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Dental Age Estimation of Lower Left Third Molar (38) Using Modified Willems Method in South Indian Population

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ABSTRACT

Introduction: One of the most important factors that affect every aspect of life is one's age. In forensic medicine and dentistry, person recognition is crucial. A person's age, gender, ethnicity, and other characteristics are used to identify them. The chronological age of a person is determined by the registration of his or her birth date. Dental maturity is preferable to tooth emergence into the oral cavity because it is less affected by local factors. Dental maturity is more reliable and can be used as an indicator of biological maturity, because they are less influenced by nutritional and endocrine status. Wisdom tooth is the last permanent tooth to erupt in the oral cavity. Since it has more range of eruption period. It can be more reliable in assessing the sex and age of the individuals.

Aim and objectives: To assess the dental age of lower left third molar (38) using willems method in south Indian population.

Materials and methods: The study was conducted by collecting 100 digital orthopantomogram from randomised controlled subjects. Then the samples were categorised into 50 males and 50 females of age group. The study was held by getting ethical approval clearance. The collected data entered excel sheets along with actual age and tooth development staging. Actual Willems staging will be done from A-H, but in our study, we modified the developmental staging into I-VIII for easy validation. Data entered in excel sheets transformed into SPSS software. In SPSS software standard deviation, p value and statistical significance was done.

Results and discussion: Primary dentition is more reliable for dental age determination, because most of the teeth will undergo simultaneous development, calcification and maturation. Except the third molar all other teeth will be seen in primary dentition. Third molars are unique in terms of their size, shape, timing of formation and eruption. The SD value is found to be 2.22 years in males and in females 3.98 years. Chronological age shows statistically significant value (p value-0.098), while tooth staging shows statistically insignificant value (p value-0.302).

Conclusion: Our present study concludes that the modified Willems method is more accurate and reliable for dental age estimation.

Key words: Dental maturity, Age estimation, Orthopantomogram, South Indian population, Left lower third molar, Innovative technique, Innovative technology

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INTRODUCTION

Forensics is the branch of science which incorporates scientific knowledge into the judicial norms. Forensics plays a major role in identification of criminals and used in cases of unidentified bodies [1]. Identification of criminals will be done mainly by the trace of evidence available on the crime scene. Skeletal and dental remains were the important evidence. Bone and tooth are the only structures which can withstand different environmental changes. Dental remains are useful in determining the age, sex and race of the individuals. Dental age estimation is required in a variety of fields like archaeology, palaeontology and forensic dentistry [2]. Owing to developmental differences, chronological age and biological age cannot always be the same. As a result, dental age, bone age, mental age, and other variables including menarche, voice change, height, and weight are all used as surrogate indicators for biological age and body development. Age and sex of an unknown individual can be identified by correlating the physical and tooth maturity. Dental post-mortem details will predict an individual's age from around 18-20 weeks 'in utero' before the last tooth is lost [3].

Dental age estimation can be determined by various methods like demerjian, atlas and nolas method. Willems' method is the modification of the demirjian method. In the year of 1973, Demirijian discovered the age estimation method [4]. The Primary dentition is more reliable for dental age determination because most of the teeth will

undergo simultaneous development, calcification and maturation. Except the third molar all other teeth will be seen in primary dentition [5]. Third molars are unique in terms of their size, shape, timing of formation and eruption. Eruption is defined as emergence or movement of tooth structure into the jawbone or occlusal plane. This makes the eruption sequence can't be a definitive factor in age estimation. Eruption can be influenced by many exogenous factors such as infection, crowding and improper spacing between teeth [6]. The appearance of the third molar will take from around 12 to 22 years. Since crown and root development can be studied independently of eruption, radiographic study of third molar development extends age estimation to 9–23 years of age [7].

Previous studies stated that the demirjian formula gave great accuracy while the indian formula gave errors [8,9]. Female dental maturity was ahead of male population.There is no specific difference in sexual trends based on modified demirjian methods across several geographical areas. Studies done on Australian and Brazilian populations states that male third molar erupts prior to females [9,10]. Much research was done in concluding the age of an individual with demirjian and gustafson method [11]. But there was no evidence regarding age estimation based on the left third molar (38) in the Indian population. Our team has extensive knowledge and research experience that has translate into high quality publications [12-31]. Our study aimed to assess the accuracy of age estimation based on the third left lower molar using modified willems method.

MATERIALS AND METHODS

The study was conducted by collecting 100 digital orthopantomogram from randomised controlled subjects. Then the samples were categorised into 50 males and 50 females of age group from 10-10.9, 11-11.9, 12-12.9, 13-13.9, 14-14.9, 15-15.9, 16-16.9, 17-17.9, 18-18.9, 19-19.9 years (Figure 1 and Table 1). The study was held by getting ethical approval clearance. The collected data entered EXCEL sheets along with actual age and tooth development staging. Actual Willems staging will be done from A-H (Figure 2), but in our study we modified the developmental staging into I-VIII (Figure 3) for easy validation. Data entered in EXCEL sheets transformed into SPSS software. In SPSS software (version 23) mean, standard deviation, p value and statistical significance were done.

Figure 1: Orthopantomogram with chronological age 11, showing the staging of 38 as III.

Table 1: Represents the sample size distribution.

Chronological age	NO of samples
10-10.9 years	Males-5
	Females-5
11-11.9 years	Males-5
	Females-5
12-12.9 years	Males-5
	Females-5
13-13.9 years	Males-5
	Females-5
14-14.9 years	Males-5
	Females-5
15-15.9 years	Males-5
	Females-5
16-16.9 years	Males-5
	Females-5
17-17.9 years	Males-5
	Females-5
18-18.9 years	Males-5
	Females-5

19-19.9 years	Males-5
	Females-5

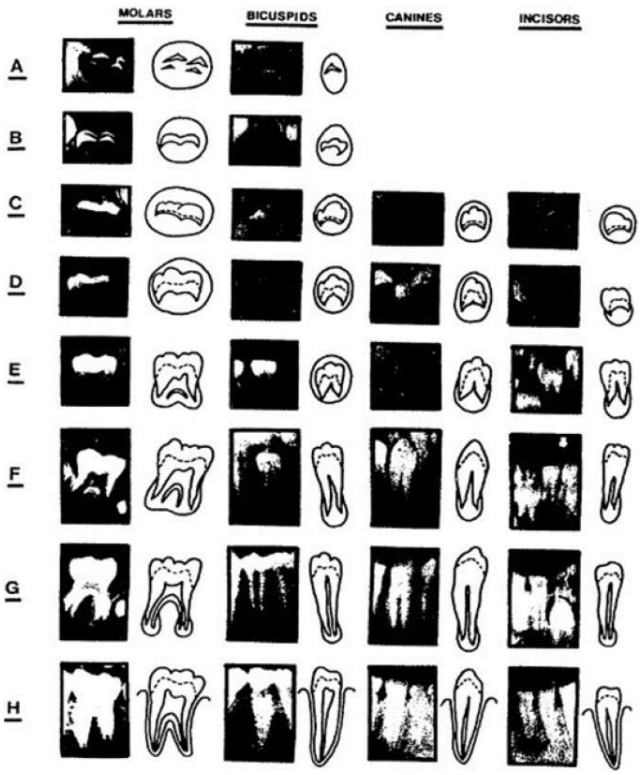

Figure 1: Original willems method, tooth developmental staging from A to H.

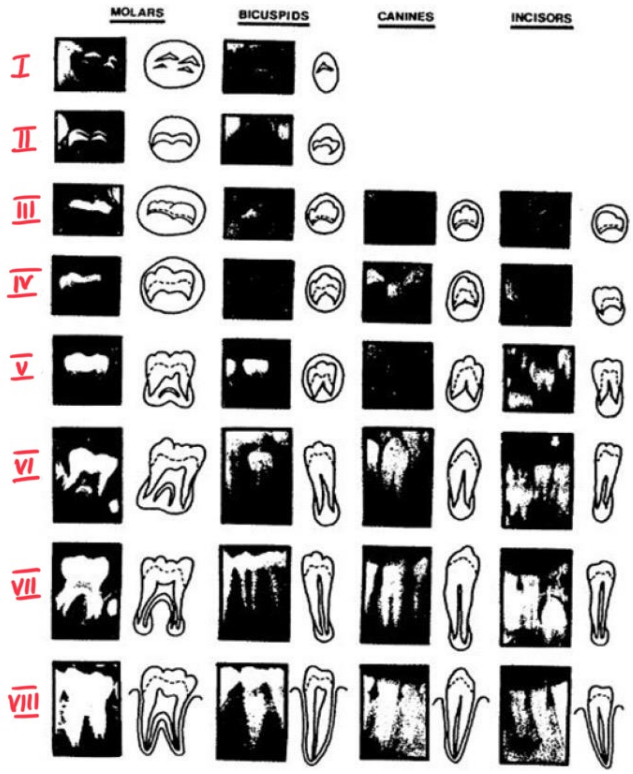

Figure 2: Modified willems method, tooth developmental staging from I-VIII for easy validation.

RESULTS

In our present study a total of 100 orthopantomogram were collected, in which 50 were males and 50 were females. The mean value of chronological age of 50 males was 14.88 and the mean value of chronological age of 50 females was 14.81. The statistical significance value was obtained 0.098. The mean value of tooth staging 38 of males was 4.60 and the mean value of tooth staging 3 of females was 4.60 (Table 2). The statistical significance value was obtained 0.302. Standard deviation value of chronological age of males was found to be 2.84 and for females was found to be 2.86. Standard deviation value of tooth staging 38 of males was found to be 2.26 and females was found to be 3.98. The standard deviation error of chronological males was 0.402 and females was 0.405. The standard deviation error of tooth staging 38 males was 0.32 and females was 0.35 (Table 2). The bar graph represents the tooth staging 38 of males in the south Indian population (Figure:4). The bar graph represents the tooth staging of 38 of females in the south Indian population (Figure 5). The graph shows the association between the mean and chronological age, in 18-18.9 years females had more variance than males (Figure 6).

Table 2: Represents the mean, standard deviation and standard deviation error of tooth staging 38 of both males and females. Tooth staging of 38 mean values of males was found to be 4.60 and in females 3.68. Standard deviation of males was found to be 2.26 and in females 2.57. Standard deviation error of males was found to be 0.32 and in females 0.35.

Tooth staging 38			
Gender	**Mean**	**Standard deviation**	**Standard mean error**
Males	4.6	2.26	0.32
Females	3.68	2.57	0.35

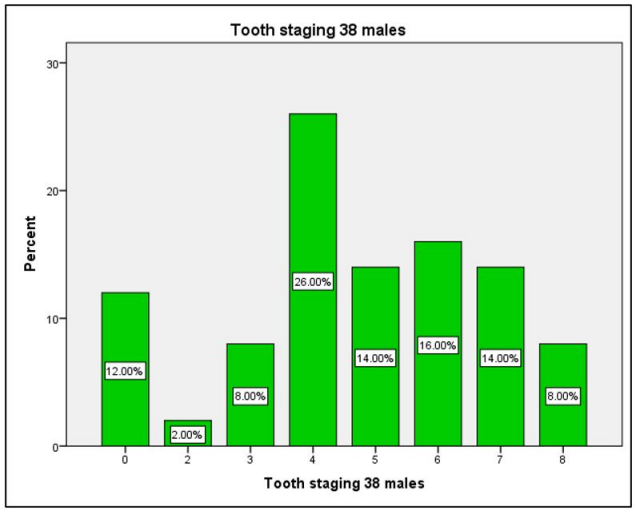

Figure 4: The bar graph depicts the tooth staging 38 south indian male population. X-axis represents the tooth staging of 38 males and Y- axis represents the percentage of the population.

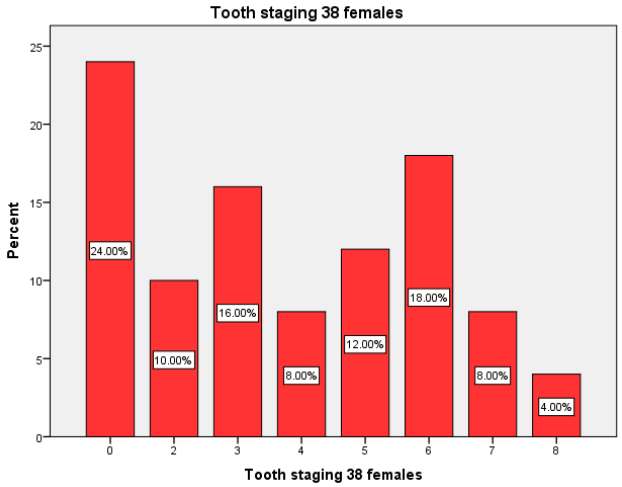

Figure 5: The bar chart depicts the tooth staging 38 of the south Indian female population. X-axis represents the tooth staging of 38 females and Y-axis represents the percentage of population.

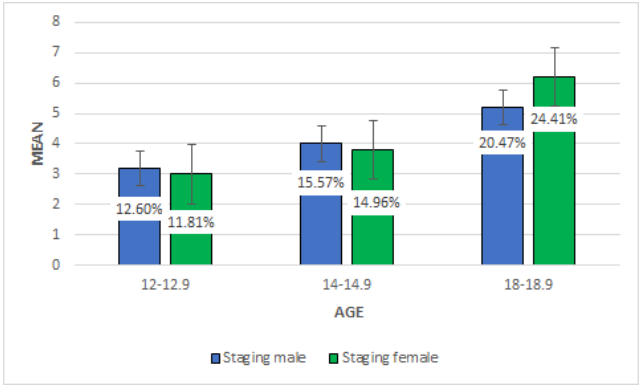

Figure 6: The bar chart represents the association between the mean and staging of chronological age. The mean and standard deviation of male is 4.60 and 2.26 respectively. The mean and standard deviation of female is 3.68 and 2.57 respectively.

DISCUSSION

Based on different methods dental age estimation of an individual will be done. On looking into the developmental stages, eruption sequence and mineralisation charts. Eruption sequence staging is reliable, because eruption of teeth into the oral cavity can be resisted by infection, inflammation, inadequate arch dimensions, and genetic abnormalities. The most common tooth always to be impacted is third molars, because they erupt after the eruption of all other teeth in the oral cavity. While the development of teeth is one of the most effective biomarkers for age estimation in infancy, the accuracy of age estimation in adolescence, when tooth development is nearly complete, eventually decreases. Third molars have the added advantage that it is the only tooth to have larger eruption time, root completion will occur up to 25 years in Indian population [32].

From the above results, the mean and standard deviation value of tooth staging 38 of males is 4.6 ± 2.26 and for females 4.2 ± 3.98. A similar study was performed [33] in third molars 37 and 38 using modified gleiser and hunt methods. The Standard deviation for Male 37 staging is ± 2.15 years and for 38 staging is ± 1.29 years. And the Standard deviation for Female 37 staging is ± 2.58 years and in 38 staging is ±2.24 years. While comparing the mean and standard deviation of both 37 and 38. 38 is most variable in the oral cavity, which can be used mostly for age and sex estimation [34]. In which male had more accurate results than females in assessing the root maturation. Previous study regarding dental age estimation of third molars using Willems's method, reveals that there is a significant correlation between the

tooth staging and chronological age in both males and females. Willems' approach understated males' mean age by 0.69 years and females' mean age by 0.08 years, showing that females mature faster than males in a sample population [35].

The statistical significance value of tooth staging, and chronological age was calculated. The p value for chronological age was and tooth staging was 0.302. Thus, suggesting the strong correlation between chronological and tooth staging, that is males had higher accuracy when comparing with females. This finding was supported by [36], they also reported that females had less accuracy while using Williams method. The variation in dental maturation between males and females is mainly due to mean value, they showed huge differences than females, whereas in females the period of growth occurs at early stages of growth from 6-7 years. The eruption of third molars has been documented to differ depending on an individual's ethnicity. According to studies conducted on the Western population, the eruption of third molars occurs between the ages of 17 and 21 [37]. Dental maturity plays an important role in estimating the chronological age of individuals due to the decreased low variability of dental indicators.

CONCLUSION

Dental age estimation plays a vital role in the field of forensic dentistry. In our study, strong correlation was observed between chronological age and tooth staging using modified Willems's method in the south Indian population. Thus, the Willems method can be used as an effective dental age estimation method. There is no previous evidence regarding the assessment of 38 using willems in the selected population, so the present study is designed to fulfil the lacunae. In the present study, mean, standard deviation and standard deviation error was calculated. Future studies should concentrate on formulation of equations using regression analysis.

AUTHORS CONTRIBUTION

Akshaya has done the data collection, statistical analysis, and manuscript preparation. Dr Abirami Arthanari had edited and revised the manuscript of the present study.

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CONFLICT OF INTEREST

Nil.

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