Original Article

Comparative Analysis of Deciduous Teeth Eruption and Ossification of Carpel Bones of Hand for Age Estimation

Age Estimation By Deciduous Teeth And Ossification Of Carpel Bones

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ABSTRACT

Objective: To determine accuracy of age estimation by comparison of deciduous teeth eruption and ossification of carpal bones of hand.

Study Design: Randomized controlled trial study.

Place and Duration of Study: This study was conducted at the Department of Forensic Medicine, Govt. KMSMC Sialkot in collaboration of Radiology Department, THQ Hospital Pasrur, District Sialkot from 25th August 2019 to 25th August 2020.

Materials and Methods: One hundred and forty children of both genders with ages 5 to 15 years were enrolled in this study. All the patients were equally divided into two groups, each group consist of 70 patients. In group A dental age estimates were made using radioscopic (RVG) pictures of the left quadrant mandibular teeth by Demirjian method and the right hand wrist radiograph by Greulich and Pyle method was used for the estimation of the age of the skeleton in Group B. Statistical analysis on differences between chronological age and approximate skeletal and dental age was carried out.

Results: There were 40 (57.14%) male and 30 (42.86%) females in group A and in group B, 38 (54.29%) male and 32 (45.71%) females. The difference between chronological age and dental age in children with ages 5 to 10 years was 0.64±1.24 years and children with ages 11 to 15 years the difference was 0.67±0.18 years in group A and in group B difference between chronological age and skeletal age among children with age group 5 to 10 years was 0.72±1.18 years and among children with ages 11 to 15 years the difference was 0.66±1.18 years. No significant difference was observed between both groups with p-value >0.05.

Conclusion: Both procedures dental age estimation and skeletal age estimation are effective for forensic age estimation. No significant difference was observed between both methods, but the combination of both methods for age assessment in children provides us more accurate age with very narrow range.

Key Words: Age estimation, Forensic, Dental age (Demirjian's), Bone age (Greulich and Pyle).

INTRODUCTION

Age is classified as the period of survival of an organism or person after birth.[1] Age estimation is an extremely important part of forensic science in forensics for the purposes of identifying dead victims, as well as for crimes and accidents.[2]

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As the rate of progress towards physiological maturity characterizes human growth, the time period of chronology has little or no place in the evaluation of a child's maturation status.[3] The measurement of the rate of maturity development that may be determined by somatic, sexual, skeletal and dental maturity is physiological age.[4]

Assessment of skeletal maturation status whether or not a patient's pubertal growth spurt is achieved will affect the diagnosis, treatment objectives, treatment planning and ultimate outcome of orthodontic therapy considerably.[5] Skeletal maturation is generally determined by steps of hand-wrist bone ossification due to the quantity in the region of various types of bones and easy accessibility, with minimal expense and time. The method of evaluating skeletal age from hand-held X-rays is the Greulich and Pyle Atlas.[6]

The changes in teeth due to age can be classified into three categories: formational, degenerative and histological. Formational or developmental shifts, such as tooth eruption and calcification are strong age predictors in the years leading up to adulthood. Age

assessment techniques based upon dental ripening can be divided into atlas methods or scoring methods like Schour and Massler, Moorrees, Anderson and Demirjian. The methods of morphological and radiological age estimation in adults are Gustafson, Bang and Ramm, Solheim, Kvaal and Solheim and Kvaal.[7,8] The Demirjian method of age assessment has been generally accepted among many proposed methods.[9] Demirjian's classifications of stages are best suited for the forensic purpose because stages are characterized by shape and development changes of teeth, which are independent of potentially complicated measurements in length.[10] Demirjian 's advantages include the objective criteria defining stages of tooth growth instead of tooth eruption, which were clearly illustrated with line diagrams and radiographic images.[11,12] We conducted present study to compare the accuracy of tooth eruption (Demirjian method) versus ossification of carpel bone of hand (Greulich and Pyle method) for forensic age estimation.

MATERIALS AND METHODS

This randomized controlled trial was conducted at Department of Forensic Medicine, Govt. KMSMC Sialkot in collaboration of Radiology Department, THQ Hospital Pasrur District Sialkot from 25th August 2019 to 25th August 2020. A total of 140 children of both genders with ages 5 to 15 years were enrolled in this study. Individual's detailed demographics were recorded after taking written consent from parents/guardians. Individuals who didn't agree to the procedure, who were uncooperative, patients with psychiatric illness, patients with abnormal tooth and hand wrist radiographic morphology were excluded.

All the patients were equally divided into two groups, each group consist of 70 patients. In group A dental age estimates were made using radioscopic (RVG) pictures of the left quadrant mandibular teeth by Demirjian method and the right hand wrist radiograph by Greulich and Pyle method was used for the estimation of the age of the skeleton in Group B. Statistical analysis on differences between chronological age and approximate

skeletal and dental age was carried out. All the data was analyzed by SPSS 24. Chi square test was applied to compare the accuracy between both procedures. P-value <0.05 was taken as significant.

RESULTS

There were 40 (57.14%) male and 30 (42.86%) females in group A and in group B, 38 (54.29%) male and 32 (45.71%) females. In group A 37 (52.86%) patients were ages 5 to 10 years and 33 (47.14%) were ages 11 to 15 years. In group B 36 (51.43%) patients had ages 5 to 10 years and 34 (48.57%) were ages 11 to 15 years (Table 1).

In group A, children with age group 5 to 10 years were mean chronological age 7.42±2.36 year, the dental age was 6.81±1.12 years the difference was 0.64±1.24 years the difference was not significant with p-value 0.063. Among children with ages 11 to 15 years the mean chronological age was 13.53±1.84 years and the dental age was 12.86±2.02 years, the difference was 0.67±0.18 years. The difference was not statistically significant with p-value >0.05.In group Bchildren with age group 5 to 10 years were mean chronological age 7.75±2.33 year, the skeletal age was 7.03±1.15 years the difference was 0.72±1.18 years the difference was not significant with p-value 0.063. Among children with ages 11 to 15 years the mean chronological age was 12.65±1.82 years and the skeletal age was 11.99±0.64 years, the difference was 0.66±1.18 years. The difference was not statistically significant with p-value >0.05 (Table 2).

Table No.1: Age and gender-wise distribution between both groups

Variable	Group A	Group B	P value
Gender			
Male	40 (57.14%)	38 (54.29%)	>0.05
Female	30 (42.86%)	32 (45.71%)	
Age (years)			
5 – 10	37 (52.86%)	36 (51.43%)	>0.05
11 – 15	33 (47.14%)	34 (48.57%)	

Table No.2: Comparison of age estimation between both groups

Age (years)	Group A				Group B			
	Chronological age	Dental age	Difference	P value	Chronological age	Dental age	Difference	P value
5 - 10	7.42±2.36	6.81±1.12	0.64±1.24	0.063	7.75±2.33	7.03±1.15	0.72±1.18	0.084
11 - 15	13.53±1.84	12.86±2.02	0.67±0.18	0.071	12.65±1.82	11.99±0.64	0.66±1.18	0.67

DISCUSSION

As it reduces the search for an unskilled individual to allow a more effective and longtime saving approach[3], age estimation should be as accurate as possible. Whilst there are different age determination methods, due to the differing differences of different ethnic groups, no standardized framework has been established.[13,14]

Therefore, in various communities each solution must be checked. To ensure ethnic uniformity in the research sample, the research group was chosen. This study consisted of 140 subjects; 70 individuals were categorized into two groups each. Group A received dental age method while group B received skeletal age method. 40 (57.14%) male patients and 30 (42.86%) females patients in group A and in group B 38

(54.29%) patients were male and 32 (45.71%) were females. In group A 37 (52.86%) patients were ages 5 to 10 years and 33 (47.14%) were ages 11 to 15 years. In group B 36 (51.43%) patients had ages 5 to 10 years and 34 (48.57%) were ages 11 to 15 years. These results were comparable to the study by Schmeling et al[15] and AlQahtani et al.[16]

In present study we found that children with age group 5 to 10 years were mean chronological age 7.42±2.36 year, the dental age was 6.81±1.12 years the difference was 0.64±1.24 years the difference was not significant with p-value 0.063. Among children with ages 11 to 15 years the mean chronological age was 13.53±1.84 years and the dental age was 12.86±2.02 years, the difference was 0.67±0.18 years. The difference was not statistically significant with p-value >0.05. A study by Patel et al[17] regarding dental and skeletal age estimation and they used Demirjian and Willem method for dental age and Greulich and Pyle method for skeletal age estimation, they reported no significant difference between both procedures however Willem's dental age estimation method proved to be the most accurate and consistent.

Azzawi et al[18] reported that the increase of dental age was found to be statistically important of 400 both boys and girls in accordance with their chronological age. 0.208 years of age were boys and 0.294 years before the girls. They also suggested that Demirjian is not applicable to Egyptian children. For each sex and age it is important to create a new adapted dental score separately for Egyptian children.

In our study, among children who received skeletal age method, we found that children with age group 5 to 10 years, the mean chronological age was 7.75±2.33 year, the skeletal age was 7.03±1.15 years the difference was 0.72±1.18 years the difference was not significant with p-value 0.063. Among children with ages 11 to 15 years the mean chronological age was 12.65±1.82 years and the skeletal age was 11.99±0.64 years, the difference was 0.66±1.18 years. The difference was not statistically significant with p-value >0.05. A study by Mughal et al[19] reported that on radiation-based hand & wrist visualization techniques including bone age estimation ultrasound were theorized, but not as precise as radiographic approaches. Bone age cannot be determined from hand & wrist X-rays when 18 years old, and thus, the medial end of the clavicle in individuals aged 18-22 years is used for the measurement of bones. Another study by Saadé et al[20] showed similarity to our study findings and reported both the dental and skeletal method can be used for age estimation with dental method being more accurate than the skeletal method.

CONCLUSION

Both procedures, age of deciduous teeth eruption (dental age) and ossification of carpal bones of right wrist (skeletal age method) can be applied for estimation of forensic age. Both procedures are safe and easy to perform, but when we estimate age by combining both skeletal and dental data, the accuracy of age estimation increase to a lot. So instead of having single parameter for forensic age assessment, the two or even multiple parameters usage give us more precise and accurate age with very narrow gap and this narrow range is more helpful and authentic in deciding criminal proceedings.

Author's Contribution:

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Final Approval of version:	Muhammad Faheem Ashraf

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