Radiographic evaluation of permanent second molar development based on nollas stage of tooth development in 9-11-year-old male children

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ABSTRACT

The aim of this study is to radiographically evaluate the second molar development based on the NOLLAS stage of tooth development in 9-11-year-old male children. For this, a total of 400 orthopantomography (OPG) images were collected from the database record of Saveetha dental college. Of these 40 OPGs were selected based on the age group between 9 to 11 years old male children. The dental age of the 2nd molar was calculated based on the NOLLAS loss stage of tooth development. After data collection, statistical analysis was done in the SPSS software. Among the study population, 33.90% were nine years old, 33.90% was ten years old, and 32.20% were 11 years old. Considering the distribution of teeth assessed majority were lower left second molar - 37 (32.20%) and least were upper left second molar-27(16.95%). Majority of the teeth attained maximum development at stage 9 (pink)-25.42%, least maturation assessed at stage 7-6.78%. The association between nollas stage and age was statistically significant (P-value of 0.000, p < 0.05). The association between nollas stage and tooth number was statistically not significant (P value of 0.106, p > 0.05). Majority of the children in the age group of 9 years had ‘crown almost completed’ in second molar (Stage 5), majority of 10-year-old children had ‘two-third root completed’ in second molar (Stage 8) and majority of 11-year-old children had ‘root completed with open apex’ in second molar (Stage 9).

INTRODUCTION

Oral health plays a very important role in the general well-being of individuals, and parents' behaviour and attitudes influence the oral health of their children. (Christabel, 2015; Gurunathan and Shanmugaavel, 2016) Biological and chronological ages are not related with body advancement. Subsequently, (Govindaraju et al., 2017a; Packiri, 2017) parameters or gotten to assess the biological advancement such as dental age, bone age, mental age that is related to body advancement. Dental age Plays an important part in forensic medicine, pediatric dentistry and also to plan orthodontic treat-
ment (Koshy and Tandon, 1998) Age assurance has incredible significance when treating orthodontic patients (Kamal et al., 2018) Therefore it is essential that the clinician can identify the development status of the person so that appropriate treatment can be planned. The foremost common cause for loss of primary teeth is because of caries. Aggregation of dental plaque may cause caries arrangement. It has a multifactorial aetiology which leads to initiation and progression of a lesion. Early childhood caries is one arising prevalent disease which can be a cause of premature loss of primary teeth (Ravikumar et al., 2017; Subramanyam, 2018) Pulpectomy procedure is performed in primary teeth to avoid extraction and to maintain its form and function (Govindaraju et al., 2017b,a,c) Fluoride is known to prevent caries by deposition of calcium fluoride crystals (Jeevanandan, 2017; Jeevanandan and Govindaraju, 2018) which is more resistant to demineralisation (Nair, 2018; Panchal, 2019) of the tooth (Somasundaram, 2015; Ramakrishnan, 2017) Dental age estimation is based upon the rate of the development and calcification of the tooth buds and the progressive sequence of their emission within the oral cavity (Sachan et al., 2013) Dental age is of specific intrigued to the pediatric dental practitioner and the orthodontist in arranging the treatment of distinctive sorts of malocclusion in connection to maxillofacial growth (Demirjian et al., 1973).

Age determination relates to numerous fields. It is additionally useful to distinguish people who give precise, subtle elements of age as in case of illegal migrants or bodies with obscure identity (Nolla, 1952) In the absence of the chronological age a solid strategy is required for the appraisal of the development status of the child to arrange diverse Treatment modalities. The development status can be evaluated by height, weight, sex, chronological age, dental age and the skeletal age of a child (Moorees et al., 1963) Difference between the chronological and biological age have driven to the improvement of distinctive markers of development such as skeletal age, morphological, sexual and other dental days (Sinha, 2014) Dental age can be helped by watching the degree of calcification of the teeth on the radiographs. Tooth calcification is more dependable markers of dental development than tooth emission since it isn’t influenced by nearby components such as primary teeth, lack of space, malnutrition, dental decay, ankylosis, orthodontic modalities in expansion to be beneath hereditary control (Nolla, 1952; Falkner, 1957) Different skeletal and dental methods are available for age assessment of the child. Different dental age assessment methods are described by NOLLAS, Demirjian’s and Willem where tooth formation at different age groups was assessed. Calcification of the tooth at different age that is the tooth formation is a more accurate way to determine the dental age (Ogodea, 2011)

In patients with deferred development, orthodontic treatment may be begun at an after arrangement in this way driving to the brief treatment term and more steady result. In case of over held deciduous teeth, the strategy encourages the assurance of the proper time for beginning the treatment. The relationship between dental and chronological age is additionally valuable within the scientific dentistry as well to assess the age or to distinguish the child. (Williams, 2001)

The aim of this study is to radiographically evaluate the development of a second molar based on the NOLLAS stage of tooth development in 9-11-year-old male children.

MATERIALS AND METHODS

Study Setting

The study was conducted with the approval of the Institutional Ethics Committee [SDC/SIHEC/2020/DIASDATA/0619-0320]. The study consisted of one reviewer, one assessor and one guide.

Study Design

The study was designed to include all children aged between 9-11 years male children and permanent second molar only included. The children who did not fall under this inclusion criteria were excluded.

Sampling technique

The study was based on the Random sampling method. To minimise the sampling bias, all the cases were reviewed priorly and included.

Data Collection And Tabulation

Data collection was done using the patient database with the timeframe work of 1st June 2019 to 30th April 2020. About 400 OPGs were reviewed, and those fitting under the inclusion criteria were included. Cross verification of data was done by a reviewer. Forty case sheets were segregated based on the age group 9-11 years Old male children. The collected data were tabulated based on the following parameters:

Patients demographic details Tooth number (teeth were included which showed maximum maturation) Nollas stage of tooth development

Statistical Analysis
The variables were coded, and the data was imported to SPSS. Using SPSS Version 20.0 Categorical variables were expressed in terms of frequency and percentage, and bar graphs were plotted. The statistical significance of the associations was tested using the Chi-square test.

RESULTS AND DISCUSSION

Among the study population, 33.90% were nine years old, 33.90% was ten years old, and 32.20% were 11 years old. Considering the distribution of teeth assessed, the majority were lower left second molar - 37 (32.20%) and the least were upper left second molar-27 (16.95%). Majority of the teeth attained maximum development at stage 9 (pink)-25.42%, least maturation assessed at stage 7-6.78%. The correlation between nollas stage and age showed a P value of 0.000. It shows a positive correlation between the two parameters and the correlation between nollas stage and tooth number showed a P value of 0.106. It shows a negative correlation between the two parameters.

Figure 1: Shows the age distribution of male children assessed in this study; X-axis - age of the male children between 9-11 years

In this study, about 400 0PGs were evaluated out of which 40 were segregated based on the age group 9-11 years old male children. The dental system is considered as an integral part of the human body; its growth and development can be studied in comparison with other physiological maturity indicators. NOLLAS method is based on ten stages of tooth development. It is accepted as the standard gold method over the years. Stage 0-absence of the crypt, stage 1-presence of the crypt, stage 2- initial calcification, stage 3- one-third crown completed, stage 4-two third crown completed, stage 5-crown almost completed, stage 6-crown completed, stage 7- one-third of the root completed, stage 8-two third of the root completed, stage 9-root completed apex open, stage 10-apical foramen closed. Among the study population, 33.90% were nine years old, 33.90% was ten years old, and 32.20% were 11 years old. (Figure 1)

Figure 2: Shows the tooth distribution based on Nolla’s stage of tooth development assessed in this study

(Figure 2) shows the distribution of the tooth that is taken in this study. Among the teeth assessed majority were lower left second molar - 37 (32.20%) and least were upper left second molar-27 (16.95%). (Figure 3) shows the distribution of the NOLLAS stage of tooth development. It included ten stages out of which stage 4,5,6,7,8 and 9 were noted in the development of the 2nd molar. Majority of the teeth attained maximum development at stage 9 (25.42%), least maturation assessed at stage 7 (6.78%).

Figure 3: Shows the distribution of Nollas stage of tooth development assessed in this study

(Figure 4) shows the correlation between age and nollas stage and p-value showed 0.000, which is clinically significant. There is a positive correlation between the age and the NOLLAS stage. (Figure 5) shows correlation between tooth number and nollas stage and p-value showed 0.106, which Is clinically insignificant. There is no correlation between the tooth number, and it is clinically insignificant. There is no correlation between the tooth number and their NOLLAS stage.

Figure 1, X-axis age of the male children between 9-11 years, Y-axis number of patients. Among
the study population, 33.90% were nine years old (pink), 33.90% were ten years old (brown), and 32.20% were 11 years old (green).

Figure 2, X axis-distribution of tooth number, Y-axis-number of teeth. Among the teeth assessed majority were lower left second molar - 37 (32.20%)(blue) and least were upper left second molar-27(16.95%)(green).

Figure 3, X-axis - distribution of nollas stage of tooth development, Y-axis-number of teeth. Majority of the teeth attained maximum development at stage 9 (pink)-25.42%, least at stage 7 (grey)-6.78%.

Figure 4, X axis-distribution of nollas stage of tooth development in the second molar, Y-axis-number of children. Majority of the children in the age group of 11 (green) attained stage 9 (root completed apex open), the age group of 10 years (brown) attained almost equal maturation in stage 5, stage 6 and stage 7 and the age group of 9 years (pink) attained maximum maturation in stage 5. The association between the age and nollas stage of tooth development was statistically significant Chi square test, p-value is 0.000, p<0.05, statistically significant.

Figure 5, X axis-distribution of nollas stage, Y-axis-number of children. 47 and 37 showed different stages of development from stage 4 to stage 9. Among the teeth assessed lower 2nd molars 37 (blue) & 47 (purple) mostly presented with nollas developmental stage 8 & stage 9. 17 (Orange) & 27 (green) mostly presented with nollas stage 5 & stage 6. The association between the tooth number and nollas stage of tooth development was statistically not significant Chi square test, p-value is 0.106, p>0.05, statistically not significant.

Figure 4: Shows the association between the age and nollas stage of tooth development

As seen repeatedly demonstrated tooth eruption is relatively imprecise as a parameter for assessing the dental age. (Choi and Kim, 1991) A better degree of precision is gotten by deciding the mineralization stage of each tooth or each tooth category as carried out by Demirjian and nolla. NOLLAS strategy was favoured in which mineralisation stages of each tooth were assessed In spite of the fact that in this strategy, the shifting mineralisation time of distinctive teeth isn’t secured. The limitations of this study are that only male gender was taken in this study and also a limited sample size.

CONCLUSIONS
Within the limitations of the study, it was concluded that majority of the second molar teeth assessed among 9 to 11 years old male children had ‘two-third root completed’ (Stage 8) or ‘root completed with apex open’ (Stage 9) according to Nollas stage of tooth development. Majority of the children in the age group of 9 years had ‘crown almost completed’ in second molar (Stage 5), majority of 10-year-old children had ‘two-third root completed’ in second molar (Stage 8) and majority of 11-year-old children had ‘root completed with open apex’ in second molar (Stage 9).

Conflict of Interest
The authors declare that they have no conflict of interest.

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