

An Appraisal of Early Loss of First Permanent Molar in Children: A Clinic Based Study.

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ABSTRACT

Background: The loss of first permanent molars (FPMs) in children is an important clinical concern due to their role in dental occlusion and function. Dental caries remains the most frequently cited cause of tooth loss.

Methods: A retrospective cross sectional descriptive study of 311 children; 158 males and 153 females. Their sociodemographic and clinical informations over a 2 year period were retrieved with the aid of the clinic daily attendance record book and case note records.

Results: Mean age of the sample population was 8.56 ± 3.16 years. The prevalence of FPM extraction was 64.2%. A total of sixty-six FPMs of children with a mean age of 12.74 ± 2.06 were extracted in all and forty five (68.2%) of these extractions were done in males. More FPM extraction was done in the lower jaw, and the lower right quadrant was the prevalent. The predominant cause of these enforced extractions of FPM was caries and its sequelae.

Conclusion: Caries is the commonest reason for FPM loss and males are more susceptible. These extractions are done more in older children and adolescents, and the lower right quadrant is the most prevalent side.

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INTRODUCTION

Early loss of a tooth also known as premature loss of tooth can be defined as loss of a tooth naturally or by extraction before its expected exfoliation in the primary dentition and loss of a tooth before the end of the life time of an individual in the permanent dentition (Hartsfield et al., 1994). Out of the numerous teeth in the mouth the first permanent molars (FPMs) also referred to as the six-year molar in children are undeniably the most important and play a great role in the development of a functionally and aesthetically pleasing occlusion. Hence, they are of great value to both Paediatric dentists and Orthodontists. These teeth serve as an index for age estimation, assessment of malocclusion, maintenance of occlusal harmony in the mixed dentition stage and provision of balance during function (Angles, 1899; Ebrahimi et al., 2010). FPMs are also a source of retention for removable appliances and anchorage for fixed appliances.

Several factors may lead to the loss of the first permanent molar (FPM) with caries being the commonest, especially in the lower socioeconomic groups. The susceptibility of these teeth to caries has been attributed to factors such as its early eruption into the oral cavity which subjects it to the harsh oral environment early, their inaccessibility

to oral care measures due to their position and the presence of pits and fissures on the occlusal surfaces of these teeth serve as stagnation areas for bacteria and debris. Furthermore, its long duration of eruption to functional position makes debris removal difficult as these teeth remain partially erupted for a significant amount of time (Powell, 1998; Gill et al., 2001; Agrawal et al., 2023; Noar et al., 2023).

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In addition. FPM may be lost prematurely by trauma or for orthodontic reasons (Andreasen et al., 2011; Proffit et al., 2019). Moreover, FPM and permanent incisors are susceptible to enamel hypo-mineralization (Molar Incisor Hypomineralisation [MIH]); a systemic condition with poorly understood cause characterized by demarcated and qualitative enamel defects. Studies have reported the prevalence of MIH children to be 6% (Noar et al., 2023). Hypomineralised teeth are prone to post eruptive breakdown of the enamel and are at a higher risk of rapidly progressive caries and enforced extraction

in developing dentition (Albadri et al., 2007, Ong & Bleakley., 2010: Noar et al., 2023).

Hence, extraction rates are high even in groups with higher socioeconomic level (Sabri, 2021). Nevertheless, when these cases present early it might be possible to explore other conservative measures to salvage the condition thereby making extraction of these teeth the last result. Other aetiologies for early loss of FPM may be connected to systemic diseases such as mucocutaneous dyskeratosis, Down syndrome, Papillon–Lefèvre syndrome, Coffin–Lowry syndrome, congenital adrenal hyperplasia, Langerhans cell histiocytosis, cherubism, hypophosphatasia, Acatlasia, Chediak–Higashi syndrome, cyclic neutropenia, erythromelalgia, Hajdu–Cheney syndrome, short bowel syndrome, leukocyte adhesion deficiency type 1 (LAD-1), and Wiedemann–Steiner syndrome (WSS) (Spodzieja & Olczak-Kowalczyk., 2022).

Unfortunately, premature loss of FPMs teeth may be associated with psychosocial problems such as reduced self-esteem and numerous intra and inter arch dental anomalies (Al-Shahrani et al., 2015; Sabri, 2021). These anomalies include lingual inclination of lower incisors, distal migration of lower canines with incisor migration and midline diastema/shift. Additionally, this loss can result in inclination of adjacent teeth into the edentulous space, periodontal compromise of the remaining adjacent teeth, supra-eruption of the opposing teeth with possible dental consequences, temporomandibular dysfunction, reduced arch length resulting in crowding and possible failure of eruption of succedaneous teeth (Saber et al., 2018; Serindere et al., 2019). Likewise, impacts such as tipping, dental arch crowding, and malalignment of adjacent teeth have also been reported (Macena et al., 2011).

However, complications of early loss of FPMs are age dependent. Early loss of mandibular FPMs in a growing child may lead to horizontal mandibular-condylar displacement which would result in facial asymmetry. Some studies have shown that early loss of the mandibular FPMs before the age of eight years may result in distal drifting, tilting and rotation of the unerupted second premolar (SPM) while late loss, after the eruption of the SPM, will result in mesial tilting and lingual rolling of the SPM which will consequently lead to space closure and development of scissor bite. In the maxilla, early loss of the FPMs results in the mesialization and rotation of the second premolar causing a posterior cross bite (Gill et al., 2001; Ong & Bleakley., 2010). Globally the prevalence of FPMs loss in children was reported to be 2.1%, 5.2% and 8.0% in different studies carried out in Mexican, Romanian

and English children respectively (Sutcliffe, 2008; Răducanu et al., 2009). However, in Nigeria the prevalence of malocclusion ranges from 76.8% – 84%. This high prevalence may be associated with the increased level of dental awareness (da Costa, 1999; Onyeaso, 2004; Ajayi, 2008).

Despite all the possible consequences of early FPM extractions, some dental practitioners still consider extraction of these teeth their first line of treatment rather than seek possible alternative means of treatment in these children. According to the updated guidelines of the Royal College of Surgeons of England faculty of Dentistry (Noar et al., 2023), this tooth should only be extracted if bony support cannot be regained, when the infectious process cannot be arrested, when there is inadequate tooth structure remaining for restoration or excessive pathological root resorption exists.

Interestingly, there is an increased awareness about malocclusion in Nigeria and with this awareness one might infer that many children are likely to want to seek orthodontic therapy for the correction of various malalignment of their teeth. Thus, there is need to investigate the prevalence of FPM extraction in children and reason(s) for such extractions in South-west Nigeria where there is a dearth of information. It is also important to determine the role this early loss of FPMs plays in the aetiology of malocclusion as the absence of the FPM in these patients might pose a challenge to the management of these cases. In addition, results from this investigation will provide the data necessary to improve the intervention protocol for the management of diseased FPM. Therefore, this study will promote awareness on early FPM loss, common reasons for its loss and so help in formulating adequate dental health care guidelines and policies.

MATERIALS AND METHODS

This is a retrospective cross sectional descriptive study of children who attended the Paediatric dental unit of a tertiary health care facility in the Southwest region of Nigeria over a twenty-four (24) months period. The inclusion criteria were a review of all patients who attended the paediatric dental clinic within the study period and required one form of treatment or the other and that are within the age's group of 0 – 16 years. Their attendance and subsequently their sociodemographic and clinical information were retrieved by one of the researchers with the aid of the clinic daily attendance record books and case records.

Information such as age, gender, diagnosis and indication for tooth/teeth extraction, tooth/teeth

extracted and quadrant from which tooth/teeth were extracted were retrieved from patients' case records. The information obtained from the attendance and case note records were entered by the principal investigator into a personal computer for analysis.

All data obtained was in keeping with ethical standards for human studies and the Helsinki declaration. Data was analyzed with statistical package of social sciences (SPSS) version 21.0 and frequency tables were generated and chi-square and t-test were used to determine the difference between means.

RESULTS

A total of 1028 teeth from 311 patients were extracted over the period under review. The age range of the patients was 1 – 16 years with a mean age of 8.56±3.16 years. About Fifty percent (50.8%) of the subjects were males. Sixty-six FPMs of children with a mean age of 12.74±2.06 were extracted in all and forty-five (68.2%) of these

extractions were done in males. The prevalence of FPMs extraction is 64.2%. Majority of the FPMs were extracted in the lower right quadrant (44.9%) and the least was extracted in the upper left quadrant (4.3%) (Figure1). The pattern of loss of the FPMs in relation to gender is as shown in (Table 1). The overall analysis of the four quadrants in relation to gender revealed a male: female ratio of FPM loss of 2:1. In the upper arch, the ratio of extraction per quadrant (right : left) in males was 4:1 while in females was 2:1 In the lower arch, the ratio of quadrant extraction was 2:1 in males and 3:1 in females. Comparing the means between genders, no statistical significance (p=0.961) was observed hence, there is no difference in FPMs loss. The major reason for FPMs loss was found to be due to caries and its sequelae which were responsible for 97.0% of the extracted teeth (Table 2). Two of the children had their FPMs extracted because of osteomyelitis involving the mandible. Table 3 shows a comparative report of FPMs loss from other documented studies.

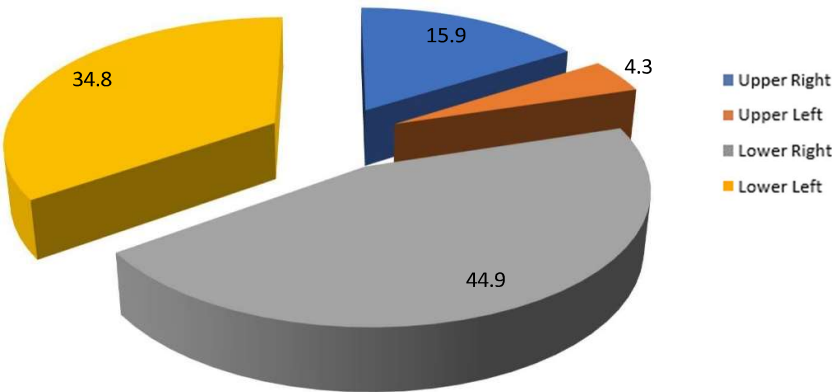


Figure 1. Distribution of permanent first molar loss by quadrant

Table 1. Distribution of FPM extraction frequency in relation to gender and quadrant affected FPM Teeth

	Quadrant 16 Freq. of loss (%)	Quadrant 26 Freq. of loss (%)	Quadrant 36 Freq. of loss (%)	Quadrant 46 Freq. of loss (%)	Total
Male	8(17.8)	1(0.02)	17 (37.8)	19(42.2)	45
Female	2(9.5)	2(9.5)	6(28.6)	11(52.4)	21
Total	10(15.2)	3(4.5)	23(34.8)	30(45.5)	66

Table 2. The indications of first molar extractions

Quadrant	Failed *RCT	Diagnosis				Irreversible pulpitis	Osteomyelitis	Total
		Dento-alveolar abscess	Apical periodontitis	Caries				
16	2	1	1	4	1	2	-	11
26		-		3	-	-	-	3
36	10		2	6	2	2	1	24
46	11		8	9	-	1	1	31
Total	23		11	22	3	5	2	66

*RCT (Root Canal Therapy)

Table 3. Global comparison of first permanent molar loss

Quadrant	Folayan et al.(2005) (1-16 years)	Alsheneifi et al.(2001) (3-13years)	Raducanu et al(2009) (5.2-17.9 years)	Present study (6 – 15 years)
Upper Right	-	-	10.5	15.9
Upper Left	-	-	19.3	4.3
Lower Right	-	-	35.1	44.9
Lower Left	-	-	35.1	34.8
*Total (FPM/ total extractions)	34/238	170/567	57/176	66/1028

*First molar extractions versus total number of extractions in patients

DISCUSSION

Tooth extraction is one of the minor oral procedures that is carried out in paediatric dentistry. This procedure may be done to relieve tooth ache or for orthodontic reasons. As beneficial as tooth extraction maybe in the short term, its long-term effect on the dental arches may be grave. (Ong & Bleakley., 2010) In children the loss of first permanent molars is an important clinical concern due to its role in the development of dental occlusion and function. Absence of the FPMs in the mouth of a child may provide information on the parent's attitude towards oral care. It may also provide information about the availability, accessibility of care and the knowledge of dental healthcare providers.

In orthodontics the FPMs are rarely the tooth of choice for extraction in the management of malocclusion. This is because it is often the teeth used for anchoring the orthodontic appliances molar bands for straight wire appliances or the placement of Adams clasps during removable appliance therapy for retention. Therefore, when

the FPMs are missing there will be a need for a more technically demanding orthodontic intervention as compared with non-extraction cases. A systematic review observed that spontaneous space closure of the extraction space may occur in 45.5% – 85.2% of cases of early loss of FPMs although a significant heterogeneity in the methodology of the included studies was noted (Saber et al., 2018). Conversely, researchers also observed that early extraction of the FPMs in the maxillary arch when the second permanent molar has not erupted will lead to a spontaneous and favourable good occlusal positioning of the second permanent molar. However, this is not the same for mandibular second permanent molar after an early extraction of the FPMs as its positioning is more variable and less predictable (Noar et al., 2023). Therefore, the timing for the extraction of the FPMs in the mandibular arch is very important for better positioning of the unerupted lower second permanent molars. Thus, the best timing is between the ages of 8 – 10 years (Gill et al., 2001; Noar et al., 2023). Unfortunately, this was not the

observation in our study as the mean age when the FPM was extracted was 12.74 ± 2.06 years. Therefore, the chances of abnormal positioning of the second permanent molars in this group of children are likely to be very high with the possibility of a need for an orthodontic intervention to correct malocclusion in the future. About the prevalence of FPMs extractions, studies have reported contrasting results. Some have reported the FPMs to be the most extracted teeth (Taiwo et al., 2014) while others have reported the contrary (Odai et al 2010; Chukwumah et al., 2014). In this study, the prevalence of FPM extraction is much lower than those reported in other studies (Alsheneifi & Hughes., 2001; Taiwo et al., 2014, Folayan et al., Albadri et al., 2007). The difference in the prevalence in our study and others may be associated with the difference in the age group studied, and the methodology employed. Notwithstanding, the prevalence of FPMs loss from this study could be used to predict that there might be an equivalent increase in the demand for orthodontic therapy among Nigerian children with early loss FPMs in the future. And this demand will be met with the need for a more complicated and prolonged orthodontic intervention as majority of these children will present with atrophied edentulous alveolar ridges (Herrera-Sanches et al., 2017). Furthermore, a decrease in the number of teeth in the mouth through early loss of FPM's have been found to lead to poor dietary habits and deterioration of quality-of-life (Aida et al., 2006). This could be because of the difficulty in chewing and consequently poor masticatory benefits, poor digestion of food and adverse health risk resulting from poor nutritional benefits from meals. Hence, a little above one tenth of the affected children with FPM extractions in this current might likely experience these complications in the future. Likewise in this study, the lower right and left quadrants were the quadrants with the most extracted teeth. This finding is like those of other studies (Alsheneifi & Hughes, 2001; Anand & Kuriakose 2009, Raducanu et al., 2009). However, in the upper arch, more FPMs were extracted from the right quadrant relative to the left. This finding is one and the same like those of Alsheneifi & Hughes and Anand & Kuriakose (Alsheneifi & Hughes, 2001; Anand & Kuriakose 2009). but differs from those of Raducanu et al where the upper left quadrant had more extracted FPMs. (Raducanu et al., 2009). The observation in the current study showing lower right FPMs as the most extracted might agree with the postulation that right-handed individuals predominate and they find it a little bit more difficult to clean the

right side of the mouth as compared to the left (Taiwo et al., 2014).

Caries and its sequelae were the primary reason for extraction of the FPM in this current study. This finding is similar to that reported by Albadri et al (2007) and may be attributed to a change in diet to western diet which is more cariogenic. Unfortunately, nowadays children erupt their FPMs early thus these teeth are exposed to cariogenic diet early. It is therefore important to diagnose and prevent the progression of caries in these children. This strategic preventive intervention will help to prevent early FPM loss. These preventive measures include education of parents and children on good oral hygiene and dietary counselling, regular dental check-ups, fissure sealing and fluoride (Griffin et al., 2008; Rugg-Gunn & Sweet., 2011). Other management strategies proposed in literature for the management of unsalvageable FPM include auto-transplantation; a viable approach that doesn't require artificial materials (Saga et al., 2011). However, success rates for this management option might vary and could cause surgical stress, root resorption, ankylosis, and infection. In situations where the FPMs must be extracted early use of a space maintainer has been advocated in children (Cardoso et al., 2022). In adult patients, a fixed prosthesis offers an additional alternative, albeit one with several drawbacks which include high cost, partial erosion of fundamental tooth components and subsequent decays and mechanical faults. An alternative to prostheses is implants. Another approach to treating first-molar loss is orthodontic repositioning with neighboring teeth; this option spares the patient from the trauma of surgery and the high costs associated with prosthesis or implant placement (Raveli et al., 2017). There is therefore a need for more investigation of the association and effects of therapeutic strategies utilized in treating malocclusion brought on by early FPM loss.

CONCLUSION

The loss of first permanent molars in children can have a significant effect on their dental health and development. This highlights the importance of FPMs in children. Caries and its sequelae remain the most significant etiological factor thus preventive care plays a pivotal role in preventing such losses. It is therefore crucial to ensure more awareness about caries preventive measures such as application of fissure sealants on newly erupted teeth. When extraction is inevitable, the clinician should adhere strictly to the principles guiding extraction of FPMs.

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