upper airway patency, as proposed by McNamara Jr, in 1984 (Fig.2), and, the linear measures of the facial convexity, facial axis angle and maxillary height from Ricketts (1960; 1981) (Fig.3). Measurements were approximated up to 0.25 degrees or 0.25 millimeters. Cephalometric tracings analysis was done by two observers, and the numerical results were used to classify type and intensity of morphologic deviations as proposed by the Orthodontic Service of the Bauru Odontology School, São Paulo State University (USP).

RESULTS

AS evaluation considering three criteria showed that all 73 children had adapted tongue rest position, all also presenting adapted tongue position during swallowing and 25 (34.25%) hypercontraction of perioral muscles. The three criteria were present in 25 (34.25%) children.

The otorhinolaryngology (ORL) evaluation detected nasal mucous membrane pallor in 29 (39.73%) children, turbinate hyperplasia in two (2.74%), hypertrophic palatal tonsils

Figure 1: Points In Lateral Cephalometric Roentgenograms

S : sella turcica	Prn : pronasal
N : nasion	Prn' : pronasal derivate
Po : anatomical porion	Sn : subnasal
Or : orbitale	Ls : upper lip
Pt : pterygomaxillary fissure	Bfa : point on intersection of the posterior border of the tongue and the inferior border of the mandible
Ba : basion	Bfp : closest point on the posterior pharyngeal wall
A : subspinale	Nfa : point on the posterior outline of the soft palate
P : pogonion	Nfp : closest point on the posterior pharyngeal wall
Gn : gnathion	

Figure 2: Point demarcation and tracing for linear and angular measures utilized in this study (modified from MacNamara Jr)

Po Or (Frankfort horizontal plane) : plane through points **Po** and **Or**.

Line Nperp : vertical line perpendicular to the plane **Po Or**, extending inferiorly from **N**.

NperpA : measurement to be made is the linear distance from Point **A** to the **Nperp**.

NperpP : measurement the distance from Point **P** to the **Nperp**.

Prn'.Sn.Ls (nasolabial angle) : angle obtained by two straight lines (**Prn'**- **Sn** and **Ls**- **Sn**

Bfa-Bfp (lower pharynx): linear measurement between points **Bfa** and **Bfp**.

Nfa-Nfp (upper pharynx): measurement linear between points **Nfa** and **Nfp**.

BaN . PtGn (facial axis angle) : angle determined by **BaN** and **PtGn**.

Figure 3: Point demarcation and tracing for linear and angular measures utilized in this study
(modified from Ricketts)

Po Or (Frankfort horizontal plane) : plane through points **Po** and **Or**.

N-P (facial plane) : linear distance from points **N** and **P**.

Convexity facial: linear distance from points **N** and **P** perpendicular to facial plane

Maxillary height: angle obtained by two straight lines (**N - Po Or plane** and **A -Po Or plane**)

BaN.PtGn (axis angle): angle obtained by **BaN** and **PtGn** lines.

in 6 (8.22%) and hypertrophic pharyngeal tonsils in 20 (27.40%). No ORL alterations were seen in 29 children. Summarizing parents' responses to a questionnaire, it was noted that parents felt their children exhibited: oral breathing- present in 33 (45.20%) children, snoring -present in 29 (39.73%), nocturnal salivary incontinence – present in 32 (43.84%) and swallowing problems -present in four (5.48%). Cephalometric evaluations detected hypertrophic palatal tonsils in 28 (38.36%) children, but in the otorhinolaryngologist evaluation, only 6 children were diagnosed as having hypertrophic palatal tonsils, two of these not confirmed by the cephalometry. No child was diagnosed with hypertrophic pharyngeal tonsils by cephalometry, although this was seen by the otorhinolaryngologist exam in 20 (27.40%) children. The frequency of type and intensity of morphologic deviations for the studied groups are shown in Tables 1 and 2.

The 31 (42.46%) children presenting facial axis deviations detected by the cephalometric evaluation consisted of five (16.13%) children with brachicephalic facial axis and 26 (83.87%) with dolicocephalic facial axis. Altered maxillary height was noted in 27 children (36.99%), 22 children (81.48%) presenting deep overbite, and five children (18.52%) demonstrated anterior open bite.

There was no significant difference for the frequency of morphologic deviations between boys and girls ($p>0,05$). With the exception of facial convexity no significant difference for the frequency of morphologic deviations was detected between white and African Brazilian children. For facial convexity an association of Class II was seen with African Brazilian children with dark colored skin ($p<0,01$), as only one child of this group was not classified as class II (Table 3). The African Brazilian children with light colored skin differed from the latter group ($p<0.05$) and behaved as the white children group ($p>0.05$).

DISCUSSION

Oromyofunctional evaluation by the speech therapist must include the exam of the morphophysiological integrity of the cranio-cervicofacial segment. In a previous report, Bertolini & Paschoal (2001) found that 57 % of school children examined presented morphological alterations, as diagnosed by clinical evaluation. The use of the cephalometric measures enables the professional to relate dentofacial aspects to posture and function, quantifying the carniocervicofacial complex, with data from maxillary-mandibular relationship and facial development tendencies, showing the patients' muscle pattern.

When evaluating AS in children during the mixed dentition phase it is difficult to determine if the morphological alteration is a transitory anomaly or if there will be definite changes in orofacial configurations. One important issue to be considered is the criteria utilized for defining if the child presents AS. Several of the myofunctional findings are commonly found during this phase and disappear when dentition is defined (Milne & Cleall, 1970; Cleall, 1972; Cleall & Bogole, 1982. Several authors include ORL alterations as a factor for orofacial development deviations (Ricketts, 1968; Trotman *et al.*, 1997; Proffit, 1978; Linder – Aronson, 1979; Harvold *et al.*, 1981, McNamara Jr., 1981; McLoughlin, 1988).

In our sample, although the otorhinolaryngologist evaluation detected slight abnormalities as nasal mucosa pallor, turbinate hyperplasia, hypertrophic palatal and pharyngeal tonsils, this was not confirmed by the lateral roentograms and had no association with cephalometric deviations. The high frequency of positive symptoms suggestive of upper airway obstruction related by parents suggests that although there was no ORL clinical and radiological alterations, other aspects of the orofacial function including the swallowing pattern was compromised. This could, as

indicated by Moss (1962), lead to permanent morphological alterations.

In this group of schoolchildren with mixed dentition presenting AS, almost half showed facial development deviation tendencies, which could be a sign that the myofunction had already influenced bone growth and dental occlusion as previously proposed by other authors (Brodie, 1953; Moss, 1962; McNamara Jr, 1973). Among the orofacial development deviations studied, it was detected that more than one-third of the children exhibited altered maxillary height. However, this specific deviation is not to be considered indicative of an abnormal development in the mixed dentition initial phase as several authors have found (Diamond, 1944; Barrow & White, 1952; Björk, 1953; Moorrees, 1959; Fleming, 1961; Van der Linden, 1990).

The higher frequency of Class II morphologic deviations of facial convexity, seen in the African Brazilian children with dark colored skin, was due to orthodontists in Brazil using the cephalometric analysis standards of Ricketts (1960, 1981) and of McNamara Jr (1984) which were both based in a Caucasian population.

Maxilla and mandible relations to the cranial base, as defined by A-Nperp and P-Nperp measures showed that the vast majority of these children with AS had abnormal relations which were: protrusion, maxillary in 61 (83.56%) children, and mandibular in 53 children (72.60%). Skeletal protrusion in the mixed dentition phase has also been reported as a common characteristic in this age by Nanja and Taneja (1972), who studied Downs' angles (1956) in six to 13 year old children. They found that children presented dental protrusion and a convex facial profile. Cephalometric measurements by McNamara Jr (1984) and McNamara Jr & Brudon (1995) during mixed dentition show that during this phase of craniofacial growth and development, from 6 to 12 years of age, the pogonion can be less the six to eight millimeters from the Nperp line. With

age, the distance is reduced, and adults show a distance from less the two millimeters up to over four millimeters. These values are compatible with a protrusion, although normal for age. In our sample, we considered normal, i.e. without protrusion, up to the values referred by McNamara Jr (1984), so when the children were classified as a convex profile they had a more severe protrusion than expected for age. This was more evident for the children with dark black skin.

Nasolabial Angle configuration was normal in more than half the children; however, when the Nasolabial Angle was altered it was severe. Half of the children who had severely altered Nasolaboal Angle presented with a closed angle and half presented with an open angle. Janson (1990), McNamara Jr (1984) and McNamara Jr & Brudon (1995) refers that in children who have normal nasolabial angle configurations, the findings of altered A-Nperp measures should not be considered for diagnosis. The clinical evaluation should prevail. In our group, more than half of the children who had altered A-Nperp, presented normal nasiolabial angle.

There are no Brazilian cephalometric or myofunctional studies in black children in this phase. However, there are some studies done with teenagers (Altemus, 1963; Brauer & Holt, 1965; Altemus, 1968; Medeiros, Henriques & Freitas, 1988; Moraes et al., 1988, Bertoz & Martins, 1981). Altemus (1960) has attributed the prognathism observed in blacks to a dentoalveolar protrusion. Cardim (1987) and Drumond (1968) reported that dental and skeletal protrusion of maxilla and mandible is characteristic of the black race.

In the current study dental positions were evaluated by radiograms but were not included as an objective. Reviewing the data further analysis was conducted for the group of 25 black children, for dental and skeletal relationships and lower lip hypotony, as shown in Table 4.

Moraes et al. (1988) reports that the racial differences in facial convexity are related to the relative positions of the points, N (nasion – in the cranial base), A (subspinale) e P (pogonion). N varies in accord to the size and inclination of the cranial base. A varies by the degree of maxillary protusion, which is greater in blacks (Cotton et al., 1951, Altemus, 1960/1968; Drumond, 1968; Alexander & Hitchcock, 1978). P which also shows racial characteristics, was repositioned due to the greater inclination of the mandibular plane (Drumond, 1968), or, to the exaggerated alveolar maxillary prognathism seen in blacks (Alexander & Hitchcock, 1978; Moraes et al., 1988). In this study racial differences referred to in the P point were not seen, as only three children had mandibular retrusion. As suggested by Moraes et al. (1988), consideration was also given to the maxillary and mandibular protusion observed in black children which must be related to the lower incisor dentoalveolar protusion and not to an skeletal component. Bertoz & Martins (1981), report that in black teenagers the incisor dentoalveolar protusion should be considered a racial characteristic.

Although all authors that studied non-white samples have called attention to the need for properly applying racial standards, it is not a common practice among orthodontist and speech therapists to consider this when planning therapy (Cotton, et al., 1951; Altemus, 1960/1968; Drumond, 1968; Silva, 1975; Alexander & Hitchcock, 1978; Jacobson, 1978; Bertoz & Martins, 1981; Medeiros et al., 1988, Moraes et al., 1988; Henriques & Freitas, 1990).

Another aspect discussed by Cardim (1987) is the soft tissue distribution in the black race in the lips, and periorbicular muscles, with black children showing hypotonic lip. Altemus (1963; 1968) comments that both lower and upper lips in blacks show an important protusion, and that these aspects are normal racial features. This should not

be forgotten when planning orthodontic and myofunctional therapies. Although in the current study the frequency of hypotonic lower lip did not significantly differ between races, 64% of the black children presented hypotonic lower lip and concomitantly, in 32% of these children hypercontraction of perioral muscle during swallowing was observed. This could be an important aspect to consider when diagnosing AS in black children and perhaps should not be considered as a criteria for AS when isolated.

CONCLUSION

Cephalometric measurements in children presenting adapted swallowing during the mixed dentition phase showed that the vast majority presented maxillary and mandibular protrusion. There was no significant difference for the frequency of morphologic deviations between boys and girls. However, between whites and non-whites an association of Class II was seen with the African-Brazilian children with dark black colored skin. Dental and skeletal protrusion of maxilla and mandible and differences in soft tissue distribution is characteristic of the black race. These aspects, that are normal racial features, should not be forgotten when planning orthodontic and myofunctional therapies. The necessity of applying racial standards, not a common practice among orthodontist and speech therapists is to be considered when evaluating and planning therapy. It should also be considered that in Brazil, due to the racial mixture, standards should be reviewed, not only considering the influence of the black miscigenation, but in certain regions, also the Native and the Asiatic influence should be studied.

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