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RESEARCH ARTICLE

ASSESSMENT OF ERUPTION OF PERMANENT MAXILLARY CENTRAL INCISORS FOR THEIR BIOLOGICAL ERUPTION TIME AND ASSOCIATED LOCAL FACTORS IN CHILDREN

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ABSTRACT

Background: Eruption is the axial movement of tooth from its non functional position in bone to functional occlusion. Root development represents the fundamental biologic parameter for tooth eruption.

Aim: Evaluate the rate of eruption of Permanent maxillary central incisors (PMCI) with respect to chronological age and biological tooth eruption time and late eruption of PMCI to associated local factors.

Materials and Methods: A cross sectional study was conducted in 100 children aged between 8-12 yrs. Who visited Department of Pedodontics and Preventive Dentistry, Rajarajeswari Dental College and Hospital seeking dental treatment. After obtaining informed consent, children were randomly selected, examined for age and clinical apparent dentition, grouped as follows,1)Control group includes children with erupted PMCI 2)Study group includes children with late eruption of PMCI, Further, children were radio graphically assessed to determine biological tooth eruption (2/3rd of root completion) and late eruption associated with local factors if any.

Results: The data was analyzed with Mann Whitney U test. Mean age of the boys (52%) and girls (48%) was 8-9yrs.The results of control group and study group showed statistical significant difference between intergroup and intra group with respect to 2/3rd of root formation for the eruption of PMCI.

Conclusion: Eruption is a physiologic process, where 2/3rdof root completion influences the chronologic eruption of PMCI. Late eruption of the same can be attributed to the presence of local factors.

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INTRODUCTION

Eruption is the axial movement of a tooth from its non functional position in the bone to functional occlusion and has a strong influence on the craniofacial development (Suri *et al.,* 2004). Normal biologic eruption time occurs when the dental root is approximately 2/3 its final length which is considered as most reliable indicator of maturation and predicts the biological age of skeletal material (Liversidge *et al.,* 2004). Delayed biologic eruption is defined as tooth eruption that has not occurred despite the formation of 2/3 or more of the dental root (Suri, 2004) (Yaqoob *et al.,* 2010). Emergence of Permanent Maxillary Incisors in the oral cavity is the most commonly encountered concern amongst the parents as it is considered to be the most unattractive deviant of occlusaltrait (Yaqoob *et al.,* 2010). Children with unerupted, delay in eruption due to developmental disturbances or missing of teeth can have a major impact on dental and facial aesthetics without affecting the function and also shown to affect children psychologically in terms of self esteem, general social interactions and speech problems (Jone, 1996). Though it is hypothesized that root development represents the fundamental biologic parameter for tooth eruption yet remains as a controversial topic till date. Hence the aim of the study was to assess the delayed eruption of the permanent maxillary incisors for their biological eruption time and associated local factors.

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METHODS AND METHODS

The objectives of this study is to evaluate the a) chronological eruption age, b) Biological eruption age, for the eruption of permanent maxillary central incisors (PMCI). A cross sectional study was conducted in 100 healthy children aged between 8-12 yrs

Table 1. Intra group comparison of control Group I A and group I B

Comparison of the mean age in the control group [Root formtn Completed & not completed] using Mann Whitney U tes									
						95% CI of the Mean			
Group I	N	Mean	SD	S.E.M	Mean Diff	Lower	Upper	Z	P-value
Group I A	39(78%)	8.67	0.70	0.11	0.48	0.03	0.93	-2.14	0.03*
Group I B	11(22%)	8.18	0.41	0.12					

Table 2. Intra group comparison of study group between Group II A and Group IIB

Comparison of the mean age in the Study group [Root Completed & not completed] using Mann Whitney U test									
						95% CI of the Mean			
Group II	N	Mean	SD	S.E.M	Mean Diff	Lower	Upper	Z	P-value
Group II A	14(28%)	8.93	0.62	0.17	0.60	0.24	0.94	-3.116	0.002*
Group II B	36(72%)	8.33	0.54	0.09					

Who visited Department of Pedodontics and Preventive Dentistry, Rajarajeswari Dental college and Hospital seeking dental treatment. Informed consent was obtained for those children who were included in the study. Demographic data of all these children were collected and the age of the patient is considered for the chronological tooth eruption time. Eruption status was examined clinically and radiographically using panoramic views. Children with special health care needs and permanent maxillary central incisors with completed root formation were excluded from the study. Biological tooth eruption time was determined by measuring root length of permanent maxillary central incisors using RVG imaging. The maturity of unerupted incisors was assessed using Cvek's classification.

1 Denotes root with wide, divergent ends and less than half their final length.
2 Denotes roots between one half and two third their final length
3 Denotes roots 2/3rd of their final length
4 Denotes teeth with open apical foramina and roots almost full length
5 Denotes teeth with complete root length

Figure 1. Cvek's classification of maturity of incisors

The children were randomly selected and divided into two groups.

Group I: CONTROL GROUP Children with erupted PMCI. Further sub divided into,

Group I A
- Erupted central incisors with 2/3rd of final root length.

Group I B
- Erupted central incisors with less than 2/3rdof final root length

Group II: STUDY GROUP Children with unerupted PMCI Further sub divided into,

Group II A
- Unerupted central incisors with 2/3rd of final root length.

Group II B
- Unerupted central incisors without 2/3rd of final root length

RESULTS

The qualitative data was analyzed using non parametric test. Mann Whitney U test was utilized statistical analysis. The mean chronological age was 8-9yrs in 52% of boys and 48% of girls. The results of control group and study group showed.

DISCUSSION

The maxillary incisors and canines are often referred to as the 'social six', are the most prominent teeth in an individual's smile. The normal eruption, position and morphology of these teeth are crucial to facial esthetics and phonetics. However, true and significant deviations of eruption time of these teeth are important and often helpful for accurate diagnosis and treatment planning (Huber *et al.,* 2008). The control group showed 78% of cases showed eruption of the maxillary teeth coincides with 2/3rd of the completion of root formation (biological eruption) irrespective of chronological age. These results were significant and in accordance with the studies in the literature (Suri *et al.,* 2004) (Liversidge *et al.,* 2004). However 22% of cases in our study did showerupted PMCI without 2/3rdof the root completion. The reasons attributed in our study were premature loss of primary teeth due to dental caries or trauma in accordance with the study done by Holan et al.(Holan *et al.,* 1992). Several studies have also shown that eruption timing of permanent successor may be delayed or accelerated after premature loss of a primary tooth, depending on the developmental status, bone density of the area and nature of the primary tooth loss.

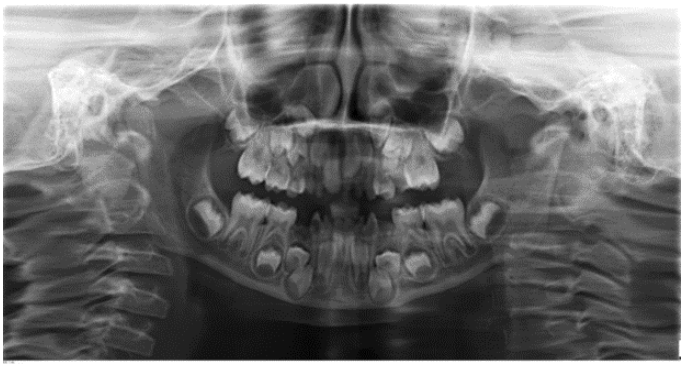
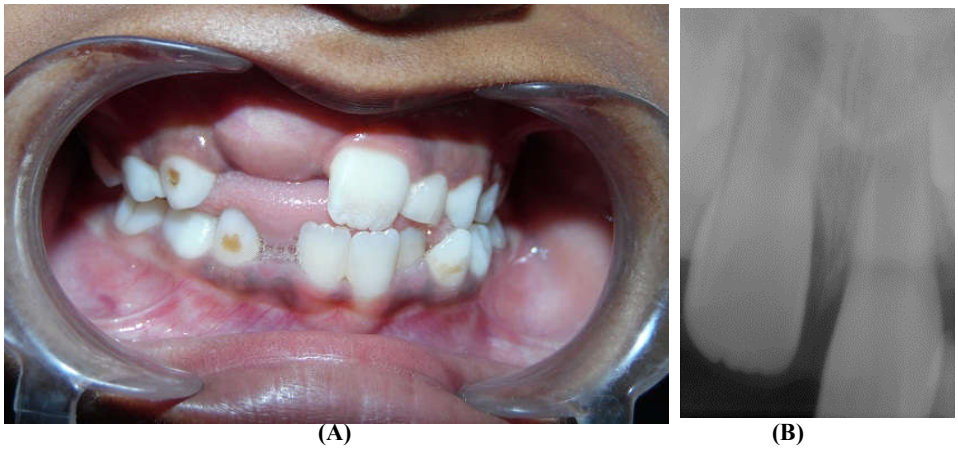


Figure 2. OPG showing eruption of central incisors 11 without 2/3rd root completion

Figure 3. Occlusal radiograph showing malpositioned central incisor 21



(A) (B)

Figure 4. A: Photograph of the patient showing thick mucosal barrier causing delayed eruption of 11; B: IOPA showing unerupted 11 without 2/3rd root Formation

(A) (B)

Figure 5. A: photograph showing supernumerary teeth in r. to 11; B: IOPA revealing supernumerary teeth i.r.to 11

(A) (B)

Figure 6. A: CBCT showing odontome in respect to 21; B: IOPA and occlusal radiograph showing odontome causing delayed eruption of 21

However the magnitude of any change in eruption timing is affected by age at the time of tooth loss (McDonald, 2004). In the study group 72% cases also showed unerupted PMCI with 2/3rd root formation. The reasons attributed for this were retained primary teeth (without exfoliation), morphological positional and developmental variants, supernumerary teeth or odontome, or presence of mucosal barrier. Trauma to the primary incisors due to their displacement,cause developmental disturbance damaging hertwig's epithelial root sheath thereby disrupting odontogensis resulting dilaceration, ectopic eruption or dentinogensis imperfecta[9].The other problems associated with trauma to the primary teeth are cystic transformation and ankylosis of primary teeth leading to delayed root resorption thereby resulting in delayed eruption of permanent successor(Huber *et al.,* 2008). In our studycertain cases of delayed eruption of permanent teeth were attributed to the presence of thick mucosal barrier in the path of eruption. According to Jones et al, Formation of a dense mucoperiostium or sub mucosa will acts as a physical barrier to eruption can occur during development which prevents the dental follicle to unite with the mucosa resulting in delay in the breakdown of the same and thereby acts as barrier for the eruption of permanent teeth (Jones, 1996). The primary teeth was retained due to non resorption or delay in the resorption of their roots for any reason, the permanent tooth may erupt in an alternate path or not erupt at all resulting in delayed eruption which was in accordance with the study done by Huber *et al.* The reason attributed for this was caused by the primary tooth becoming ankylosed or nonvital, due to trauma or caries (Huber, 2008). Dibase advocated that when a delay in eruption was observed, often the affected incisors had a reduced root formation with an open apex, altered root curvature, labial displacement and labial inclination, as well as mesial/ distal displacements/ inclination (Dibase 1971). In cases of ectopic development of tooth germ, the root is moulded to match the palatal curve at the time of root formation leading to maxillary incisor impaction.

In our study certain cases showed delayed eruption due to the presence of supernumerary tooth. It is more often associated with conical or peg shaped type which showed the displacement of the incisors but Bodenham suggested that the tuberculate or the invaginated supernumerary has been shown to cause more cases of delayed eruption of the maxillary incisors.It is also mentioned that vertical orientation of supernumerary teeth are more responsible for the delayed eruption (Mitchell, 1992) (Bodenham, 1967) (Tay *et al.,* 1984). In our study very few cases showed delayed eruption due to the presence of odontome in the eruption pathway of PMCI. Hitch in suggested that odontomas are either inherited or an interference with genetic control of tooth development. Trauma, infection, or growth pressure may disturb the biological mechanism that controls the tooth development and may be regarded as a source leading to an odontoma (Hitchin, 1974). Other reasons in the literature shows that, X-radiation has also been shown to impair tooth eruption. Root formation impairment, periodontal cell damage, and insufficient mandibular growth also seem to be linked to tooth eruption disturbances due to x-radiation (Huber *et al.,* 2008).

Conclusion

Eruption of permanent maxillary incisors are usually occurs when 2/3rd of the root formation is complete. However significant variation in these eruption pattern requires complete evaluation both clinically and radio graphically as there may be underlying local or systemic conditions. Though most such cases require only regular monitoring for space and follow up, few cases do require surgical and orthodontic interception to formulate proper treatment plan to achieve best possible outcome for each patient.

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