AGE ESTIMATION USING RADIOGRAPHIC VISIBILITY OF PERIODONTAL LIGAMENT IN LOWER THIRD MOLARS

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ABSTRACT

Background

Third molar mineralization has been utilised frequently as a forensic age determination technique. The creation of novel strategies is crucial because this technique is ineffective after the age of 18, particularly when determining whether a person is older than 21. For this, it has been advised that the periodontal ligament be visible.

Materials and Methods

Periodontal ligament visibility was assessed in the lower third molars, using a sample of 53 orthopantomogramme, 32 which belonging to females and 21 belonging to males, from a patient visiting the saveetha dental college and hospitals, Chennai from December 2021 to March 2022 aged 17 to 31 years. A classification of four stages based on the visual phenomenon of disappearance of the periodontal ligament of fully mineralized third molars was used. For each stage, median, variance, minimal and maximal age were assessed.

Results:

The relationship between age and stage of periodontal ligament had a statistical significance for both sexes. In this population, stage 3 can be used to state that a male person is over 20 years-old for females, another marker should be used.

Conclusion:

This method demonstrates reliability because there is a less significant relationship between the age of the person and the PDL visibility.

Keywords**:** Gender, age estimation, third molar, periodontal ligament.

INTRODUCTION

Estimating an individual's age is a critical step in forensic dentistry. Age estimation is done for both alive and deceased people[1]. Age verification is required for legal evidence because juvenile and adult legal systems operate differently[2]. One of the markers in the evaluation that were used to define maturity and estimate age is the development of teeth. Clinical, radiological, histological, or biochemical methods of investigation can be used to estimate age from teeth. In this situation, the radiography approach is simple and non-destructive.[3] The eruption of third molars and mineralization are the key factors in determining a late juvenile's age.[4]

Third molar mineralization is frequently observed to be finished at under 21 years but in some populations, mineralization of the third molars has been reported to have been completed under the age of 18[5]. Several new techniques in estimating dental age have been proposed, specifically to determine

whether the individual is under or beyond the 18 year threshold with a greater possibility, particularly after root formation of the third molar is complete[6].

The same investigation was carried out by Sequeira et al. (2014) with a sample of 487 panoramic radiographs drawn from the Portuguese population, with a sample age range of 17–31 years[7]. His research came to the conclusion that stage 3 of the periodontal ligament space visibility should be utilized to determine a male's age of 21. Additionally, it was shown that there was a strong correlation between chronological age and the periodontal ligament space visibility stage.[8]

Similarly Another study was conducted by Lucas et al (2016) using a panoramic radiograph with a sample totaling 2000 which was divided evenly into several age groups ranging from 16 to 25.9 years. The sample consisted of 50 females and 50 male in each age group[9]. In this study, Lucas et al (2016) concluded that stage 2 and 3 of periodontal ligament space visibility can be used to estimate age 18 years with a very high degree of probability[10].

According to earlier studies, panoramic radiographs did not clearly show the roots of the mandibular third molars. This study's objective was to evaluate whether the periodontal ligament space visibility approach is adequate for calculating age, specifically for establishing the age threshold of 18 years by digital periapical radiographs.

MATERIALS AND METHODS

The type of this research is analytic observational, which is to determine the estimated age by observing periodontal ligament space visibility on mandibular third molars assessed with digital periapical radiography and observing the relationship between the stages and chronological age using a cross sectional approach. Periodontal ligament visibility was assessed in the lower third molars, using a sample of 53 orthopantomograms, 32 which belonging to females and 21 belonging to males, from a patient visiting the saveetha dental college and hospitals, Chennai from December 2021 to March 2022 aged 17 to 31 years. A classification of four stages based on the visual phenomenon of disappearance of the periodontal ligament of fully mineralized third molars was used. For each stage, median, variance, minimal and maximal age were assessed. Purposive sampling technique was used as the sampling method by selecting samples based on inclusion and exclusion criteria.

Inclusion criteria : patients with completely erupted right and left mandibular third molars (M3), aged 17-24 years, mandibular M3 teeth were not impacted, there was no caries or large fillings on mandibular M3 teeth, the patient was not currently under orthodontic treatment and and is not undergoing root canal treatment on his mandibular M3 tooth.

Exclusion criteria : root growth of mandibular M3 teeth that had not been completed and the presence of pathological conditions in the periodontal and periapical tissues.

Periapical radiographs were taken of the mandibular third molars on both sides (left and right) and all of the radiographs were evaluated based on consideration of the exclusion criteria. To determine and record the stages of periodontal ligament space visibility (Figure 1) that was seen on each periapical radiographs. The description regarding each stage of the periodontal ligament space visibility proposed by Olze et al (2010) consists of :

a. Stage 0: The periodontal ligament space is visible along the entire root

b. Stage 1: The periodontal ligament space is partially invisible on one root (starting from the apex to half the root).

c. Stage 2: The periodontal ligament space is not fully visible at one root (apex to cemento enamel junction) or partially invisible at both roots (1)

d. Stage 3: The periodontal ligament space are not visible along almost the entire of two roots.
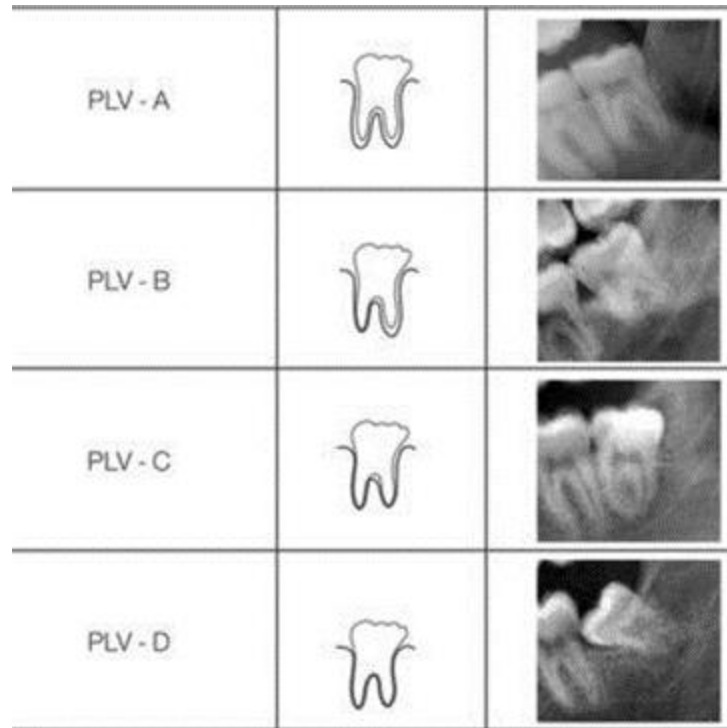
Figure 1

RESULTS

Figure 2

(a)   **(B)**

(a) Stage 0 seen on periapical radiograph in sample aged 20 years old ,

(b) Stage 1 seen on periapical radiograph in sample aged 21 years old

In Figure 1 (a), show that the whole periodontal ligament space is still visible in the two roots of the tooth (48), so it is categorized as stage 0.

In Figure 1 (b), it can be seen that the periodontal ligament space is blurry at half of the root in the mesial part (38) so it is categorized as stage 1 (indicate the visible periodontal ligament space).

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16	1	1.9	1.9	1.9
	16	1	1.9	1.9	3.8
	17	2	3.8	3.8	7.5
	18	4	7.5	7.5	15.1
	19	4	7.5	7.5	22.6
	20	3	5.7	5.7	28.3
	21	2	3.8	3.8	32.1
	22	2	3.8	3.8	35.8
	23	1	1.9	1.9	37.7
	24	2	3.8	3.8	41.5
	25	1	1.9	1.9	43.4
	26	2	3.8	3.8	47.2
	27	4	7.5	7.5	54.7
	28	1	1.9	1.9	56.6
	29	3	5.7	5.7	62.3
	30	2	3.8	3.8	66.0
	31	2	3.8	3.8	69.8
	32	4	7.5	7.5	77.4
	33	2	3.8	3.8	81.1
	34	2	3.8	3.8	84.9
	35	2	3.8	3.8	88.7
	36	1	1.9	1.9	90.6
	37	1	1.9	1.9	92.5
	38	2	3.8	3.8	96.2
	39	1	1.9	1.9	98.1
	40	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

Table 1: Descriptive Analysis of Age at Each Stage of the Periodontal Ligament Space Visibility Based on Gender,
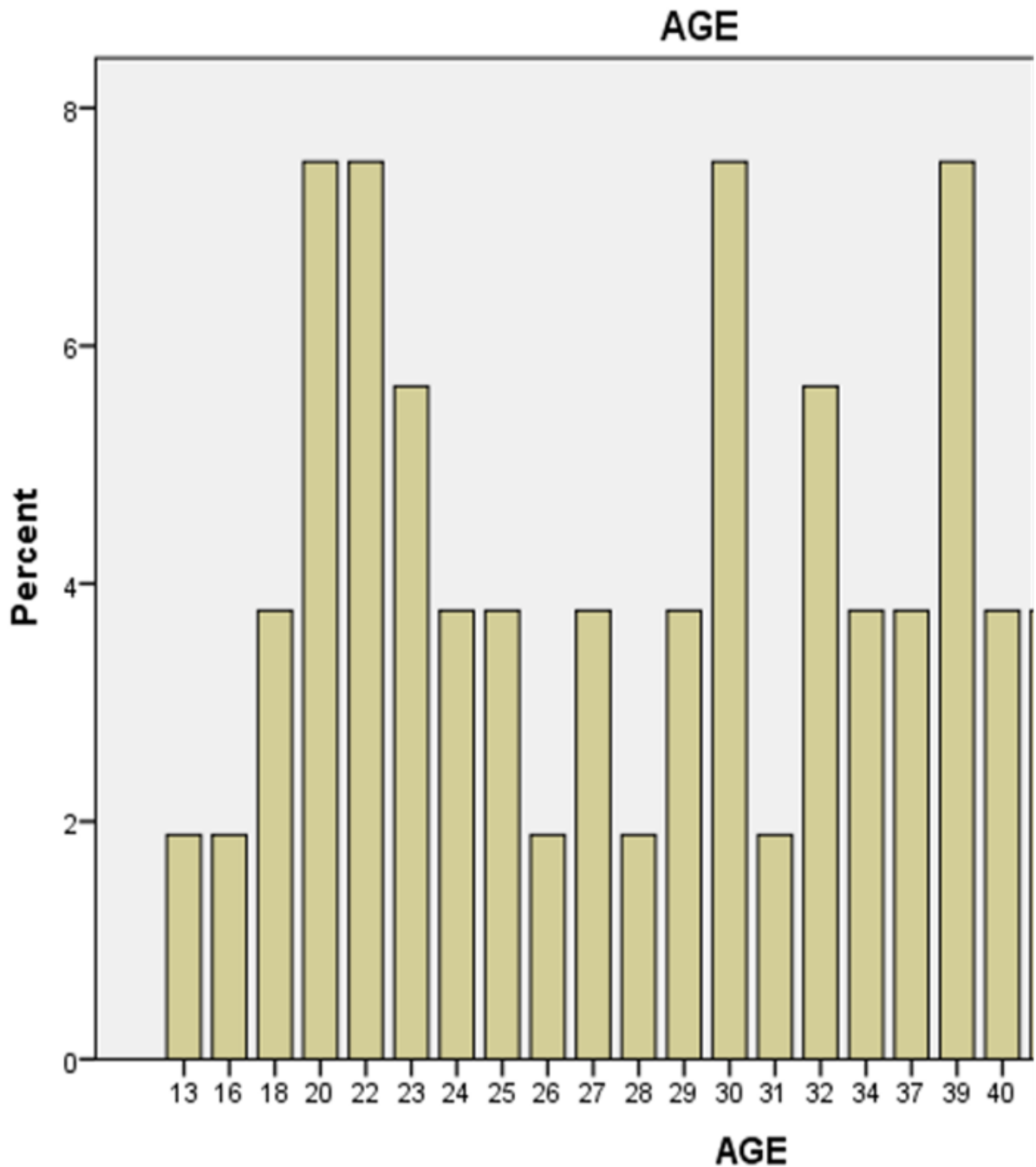
Graph 1
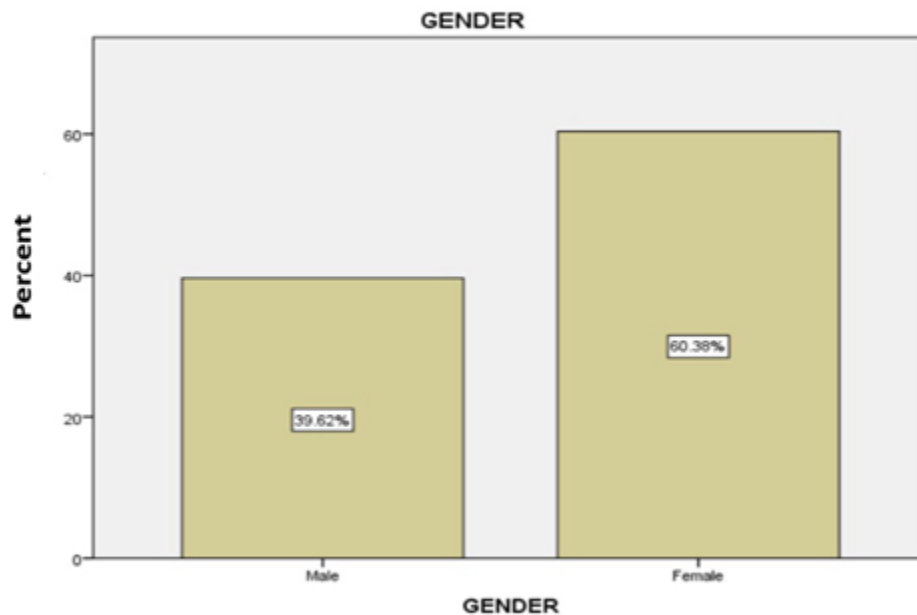
The above graph represents the percentage f males and females involved in this study,

1. Males - 39.62%

2. Females - 60.38%

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	21	39.6	39.6	39.6
	Female	32	60.4	60.4	100.0
	Total	53	100.0	100.0	

Table 2: Descriptive Analysis of Age at Each Stage of the Periodontal Ligament Space Visibility Based on Gender,

Graph 2: The above graph represents the percentage of age groups between 13-40 years old involved in this study.

DISCUSSION

The forensic approach of age estimate has become quite popular on a global scale[12]. One of the most reliable techniques in the field of forensics is dental identification[13]. Dental age often exhibits less variability than skeletal age for a given chronological age[14]. When compared to bone, the development of the teeth is far less affected by unfavourable environmental factors such diet and endocrine dysfunction[15][24].(2) Age estimation is particularly helpful for resolving legal issues because it aids in

incarcerating the right offender.[16][25](3)The calculation of an appropriate age is beneficial for the planning of orthodontic and surgical operations, as well as for the proper diagnosis and treatment.[17][26](4)

In the forensic sector, age estimation techniques employing third molars have shown to be extremely important, especially for the age range of 18 years or older where other techniques based on teeth cannot be used.For several diagnostics, the use of panoramic radiography has proven to be crucial[18]. It is helpful for establishing when teeth have reached the end of their developmental phases, examining all four jaw regions on a single radiograph, and figuring out where the third molar teeth are located8. Survey radiographs, or panoramic radiographs, are frequently used. Therefore, no additional radiographs are required for age assessment.[19]

Panoramic radiographs do a good job of illustrating incidental findings, which aids in the administration of treatment [20]. The same panoramic radiograph that was taken to determine the patient's age may be utilised for diagnostic and therapeutic purposes[21]. For young immigrants in Scotland whose exact birthdates were unknown, Thorson and Powel11 suggested the utility of using panoramic radiography to determine age based on the completion of third mandibular molars[22,23].

In our study, the analyzed results showed that the P value was <0.05(Table 4), which meant that there is a significant correlation between chronological age and periodontal visibility staging. This was in accordance with the previous study conducted by Catarina- Dourado10et al. The correlation coefficient 'Rho' was found to be 0.73. This confirms that estimating age using periodontal ligament visibility staging is relatively.accurate. Present study also showed no intra-observer significant differences, underlining the reliability & reproducibility of this methodology.

Our study determined the effect of gender on periodontal ligament visibility staging, and we found that gender had no significant influence on the visibility staging of periodontal ligament.

In the present study stage 0 of PDL visibility staging was almost exclusively seen below 21 years in both genders. According to this present study stage 1 shows the predictability of age above 19 years and stage 3 shows predictability of age above 23 years. Furthermore, stage 0, 1 & 3 first appeared in male gender before female gender for same age. Stage 2 was not present in any of the radiographs studied. This is not in accordance with the study conducted by Catarina-Dourado10et al. in Portuguese population, where they predicted stage 2 for persons with 21 years of age.This could probably be attributed to the ethnic differences in the mineralization and subsequent thinning of PDL surrounding the teeth roots. Our team has extensive knowledge and research experience that has translate into high quality publications(5–14)

CONCLUSION
Within the limitations of our data, this method demonstrates reliability because there is a less significant relationship between the age of the person and the PDL visibility. Since there are obvious differences between ethnic communities, this approach should be utilised with appropriate demographic standards.

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