NOLLA'S METHOD - AGE ESTIMATION USING LEFT THIRD MOLAR MANDIBULAR (38)

Running title: Age estimation by the application of Nolla's method.

Type of study: Original research

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ABSTRACT:
BACKGROUND: Because teeth and dental restorations are resistant to fire, the elements are valuable in identifying them. This allows a lost kid or remains to be identified. In both conventional dentistry and forensic dentistry, age estimation is useful. It's also utilised in anthropology to figure out how old past populations were based on immature skeletal remains. In live people, dental age is determined mostly using non-invasive methods such as a general physical examination, an intraoral examination, and a panoramic radiograph. The goal of this study is to use Nolla's approach to estimate age using the mandibular left third molar (38).
AIM: The goal of this study is to use Nolla's approach to estimate age using the mandibular left third molar (38).
MATERIALS AND METHODS:Orthopantomographs [25 male and 25 female] were used to investigate the usage of Nolla's approach to estimate the age of children. The OPGs belonged to children between the ages of 10 and 15.
RESULT: The study's findings revealed that there was a clear link between gender and 38 staging. Gender was revealed to be statistically significant with 38 stages [p value 0.05]. In this study, there was no link or association between gender and actual age of the youngsters. For gender, actual age has little statistical significance [p value 0.05]. The age standard deviations for boys and females in this study are 1.48313 and 1.33601, respectively. The standard deviation values for the 38 boys and females in this study are 2.432 and 2.318, respectively.
CONCLUSION: The current study concludes that larger sample sizes and population-specific data should be developed in future investigations.

KEYWORDS: Forensic Dentistry, Nolla's approach, Orthopantomographs, Dental age, Chronological age, revolutionary method, innovative technology

INTRODUCTION:
The development of the dentition can be utilised to determine age in live humans in contexts such as achievement of maturity, criminal responsibility, consent, marriage, and employment. Teeth are non-destructible and have the least turnover of their structure, making them an important clue for forensic odontology identification. Nolla established a system for determining dental age based on the radiological appearances of maxillary and mandibular teeth. The approach is a classification of a child's dental development. It has phases ranging from 0 to 10 that depict events in a child's dental development. Nolla classified the stages of permanent dentition calcification as follows: 0-no crypt, 1-crypt present, 2-initial calcification, 3-one third of the crown formed, 4-two thirds of the crown formed, 5-crown almost complete, 6-crown completed, 7-one third of the root formed, 8-two thirds of the root formed, 9-root almost complete apex open, 10-root complete apex closed. Every dentist who works with children must be well-versed in the development of the dentition. A comprehensive study of the development of the teeth should be very beneficial in broadening one's ideas about the impact of development on dental disorders and maybe improving one's clinical judgement.
Numerous investigations have pointed out that the development of the dentition has a close association to some other measures of growth in the study of child growth and development. Although the timing of tooth eruption in the mouth of various individuals varies widely, the majority of youngsters show some regularity in their eruption sequence. However, considering eruption alone makes one aware of only one stage of the dentition's development. A measure of calcification at various ages will provide a more precise indicator and contribute to the whole idea of the organism. Forensic Odontology is a branch of dentistry that uses a dentist's expertise to help the legal system. In forensic investigation, determining age is crucial. Age is an essential consideration when planning orthodontic and pedodontic therapy. It is becoming more often used in civil and criminal cases, as well as in determining the age of a deceased person in mass disasters and natural disasters. When the birth date is unavailable, such as in the case of illegal immigrants,
age estimation provides useful information. In terms of job and marriage, the chronological age of living people is also crucial. The degree of physical maturity of humans can be estimated using skeletal, dental, and psychological approaches. In anthropology, age estimation is used to calculate a person's age.
It is also possible to determine a person's gender. It can be used to estimate the chronological age of people who don't have any documents for judicial purposes. In terms of chronological age, Nolla's technique revealed no significant differences.(1). Although Nolla's approach aids in the determination of dental maturity in Spanish children, it tends to underestimate age in general (2). The use of a combination of Nolla and Demirjian methods to calculate chronological age from dental age has a predictive capability of over 99 percent and is quick, simple, and economical (3). Demirjian's method was more accurate in all age groups and for both genders than Nolla's method, which is only useful in the lower age groups.
In the North Indian population, Demirjian's method is more appropriate than Nolla's method (4).

The correlation of dental age using the modified Demirjian method and the Nolla method using an orthopantomograph with skeletal maturation using the cervical vertebral maturation index using a lateral cephalogram revealed that the age estimation methods were not accurate in predicting age in the Indian population (5). The Western population has been the subject of several studies comparing dental age to chronological age. In the Indian population, however, just a few studies have been published.
Our group has a wealth of research and knowledge, which has resulted in high-quality publications(6),(7),(8),(9),(10),(11),(12),(13),(14),(15),(16),(17),(18),(19),(20),(21),(22),(23),(24),(25).The current study's goal is to use the mandibular left third molar to estimate age using Nolla's approach in the South Indian population.

MATERIALS AND METHODS:
The research was carried out at Saveetha Dental College in Chennai, India. Saveetha Dental College's Department of Oral and Maxillofacial Radiology provided 50 orthopantomographs, 25 male and 25 female. For this study, the age group considered was 10-15 years old. As a result, all of the OPGs belonged to youngsters aged 10 to 15. In this study, the development of the mandibular left third molar was chosen for dental evaluation. This is due to the fact that numerous teeth are developing and calcifying at the same time. Except for the third molars, most teeth calcify and erupt after early adolescence. As a result, from late adolescence to early adolescence, the third molar development is the most important indicator of age. In addition, the differences in the developing stages of the third molar in different groups necessitate further ethnic-specific reports in other regions of the world. This would give a clear picture of the relationship between an individual's chronological age and the growth stages of the third molar, as well as the fact that mandibular teeth erupt before maxillary teeth, and teeth erupt earlier in females than males. Each orthopantomograph's mandibular left third molar was thoroughly examined and compared to the Nolla table's developmental stages and comparative photographs.For all 50 OPGs, 38 stagings were documented. The data was entered into excel, then imported into spss (statistical package for the social sciences), where descriptive and inferential statistics (chi square test) were calculated. For boys and girls in this study, the average and standard deviation values for actual age and 38 staging were also calculated. The lead investigator/guide internally evaluated and confirmed the data. There was no such thing as a conflict of interest. NIL for error detection and censored data.

SAMPLE DISTRIBUTION

GROUPS	AGE (YEARS)	MALE	FEMALE
1	10 to 10.9	5	4
2	11 to 11.9	5	6
3	12 to 12.9	5	6
4	13 to 13.9	5	4
5	14 to 14.9	5	5

Table 1 - According to age, the distribution of male and female sample.

RESULT:
According to the findings of this study, the average age of the males and females engaged in this study is 12.352 and 12.30, respectively. The average values of 38 staging for males and females in this study are 3.8 and 3.96, respectively. The age standard deviations for boys and females in this study are 1.48313 and 1.33601, respectively. The standard deviations for the 38 males and females in this study are 2.432 and 2.318, respectively. In all cases, a p value of 0.05 was considered statistically significant. Gender has no correlation or association with real age, according to statistical study (chi square test) (p value=0.153).
As a result, there was no discernible difference in the actual ages of the boys and girls in this study. The study's findings indicated that gender and 38 staging had a substantial link or association (p value=0.02). There was a considerable difference in the 38 staging of boys and females from then on.

Figure 1 depicts the stages of mandibular and maxillary tooth development. Figure 2 shows the mandibular left third molar at stage 6 (crown complete) on a radiograph. Figure 3 shows the mandibular left third molar at stage 3, or one-third of the crown finished, on a radiograph. The mean and standard deviation values for real age and 38 staging of boys and females in this investigation are shown in Table 1. The p values obtained after performing the chi square test for real age and 38 staging of males and females in this study are shown in Table 2. According to the findings of the study, 38 staging is shown to be statistically significant for gender (p value 0.05). There was no significant correlation between gender and age (p value 0.05). Figure 4 is a bar chart that shows the percentage of boys and females who participated in this study along with their 38 staging. The X axis reflects gender, while the Y axis shows the phases assigned to males and females' mandibular left third molars. According to the findings of the current study, the majority of males (12%) were assigned to stage 5, whereas the majority of females (14%) were assigned to stage 6. Stages 2,8,9, and 10 were not recorded for any of the participants in this study. Figure 5 is a bar chart that compares gender with age groups ranging from 10 to 15. It displays the percentage of males and females in a given age group. The gender is represented on the X axis, while the age group is represented on the Y axis. According to the study's findings, the majority of boys (18%) belonged to the age group 12.1 to 13, while the majority of females (14%) belonged to the age group 10 to 11.

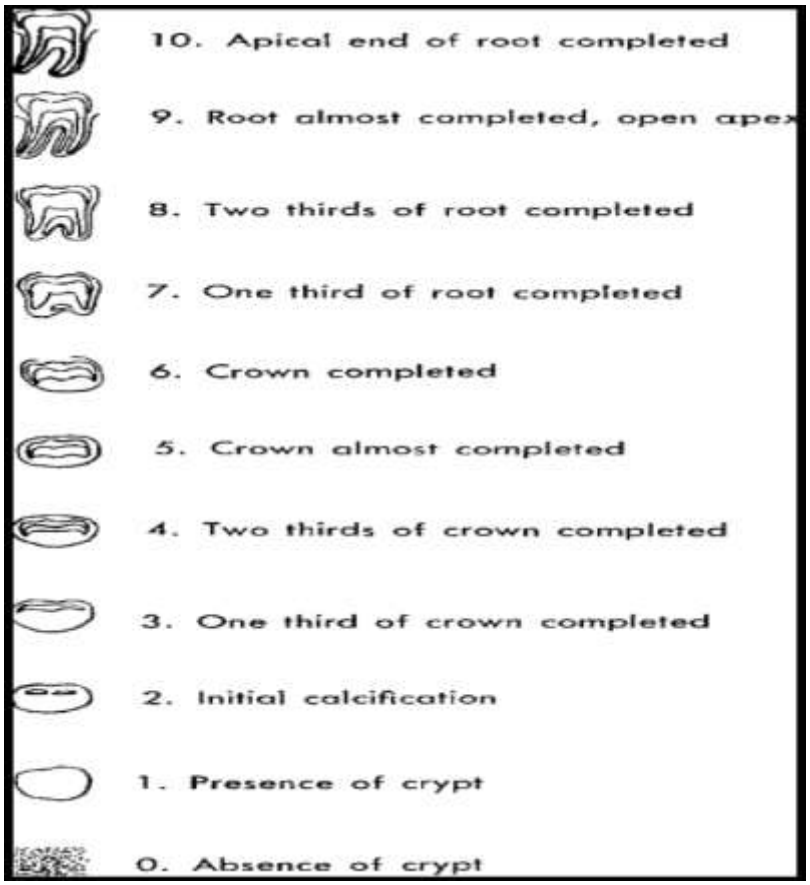


Figure 1 depicts tooth development stages allotted by Nolla.

Figure 2 shows the mandibular left third molar at stage 6 (crown complete) on a radiograph

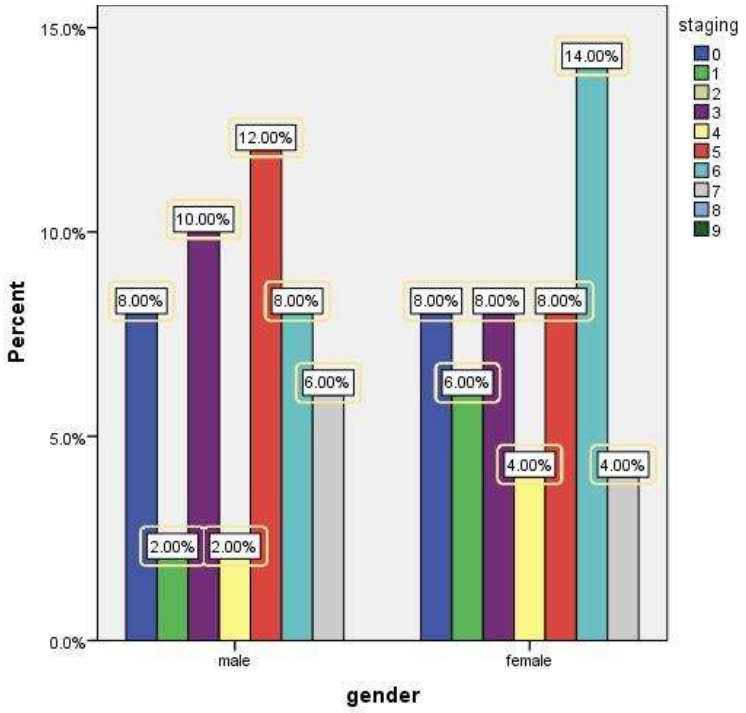
Figure 3 shows the mandibular left third molar at stage 3, or one-third of the crown finished, on a radiograph.

GENDER		MEAN	STANDARD DEVIATION
MALE	Actual age	12.3528	1.48313
	Staging	3.8	2.432
FEMALE	Actual age	12.308	1.33601
	Staging	3.96	2.318

Table 2: The mean and standard deviation values for real age and 38 staging of boys and girls in this investigation are shown in this table.

	ACTUAL AGE P VALUE	STAGING P VALUE
GENDER	0.153	0.02

Table 3: The p values obtained after performing the chi square test for real age and 38 staging of males and females in this study are shown in this table.According to the findings of the study, 38 staging is shown to be statistically significant for gender (p value 0.05). There was no significant correlation between gender and age (p value 0.05).



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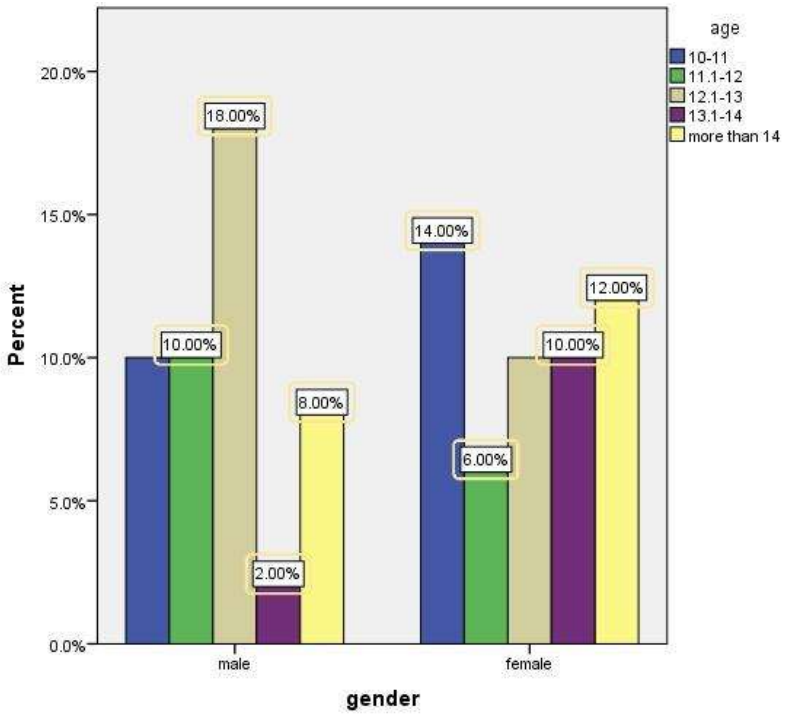

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DISCUSSION:

The results of this investigation revealed that stages 2,8,9, and 10 were not appropriate for the study population. The 38 stagings have been completed for 50 children, 25 males and 25 females. Researchers exploring Nolla's age estimation method using the mandibular left third molar should benefit from the findings of this study. The dental system and the development of the dentition are essential aspects of the human body. The human body's growth and development can be evaluated in conjunction with other physiological maturity indicators including bone age, menarche, and height (26). Nolla's approach was first introduced in 1960. Individual tooth 9 calcification phases have been provided by Nolla (stage 0 to 10). It features extra mineralization stages, proving it to be more precise and trustworthy, making it the most widely used approach worldwide (27). In 2011, Nolla's approach was tested to see if it was suitable for determining the dental age of Turkish youngsters. The strategy appears to be good for Turkish boys, but not for Turkish girls, according to the study (28). In a 2012 study, the validity of the Demirjian and Nolla methods for determining dental age in North Eastern Turkish children were evaluated, and Nolla's method was found to be more accurate for measuring dental age in this population (29). The current study supports previous research by other researchers, demonstrating that Nolla's method of calculating dental age by analysing 10 phases of tooth development is superior than other methods and simple to implement. Tooth development is less variable than other developmental traits, and it also has a low correlation with chronological age (30). Many studies have been undertaken earlier to analyse the dental age utilising Nolla's method of age estimation in their respective population or location in Bangladesh, England (31), Brazil (32), Turkey (33), Malaysia (34), and East Turkey(28), according to previous literature studies. In the majority of investigations, Nolla's approach of age estimation was shown to be more accurate (1), whereas other studies (31) found the opposite. In a study of the North Indian population, researchers discovered a strong link between skeletal age and dental age (as determined by Nolla's method) in both sexes in the 12–14 year age range (35). In contrast, according to another study, Demirjian's approach was superior to Nolla's method in the North Indian population because it was applicable to all age groups, but Nolla's method was only suitable to the younger age groups (4). In circumstances involving child abuse, child marriage, child labour, and so forth, dental age estimation utilising the age bracket 10 to 15 years is useful. Abirami et al. conducted a study that was similar to ours in that it used a third molar to estimate age (36). The study's sample size was tiny, which

was a constraint. It also only tests for age estimates using Nolla's method on a population from South India. Studies with a bigger sample size, population, and race/ethnic specific data should be developed in the future.

CONCLUSION:

Age estimation is a crucial part of forensic investigation. The age of a patient can help with treatment planning for orthodontic and pedodontic patients. It's becoming more common in both civil and criminal cases. In mass tragedies and natural calamities, it aids in the identification of a deceased person's age at the time of death. It's becoming more common in both civil and criminal cases. When a birth date is unavailable, such as in the case of illegal immigrants, age estimation provides useful information. In circumstances of employment and marriage, the chronological age of living persons is also relevant. It aids in assessing whether a person should be prosecuted as a juvenile or as an adult. Studies with a bigger sample size and population-specific data should be developed for future research.

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AUTHOR CONTRIBUTIONS:

Vishaka.S - contributed in designing the study, execution of the project, statistical analysis, manuscript drafting.
Dr.V.Vishnu Priya: contributed in study design, guiding the research work, manuscript correction.
Abirami Arthanari, Gayathri.R, Kavitha.S, Reshma PK: study design, statistical analysis, manuscript proofreading and correction.

CONFLICT OF INTEREST:

The authors certify that this work has no conflicts of interest.

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