

CERVICAL VERTEBRAE AS GROWTH AND DEVELOPMENT ESTIMATOR IN CLEFT LIP/PALATE PATIENTS

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ABSTRACT

The analysis of the cervical vertebrae maturation in lateral cephalometric radiographs, which is a routine in orthodontic diagnosis, has become itself an alternative method in the definition of bone development phase, consequently has helped to determine the best period to initiate a treatment involving patients' development and growth. Many methods have been proposed in order to evaluate these changes, among with LAMPARKY'S, relating changes when observing cervical vertebrae size and shape. Later, this method was modified by HASSEL & FARMAN. The goal of this work comes from the need to estimate the time in which cleft lip/palate patients show craniofacial growth and development alterations. Lateral cephalometric radiographs and carpal radiographs were evaluated in the Hospital for Craniofacial Anomalies Rehabilitation in patients aged 7 to 17 (male and female) using HASSEL & FARMAN and GREULICH & PYLE'S methods. Data analysis showed a 92% effi-

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cacy in both methods. Therefore, any of the cited methods can be used as development and growth evaluation tool.

KEY WORDS: Cervical vertebrae; growth; cleft lip/palate

INTRODUCTION

The strategies for correct orthodontic planning depend, most of the time, on a careful analysis of the patient's growth pattern and the development so far achieved, mainly the evaluation of the remaining growth potential. Studies reveal that children in the same age range show different developmental stages. Therefore, the chronological age cannot be taken as a safe indicator of the physiological maturity. The recognition of the periodical variation in the growth speed of patients has great clinical importance in orthodontics since the age of patients seeking assistance varies considerably. In this sense, the evaluation of the skeletal age should be more precise, followed by the secondary sexual characteristics, the morphologic aspects and the chronological age (BENEMANN et al., 1997).

Chronological age has a direct correlation with the cervical vertebrae maturation – the greater the age, the greater the cervical vertebrae maturation index is. Until 12 years there is no statistical difference between males and females. From there on, females show an accelerated rate (GENEROSO et al., 2003).

By the analysis of cephalometric x-rays in lateral norm in children from 5 to 18 years it was demonstrated that the Hassel and Farman (1995) method was good to determine the stage of bone maturity (SAN ROMAN et al., 2002).

The evaluation of the skeletal age was more efficient than that of the biological evaluation, by analyzing cephalometric telerradiographs in lateral norm (FISHMAN, 1979).

Through the study of the interrelations between the measure of the somatic, skeletal, dental and sexual maturity it was concluded that there is an interrelation between them being the skeletal maturity well defined by the analysis of the hand bones (DEMIRJIAN et al., 1985).

Cervical vertebrae were used by Hellsing (1991) to correlate the alteration in the height and width of these structures in the pubertal growth. Results reveal that both height and width of cervical vertebrae can be used as an indicator of skeletal growth.

The aim of the present study was to analyse the method proposed by Hassel and Farman (1995) and Greulich and Pyle (1949, 1959) as

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an estimator to the bone age in patients with cleft lip/palate, verifying the confiability of these methods to determine the development and growth in patients with craniofacial anomalies.

MATERIAL AND METHODS

It was used a sample of lateral norm and carpal teleradiographs of 220 cases with clef lip/palate in the age range of 7 to 17 years old, females and males, allotted by age.

Radiographs were provided by the archive of the Hospital for Rehabilitation of Craniofacial Anomalies of the University of São Paulo, in Bauru-SP, separated by sex and age. Carpal and cephalometric x-ray must be of the same period.

These were selected among those showing adequate technical details to the correct visualization of the structures to be studied using diagnostic aids such as magnifying glasses, negatoscope and clinical records of anamnesis and the diagnosis of the case.

The carpal x-ray presented average contrast and density, optimal clarity and minimal distortion, showing all hand and wrist bones, from the epyphsis of ulna and radium to the distal phalanx positioned in the center of the film, without superimposition or cuts. In the teleradiographs it was possible to see the region from the 2nd to the 6th cervical vertebrae, without superimposition, while the patient was standing.

The x-rays were analysed by the methods of Greulich and Pyle (1959) and Hassel and Farman (1995), which give data on the normal pattern of bone growth and development.

The Greulich and Pyle (1959) method consists in an atlas that contains the common mean variation of bone structures of hand and wrist, from birth to adulthood, with separate patterns to each gender. The observation and comparison of the 30 ossification points in the x-rays of hands and wrist of children determine whether the bone age is similar to that of the pattern. If the comparison lays in between two patterns, the bone age will be the corresponding intermediate age. The atlas has radiographyc patterns of three months for the first 18 months, six months until 5 years and thereafter, anual interval untill 18 years old for females and 19 for males. With carpal x-rays it would be possible to estimate the period of various events of the skeletal growth including its finalization.

The method proposed by Lamparski (1972) was adapted and only the second, third and forths cervical vertebrae were evaluated in the present study (C2 – odontoid process, C3 and C4, pre-

spectively) due to the fact these structures are not shielded by the thyroid protection collar during x-ray. Authors divided by authors in six stages: initiation, acceleration, maturation, transition and finalization. Each of these stages would present their characteristics and represent a probable percentage of the overall skeletal growth, confirming the morphological changes of the cervical vertebrae as reported by Lamparski (1972), and would speak for the different growth stage of an individual. These changes include characteristic modification in the form of C4 and C3 vertebrae, from a wedge form with an inclination of the upper rim, from posterior to anterior, to a regular form, square, and, consequently, to a form with a vertical dimension (height) greater than the horizontal dimension (width). The inferior rim of the C2, C3 and C4 vertebrae are straight or flattened when immature with the formation of a concavity that becomes more marked with time. The order of the onset of this concavity also indicated the stage of development, appearing sequentially from C2 to C4. Thus, for these authors, the visual evaluation of a lateral cephalogram could estimate the growth period of an individual what is helpful since one can have information of the remaining growth and be able to plan the treatment adequately.

After data collection the Turkey test was used with variation of 10% (significance level = 0.10) to compare the data from the analysis of the x-rays of patients with craniofacial anomalies and to connect the findings with normal individuals as described in the methods of Hassel & Farman and Greulich & Pyle.

RESULTS

In the present study no difference was found with statistical significance in the data from patients with cleft lip/palate when compared with normal patterns in the literature. As can be seen in TABLE 1, for males, the stages reported by Hassel and Farman (1955) began before age 7 with a peak at age 12 and finalization at age 17. In the method proposed by Greulich and Pyle (1959), it was observed a constant result in most ages. Only at age 11 was there some discrepancy (11.9 years). For females (TABLE 2), the stages proposed by Hassel and Farman (1995) began before age 7, with a peak at age 12 and finalization at age 17.

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TABLE 1 – Results of the analysis of bone maturity in male children of the HRACF analysed by the method of Hassel and Farman (1995) and Greulich and Pyle (1949, 1959).

Chronologic age (in years)	GREULICH and PYLE (age/year mean)	HASSEL and FARMAN (phase mean)
7	6.7	1.3
8	8.1	1.2
9	9.3	2.0
10	10.2	2.7
11	11.9	2.4
12	12.2	3.4
13	12.9	4.0
14	13.8	4.4
15	14.7	4.9
16	16.0	5.5
17	17.0	5.8

TABLE 2 – Results of the analysis of bone maturity in female children of the HRACF analyzed by the method of Hassel and Farman (1995) and Greulich and Pyle (1949, 1959).

Chronologic age (in years)	GREULICH and PYLE (age/year mean)	HASSEL and FARMAN (phase mean)
7	6.9	1.3
8	8.2	1.5
9	8.9	2.2
10	10.1	2.5
11	10.7	3.0
12	12.0	4.2
13	13.8	4.5
14	14.3	4.7
15	15.2	5.0
16	16.0	5.4
17	16.9	5.9

The tests revealed that the probability of results for 220 male and female patients with cleft lip/palate did not reveal any significant difference (FIGURE 1).

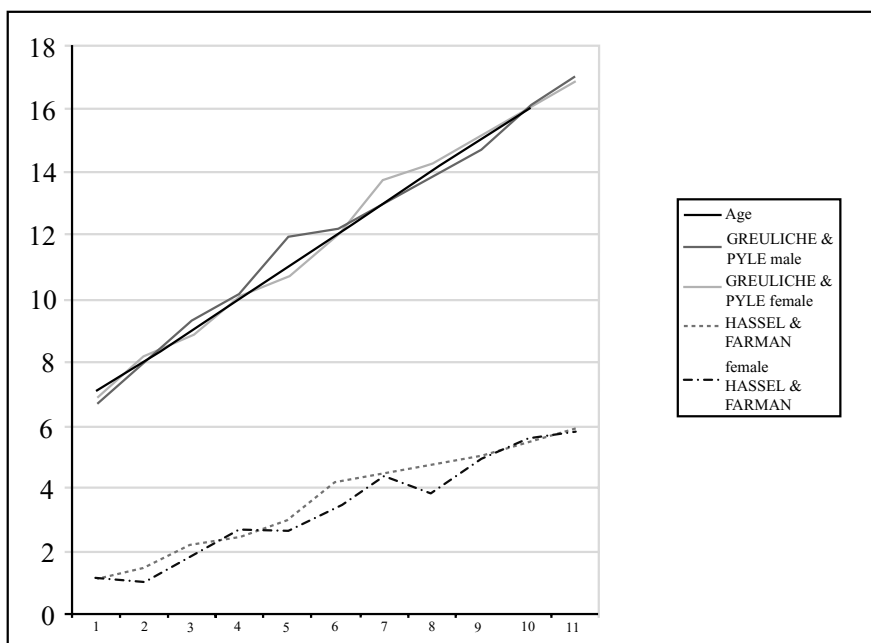


FIGURE 1 – Evaluation of male and female children at the HRAC as compared to their chronological age.

DISCUSSION

The puberty growth phase is the best period for a functional orthodontic and orthopedic treatment, in which body transformation stake plase, mainly in the head and neck, leading to better results. For use of orthodontic and orthopedic techniques in patients with craniofacial anomalies as special care should be taken in what regards the development and growth of these patients (GRACIANO, 1998).

It was observed that there is no significant difference between the Greulich and Pyle method and that of Hassel and Farman for the evaluation of the skeletal maturation of patients with craniofacial anomalies, for both males and females. The comparison of the results with those of other populational groups suggests that the technique of analysis of the cervical vertebrae is neutral in what regards race and patiens with some sort of craniofacial anomalies.

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The test of Turkey (TABLE 3) with a variance of 10% (significance level = 0.10) revealed that the confiability of the methods of Greulich and Pyle (1959) and Hassel and Farman (1995) in patienst with clef lip/palate is 92%. It is suggested to expand the use of this technique in functional orthodontic and orthopedic clinics in order to expose patients to a lower dosage of radiation and to reduce costs and time in the analysis of x-rays.

TABLE 3 – Variance analysis, Test of Turkey (significance level = 0.10) comparatively betwenn data of chronologic age (CA) X Greulich & Pyle (GP) X Hassel & Farman (HF).

COMPARISON	DIFFERENCE	INTERPRETATION
male IC X GP X HF	-0.0727272	Non significant
female IC X GP X HF	-0.0909090	Non significant

CONCLUSION

The Greulich and Pyle and Hassel and Farman methods for bone age estimantion can be safely used to verify the skeletal maturation on x-rays of individuals with clef lip and /or palate.

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