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Original Article

An evaluation of craniofacial growth pattern in North Indian children

Vivek Mehta *, R.K. Pandey

Department of Pediatric and Preventive Dentistry, Faculty of Dental Sciences, King George Medical University, Lucknow, India

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ABSTRACT

Objective: The aim of this study was to assess craniofacial growth pattern in children with generalized decreased skeletal age and compare it with the children having normal skeletal age.
Materials and methods: Lateral cephalograms and hand wrist radiographs of 40 patients (age group 3–14 years) were taken and skeletal age assessment was done with hand wrist radiographs according to Greulich and Pyle, based on which two groups were made, Group A – Control group (normal skeletal age) and Group B – study group (decreased skeletal age). Group A had a sample size of 21 and Group B, a sample size of 19. These were further divided into subgroups according to age: subgroup (a) – 3 to 6 years, subgroup (b) – 7 to 11 years and subgroup (c) – 12 to 14 years. The skeletal and dental patterns were analyzed with Down's Cephalometric analysis. Student "*t*" test was used to verify comparisons in all the subgroups of patients of Group A and Group B.
Results: The facial angle and Cant of occlusal plane exhibited maximum difference between the two groups which indicated that mandibular growth was affected more than other bones in diseased child patients.
Conclusion: The present study led to the conclusion that craniofacial growth was retarded in children with generalized decreased skeletal age in comparison to healthy child patients.

1. Introduction

Physiologic growth of an individual child is defined as a child's progress towards completeness of development or maturity. It is a dynamic statement for the general health of that child. Its correlation with skeletal age can be is assessed at any single point through the growth chart, although this information is not very meaningful, still it indicates whether the direction of individual's growth is average, a variant of the norm, or pathologic. In other words, it is of great significance to find out that the children visiting the dental outpatient departments have skeletal age in concordance with chronological age to rule out any endocrinological disturbances which may influence the treatment planning and treatment outcome for these patients. Bone age assessment, a procedure frequently performed in paediatric radiology is based on a radiological examination of skeletal development of the left-hand wrist and comparison with the chronological age. A discrepancy between these two values indicates abnormalities in skeletal development. General principle of orthodontic and orthopaedic treatment in children is to utilize growth of the child considering the amount of growth remaining and the direction in which the forces are to be applied to stimulate growth in desired direction. Ricketts[1] believes that "to take advantage of growth, we must have some idea first of its amount and second of its direction". Singer[2] has added a third ingredient, the need to know the time when the major growth increments are likely to occur. Thus in addition to studying the craniofacial growth in normal children, it is important to understand the growth in children with deviating growth pattern[3] or in children with reduced or accelerated skeletal age so that the clinician would be able to assess the best time for providing orthodontic/orthopaedic treatment to the child and optimal direction of application of force to minimize undesirable effects.

2. Aim

The aim of this study was to assess the craniofacial growth pattern in children with generalized decreased skeletal age and compare it with the growth pattern of normal healthy child patients of same chronological age at a tertiary health centre.

3. Material and methods

The present study was conducted on 40 North Indian healthy and diseased children, 25 males and 15 females in the age group

* Corresponding author. Present address: Department of Pediatric and Preventive Dentistry, Faculty of Dentistry, Jamia Millia Islamia, New Delhi 110025, India.
E-mail addresses: drvivekmehta1@gmail.com (V. Mehta), rameshpandey99@gmail.com (R.K. Pandey).

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Table 1
Number of samples used in each subgroups of the study.

Sub groups	Age group	Group I	Group II
Group A	3–6 years	$N=6$	$N=6$
Group B	7–11 years	$N=7$	$N=5$
Group C	12–16 years	$N=7$	$N=6$

from 3–14 years out of which 37 children were selected from the Outpatient Department of Pediatrics and Outpatient Department of Pedodontics and Preventive dentistry, C.S.M. Medical University, Lucknow.

Healthy children (control group) were selected according to Indian weight standards developed by Aggarwal et al.[4] The normal variation range in weight was taken between 3rd and 97th percentile curves for a particular age. The child patients beyond this range were not included in the study.

A brief history of each child including name, age, sex, date of birth, name of the school and address was recorded. The informed consent was obtained from the parents and school teachers. The study included hand wrist radiographs of left hand and lateral cephalograms using $8'' \times 10''$ films.

The hand wrist X rays were studied for skeletal age assessment based on atlas by Greulich and Pyle[5] and thereafter the sample was categorized into 2 groups – Group A or Control group comprising of 21 patients having normal skeletal age and Group B or Study group comprising of 19 patients having decreased skeletal age. Further the sample was subclassified into subgroups – (a), (b), (c) according to the chronological age of the child. The subgroup (a) consisting 6 of patients in the range of 3–6 years, subgroup (b) of 7 patients in range of 7–11 years and subgroup (c) of 7 patients in the range of 12–14 years.

Craniofacial growth for each individual was evaluated by lateral cephalogram. The cephalograms were traced and Down's analysis was preformed for each individual as it is one of the most commonly used analysis which shows conformity with the present study. The ten different parameters (facial angle, angle of facial convexity, A–B plane angle, mandibular plane angle, *Y*-axis angle, Cant of occlusal plane, inter-incisal angle, incisors (1) occlusal plane angle, incisor (1) mandibular plane angle, upper incisor (1) to A-Pog line) were evaluated for both the Group A and Group B subjects and presented in Table 1. After analyzing skeletal and dental parameters, Student '*t*' test was used to verify comparisons in all the subgroups of patients with and without generalized decreased skeletal age.

4. Results

Craniofacial growth parameters of Group A and Group B for three subgroups were summarized in Table 1 and Figs. 1–10.

All investigated parameters of Group A and Group B subjects for all the three subgroups showed no significant pattern. Group A subjects are highly variable than Group B. Inter-incisal angle showed the maximum and A–B plane angle the least angle value. Angle of facial convexity, mandibular plane angle, *Y*-axis plane, Cant of occlusal plane, inter-incisal angle of normal and diseased subjects in all the three subgroups does not differ significantly ($p > 0.05$). Facial angle and incisor (1) occlusal plane angle in subgroup (a) of diseased were found significantly ($p < 0.05$) lower than normal while A–B plane in subgroup (c), incisor (1) mandibular plane angle in subgroup (a) and upper incisor (1) to A-Pog line in age subgroup (a) and (b) of Group B were found significantly ($p < 0.05$) higher than the normal. The high variation in angles of the parameters of Group A in all the subgroups made other comparison insignificant ($p > 0.05$).

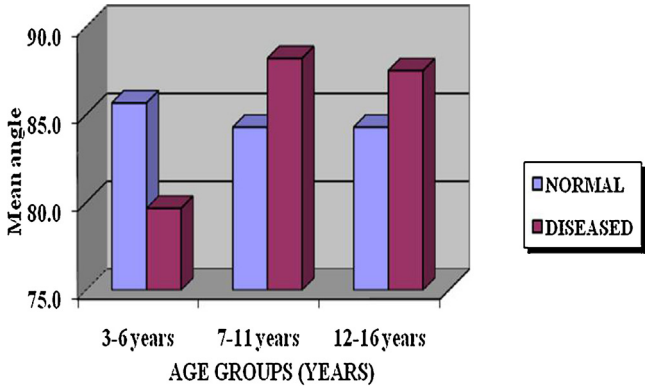

Fig. 1. Facial angle in subgroup (b) and (c) of Group B (diseased) were greater than Group A while of subgroup (a) were greater in Group A than Group B.

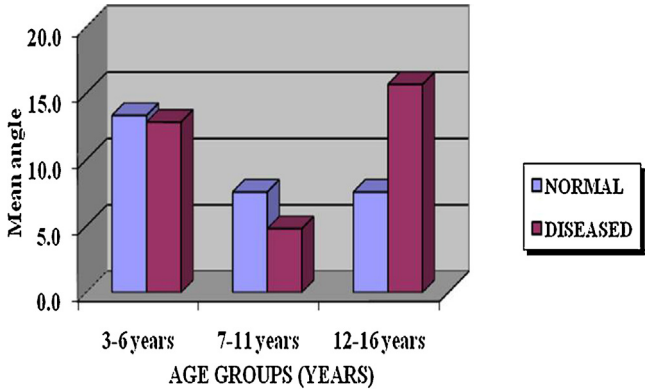

Fig. 2. Angle of facial convexity of only subgroup (c) showed a considerable increase in diseased group (Group A) than normal group (Group B) while the other two subgroups did not show much variation.

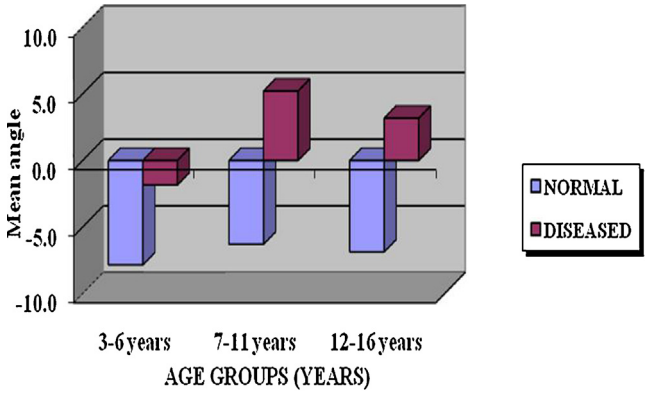

Fig. 3. A–B plane angle showed a great variation between Group A and B with Group A showing negative values and Group B showing positive values in all the three subgroups.

4.1. Correlation of craniofacial growth parameters of Group A

All the investigated craniofacial growth parameters of Group A significantly ($p < 0.01$) correlated with each other except incisor (1) mandibular plane angle and upper incisor (1) to A-Pog line with angle of facial convexity. These significant associated parameters suggest that these are linearly dependent on each other and can be estimated by simple linear regression. Parameters also show positive association with each other except A–B plane angle. Facial angle may be the best indicator parameter for predicting other

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