

Deciduous Tooth Eruption and Carpel Bone Ossification are two Methods used to Estimate a Person's age that can be Compared for Forensic Purposes

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ABSTRACT

Objective: The ossification of the carpal bone in the hand and the emergence of deciduous teeth were both used to estimate a person's age according to forensic standards.

Study Design: Comparative study

Place and Duration: Department of Forensic Medicine & Toxicology, LUMHS, Jamshoro, Sindh, Pakistan. July 2022-Feb 2023

Methods: A total of 110 children, both boys and girls, aged 3 to 14 years, participated in the study. The patients were equally split into two groups, each including 55 persons. Group I employed radioscopic (RVG) images of the left quadrant mandibular teeth to estimate age using the Demirjian technique, whereas Group II used a radiograph of the right wrist to estimate skeletal age using the Greulich and Pyle method. Disparities between chronological age and estimated skeletal and dental age were analyzed statistically. SPSS 22.0 was used to analyze all data.

Results: There were majority males 55 (54.5%) in group I and 32 (58.2%) male cases in group II. In group I chronological age was 6.12±6.33 years and dental age was 5.75±8.63 years among patients of age group 3-8 years with difference 0.70±2.34 and patients of age group 9-14 years had chronological and dental age was 12.41±3.52 years and 11.16±2.67 with difference 0.72±1.29 while in group II chronological age and skeletal age among patients of age group 3-8 years was 8.02±3.42 years and 8.0±0.14 with difference 0.62±2.29 and patients of age group 9-14 years had chronological and skeletal age was 11.45±2.67 years and 10.90±0.93 with difference 0.60±1.22. With a p-value of >0.05, no difference was found between the two groups.

Conclusion: Both dental and skeletal age estimation methods are reliable and accurate for determining a person's age in a court of law, it has been determined. There was no discernible difference between the two approaches.

Keywords: Bone Age (Greulich and Pyle), Forensic, Dental Age (Demirjian's), Age Estimation

INTRODUCTION

Age is characterized as the amount of time an entity or person has endured following birth. [1] Forensic medicine places a great deal of emphasis on age estimation, a branch of the forensic sciences, for identifying deceased victims as well as in relation to crimes and accidents. [2,3] Several medical and paramedical disciplines, including endocrinology, pediatric medicine, and the planning of orthodontic and pediatric dental treatments,[4] pediatric medicine, and pediatric dentistry,[5] emphasize the significance of age determination. [4]

Chronological age is rarely, if ever, taken into consideration when determining a child's developmental stage because human growth is marked by wide diversity in the rate of advancement toward physiological maturity. [5] Somatic, sexual, skeletal, and dental maturity can all be used to estimate an individual's physiological age, which is a record of their rate of development towards adulthood. [6] The annual increases in height or weight can be used to determine somatic maturity. Secondary sexual traits, like male voice changes and female menarche, alter as a person ages sexually, signaling sexual maturity. Due to the fact that they may only be used following serial recordings, these maturity indicators are of limited value. In order to estimate skeletal maturity, it is necessary to look at how individual bones initially develop and then ossify. [7]

Physiologic maturity offers greater consistency and stability than chronological age. This stage of development can be evaluated using any of the following criteria: somatic, sexual, skeletal, or dental maturity [8]. Therefore, a forecast based on reliable correlations may be made after just one examination [9]. By observing changes to the bones in the hand and wrist, this method has been used to assess skeletal development. Because only 0.0001-0.1 mSV of effective dose is obtained at each exposure, taking these radiographs is completely safe. This dosage is comparable to less than 20 minutes of background radiation, using a two-minute transatlantic flight as an example

[10]. An other physiological method of evaluating skeletal growth is the calcification of tooth tissue. This strategy appears reliable because of its low variability. It is the area of the body that is least affected by factors that affect the eruptive process of teeth, such as endocrine, systemic, or other factors [11]. Since this system is fundamental to the human body, it should be studied in conjunction with other physiological maturation indicators such bone age, menarche, and height [12].

We conducted the current investigation to compare the precision of tooth eruption (Demirjian method) vs ossification of carpal bone of hand (Greulich and Pyle method) for forensic age assessment.

MATERIAL AND METHODS

This comparative study was conducted at Department of Forensic Medicine & Toxicology, LUMHS, Jamshoro, Sindh, Pakistan. After receiving signed parental or guardian consent, the specific demographic information of each person was recorded. Those with psychological conditions, those who were unable to cooperate, those who had aberrant tooth and wrist radiography morphology, and those who did not consent to the surgery were all rejected.

Included cases were aged between 3-14 years. The study comprised participants who had adequate dental hygiene, undamaged right hand and wrist, and all mandibular left quadrant teeth that had either fully or partially erupted. The patients were equally split into two groups, each including 55 persons. Group I employed radioscopic (RVG) images of the left quadrant mandibular teeth to estimate age using the Demirjian technique, whereas Group II used a radiograph of the right wrist to estimate skeletal age using the Greulich and Pyle method.

Using SPSS 22.0, all the data was examined. To compare the accuracy of the two methods, the Chi square test was used. Significant was defined as P-value <0.05.

RESULTS

There were majority males 55 (54.5%) in group I and 32 (58.2%) male patients in group II.(figure 1)

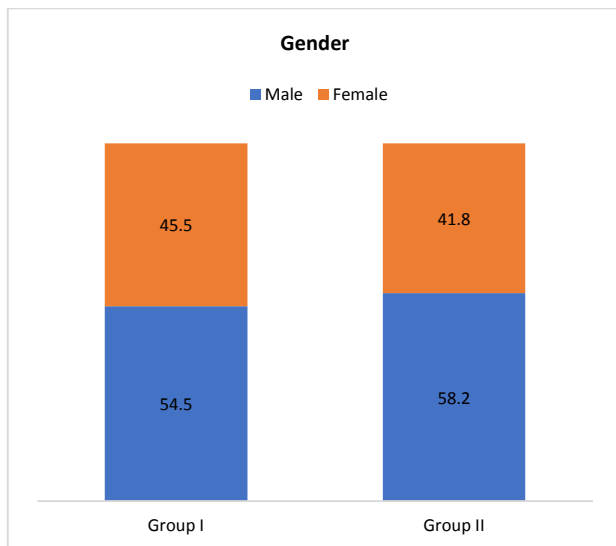


Figure-1: Gender distribution among both groups

In group I chronological age was 6.12 ± 6.33 years and dental age was 5.75 ± 8.63 years among patients of age group 3-8 years with difference 0.70 ± 2.34 and patients of age group 9-14 years had chronological and dental age was 12.41 ± 3.52 years and 11.16 ± 2.67 with difference 0.72 ± 1.29 while in group II chronological age and skeletal age among patients of age group 3-8 years was 8.02 ± 3.42 years and 8.0 ± 0.14 with difference 0.62 ± 2.29 and patients of age group 9-14 years had chronological and skeletal age was 11.45 ± 2.67 years and 10.90 ± 0.93 with difference 0.60 ± 1.22 . With a p-value of >0.05 , no difference was found between the two groups.(table 1)

Table-1: Age estimate comparison between the two groups

Variables	Demirjian technique	Greulich and Pyle
Age (3-8years)		
Chronical age	6.12 ± 6.33	8.02 ± 3.42
Dental age	5.75 ± 8.63	8.0 ± 0.14
Difference	0.70 ± 2.34	0.62 ± 2.29
Age (9-14years)		
Chronical age	12.41 ± 3.52	11.45 ± 2.67
Dental age	11.16 ± 2.67	10.90 ± 0.93
Difference	0.72 ± 1.29	0.60 ± 1.22

DISCUSSION

Because the developmental phases of various biological systems differ, the concept of physiological age was created as a tool to gauge a child's growth or maturity. Since that children of the same chronological age exhibit a diversity of developmental stages, child dentition may be used as one of the skeletal techniques for physiological age evaluation [13]. The Demirjian method is incredibly precise and strongly correlates with chronological age [14].

Tooth development has been more widely used as a way of tracking dental maturation than tooth eruption because it can be radiographically observed as a continuous and progressive process, and because most teeth may be examined at each test. By integrating data on the stages of the growth of many teeth, one may calculate the dental age of a person [15]. An established method for assessing skeletal maturity is the Fishman technique. According to the time and sequencing of the development of the carpal bones and certain ossification processes, several studies have documented the use of hand-wrist radiographs as an indication for determining skeletal maturity [16]. Mohammed et al.

also employed this strategy of skeletal maturation as a trustworthy method of estimating an individual's mean age in their investigation of the South Indian population [17].

In current study 110 children had age 3-14 years were presented. Majority of the cases were males in our study. These results were comparable to the previous study.[18] In our study, group I chronological age was 6.12 ± 6.33 years and dental age was 5.75 ± 8.63 years among patients of age group 3-8 years with difference 0.70 ± 2.34 and patients of age group 9-14 years had chronological and dental age was 12.41 ± 3.52 years and 11.16 ± 2.67 with difference 0.72 ± 1.29 while in group II chronological age and skeletal age among patients of age group 3-8 years was 8.02 ± 3.42 years and 8.0 ± 0.14 with difference 0.62 ± 2.29 and patients of age group 9-14 years had chronological and skeletal age was 11.45 ± 2.67 years and 10.90 ± 0.93 with difference 0.60 ± 1.22 . With a p-value of >0.05 , no difference was found between the two groups. According to 400 boys and girls, both boys and girls, and according to their chronological ages, Azzawi AM et al. [19] observed that the rise in dental age was statistically significant. The guys were 0.208 years old, and the girls were 0.294 years older. Furthermore, they asserted that Demirjian does not apply to minors in Egypt. For Egyptian children, it is crucial to develop fresh, individually tailored dental scores for each sex and age.

In a study by Patel PS et al [20] on estimating dental and skeletal ages, they used the Demirjian and Willem method for estimating dental ages and the Greulich and Pyle method for estimating skeletal ages. They found no significant differences between the two procedures, but Willem's dental age estimation method was the most reliable and consistent. Because it is relatively simple to understand, takes less time, and has better inter-observer reliability, the skeletal age for each hand-wrist radiograph was determined using the Greulich and Pyle atlas approach. [21] In this study, the Greulich and Pyle atlas was employed because there was no norm for skeletal age evaluation for the Indian population. [22]

Our study led us to the conclusion that the two techniques—dental age method and ossification of bone (skeletal age method)—can be used for forensic age determination. These processes are secure and simple to carry out.

CONCLUSION

Both dental and skeletal age estimation methods are reliable and accurate for determining a person's age in a court of law, it has been determined. There was no discernible difference between the two approaches.

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