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## **Correlation of dental age, skeletal age, and chronological age among children aged 9-14 years: A retrospective study**

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**Abstract**---Background: Understanding growth, which may be one of the most elusive variances, is critical for diagnosis and therapy planning. It has been common practice to use a child's skeletal age or dental age as a proxy for their actual age. Multiple studies have looked at how various populations' dental and skeletal maturity rates correlate with chronological age. The current research aimed to replace skeletal age estimate with dental age estimation in the community. Methods: "In all, 104 samples were collected, with girls and boys each accounting for nearly half. Demirjian's method was used to calculate the patient's chronological age based on their teeth, while hand-wrist x-rays and Fishman's skeletal maturation index were used to calculate the patient's chronological age based on their bones." Results: We used Spearman's position request connection coefficients to examine the correlation between skeletal and dental

maturation. Mean ages of men and women are not fixed at 11.89 1.867 and 12.21 1.473 years, respectively. "Researchers found a strong relationship between chronological age and measures of dental and skeletal maturity (P 0.01). The correlation between dental and skeletal ages was statistically significant (P 0.001), with a connection value of 0.683 for males and 0.704 for women." Conclusion: Based on the results of this study, dental age may be utilized as a proxy for a person's chronological age in the context of a population with various degrees of dentition.

**Keywords**---dental age, skeletal age, chronological age, children.

## **Introduction**

A human being develops physically via a series of processes that transform a single cell into a highly sophisticated adult. Understanding what constitutes normal human development and maturation is crucial for spotting any signs of aberrant or pathologic expansion. Understanding growth, despite the fact that it is one of the most nebulous differences, is crucial for diagnosis and therapy. [1] To determine whether or not height and weight are useful for gauging growth, longitudinal data are required. Developmental age has traditionally been calculated using the child's skeletal age or dental age. The development of the skull and face has been linked to skeletal maturity in several studies. Bone radiographs have the drawback of exposing the patient to more radiation, and dental practitioners to the learning curve of learning new skeletal landmarks. The alternative option is using an orthopantomogram, which is often used in dentistry to assess the patient's chronological age based on their teeth. Multiple studies have examined how chronological age correlates with skeletal and dental maturity. Statistically representative growths were used in several research to inform the development of the criteria. [2] But there have been no reports looking at this connection among the particular population till now. The goal of the current investigation was to determine whether dental age estimate may be used as a substitute for skeletal age estimation in the population under consideration.

## **Materials and Methods**

This research looked back rather than forward. The study's methods have been approved by the institution's ethics board. A total of 104 samples were analysed. Sample size was calculated using G\*Power 3.1.2 software with the following parameters entered: effect size = 0.6,  $r = 0.4$  between dental age and skeletal age, 95% confidence interval, 90% power. The final sample size was 104, with 52 participants in each of the male and female groups. The necessary information was retrieved from the pre-treatment files of children who had previously been seen by the clinic.

## **Sample Selection**

The inclusion criteria were

- Patients with same geographical nativity
- Age between 9 and 14 years (mixed dentition stage)
- No systemic disease affecting growth
- No history of orthodontic treatment
- Good quality of the radiographs
- No abnormal dental conditions (e.g., impaction, congenitally missing teeth).

The exclusion criteria were:

- Incomplete patient records
- History of premature extractions.”

This evaluation made full use of radiographs (including orthopantomograms and radiographs of the hands and wrists), complete clinical narratives, following paper for cephalometric estimations, a ruler, a scale, an X-beam watcher, an eraser, and reference graphs for the Demirjian method and the Skeletal Maturity Index (SMI) developed by Dr. Fishman.

### **Chronological age estimation**

Using the date of birth as a denominator, the age at the time the radiograph was taken was calculated.

### **Dental age estimation**

The presence or absence of seven permanent teeth in the third cranial quadrant allowed us to determine the age of the subject using a cephalometric following sheet (incisors, canine, premolars, and molars, first and second). The teeth were assigned finality grades (A-H) according to how they felt at the very tip.

### **Skeletal age estimation**

Thumb, third finger, fifth finger, and radius radiographs were used to determine a person's skeletal age using Fishman's SMI [4], which takes into account the four phases of bone maturation present in six anatomical locations.

### **Results**

The reviewers were able to recall 104 cases. All 52 male and female patients in the 9-14 age range received the same examples. The process of linking chronological ages to those determined from dental and skeletal remains is complete. Skeletal growth and dental maturation were correlated using Spearman's position request connection coefficients. Ages of 11.56 years for men and 12.02 years for women are not fixed. Relationship coefficients do not provide a definitive answer for establishing firm bonds between male and female skeletons, dental arches, and the sequence of their molars. For both dental and skeletal ages, we discovered a statistically significant association with ordered age (P 0.01). Males showed a correlation of 0.67 (P 0.01) between dental and sequential age and 0.76 (P 0.01) between skeletal and sequential age (Table 1). There was a significant positive association between dental age and skeletal age (P 0.001), with a value of 0.56.

Female dental and ordered ages were linked at a coefficient of 0.67 (P 0.01), whereas skeletal and sequential ages were linked at a coefficient of 0.63. (P 0.01). The connection between dental and skeletal ages was found to be extremely significant at P 0.001 and a value of 0.65.

Variable	Male		Female	
	Correlation coefficient	P value	Correlation coefficient	P value
Dental age	0.67	0.000	0.67	0.000
Skeletal age	0.76	0.000	0.63	0.000

## Discussion

The wide range of human growth patterns that are still visible inspired the notion of evaluating natural or physiological development. Skeletal changes, the presence or absence of sexual characteristics, and tooth growth are all reliable indicators of age in humans. There is a correlation between the density of a person's skeleton and his or her level of physiological maturity [5]. [6] Radiographic evidence of skeletal development provides a quantitative measure of the rate of change in bone size, shape, and mineralization that describes the bone's capacity to accommodate normal growth. Humans continue to set the standard for advancement in terms of every bone in their bodies. However, due to the fact that everyone has a different internal clock, there is considerable variation in the timing of these adjustments. [7]

Due to the fact that Fishman's SMI may be used on subjects older than 9 years old, the study population includes those who are in the late mixed dentition stage. Additionally, pubertal development typically often begins around age 10 in young females and age 12 in young men, providing the optimum chance to complete the goals of orthodontic treatment in the briefest time. [8] Numerous studies have shown the reliability and legality of the hand-wrist radiograph, which is the most common and widely used method of skeletal age assessment. Radiographic assessment of the SMI was suggested by Fishman [3] because to the prevalence of 11 indicators shown throughout childhood and adolescence. Extending the picked epiphyseal, hardening the adductor sesamoid, covering the shafts with epiphysis, and maybe converging the shafts were the four stages of development that were shown to be consistent across time.

Numerous authors have shown that Demirjian's approach is the gold standard for determining a person's age based on their teeth, hence this is the technique that was used in the study. [9],[10],[11],[12],[13],[14] Participants in this cross-sectional study were assigned at random to one of many age groups. The approach, most likely, has the benefit of rapidly amassing data on enhancement throughout a wide range of ages. Information acquired via cross-sectional studies is particularly useful for laying forth public norms for development and examining progress across various groups. [2]

The purpose of this investigation was to establish a correlation between children's skeletal and dental ages and their chronological sequence of development when they had mixed dentition. Knowing the age-to-age relationship of a child is crucial for clinical assessment of how much growth potential exists and how much

progress has to be made with that child. As the expedition's results showed, there was a strong relationship between skeletal and dental ages and chronological age in both sexes. Dental and skeletal ages are highly correlated, with  $r$  values of 0.683 and 0.704, respectively, when analysing male and female populations. This is the first study to reveal a correlation between age and health risks in India. When Hegde and Sood [15] examined 197 cases (6-13 years old) to determine the viability of Demirjian's system in the Belgaum population, they discovered a mean difference of 0.14 years between legitimate and studied age (confusion by 51 days) and a negligible difference of 0.04 years (misconception by 15 days) for females. They also discovered a massive positive direct association between skeletal and dental ages.

### Conclusion

A pedodontist has to track the kid's development to see how it stacks up against the usual and figure out how best to treat the kid. Based on the results of this research, dental age may be used as a surrogate for chronological age when assessing individuals with varying degrees of dentition. There should be more people included in the study so that the findings are more accurate.

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