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Management of Apical Fenestration in a Primary Tooth: A Case Report

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ABSTRACT

Background: Apical fenestration is a condition characterized by a defect in the alveolar bone that results in the exposure of the tooth apex through the oral mucosa. Extraction is one of the treatment options that can be performed to eliminate the associated symptoms and source of infection.

Objective: This case report aims to describe the management of apical fenestration in a primary tooth using local infiltration anesthesia.

Case Report: A 9-year-old boy presented to the Dental Clinic of Batu Brak Community Health Center accompanied by his mother, with a chief complaint of mobility of the upper right posterior tooth and exposure of the root through the gingival tissue. The patient's mother was concerned because the tooth appeared increasingly inclined toward the palate and requested its extraction. The patient was treated by extraction of the affected tooth under local infiltration anesthesia.

Conclusion: Extraction performed under local infiltration anesthesia may be considered an effective treatment option for managing apical fenestration in pediatric patients.

***Keywords*:** Apical fenestration, primary tooth, tooth extraction

INTRODUCTION

According to the American Association of Endodontists (AAE), apical fenestration is a condition in which a window-like defect or opening develops in the alveolar bone, resulting in exposure of the tooth apex to the oral environment. This condition most commonly occurs on the facial aspect of the alveolar process.[1–4]

Apical fenestration has been classified into several types (Figure 1). Type I is characterized by protrusion of the apical third of the root without involvement of the apical foramen. Types II and III involve protrusion of the middle third and cervical third of the root, respectively, without extension to the alveolar crest. Type IV involves fenestration extending from the apical third to the middle third of the root, with or without involvement of the apical foramen. Type V extends from the middle third to the cervical third of the root without reaching the alveolar crest. Type VI involves exposure of the entire root without extension to the alveolar crest.[5–7] To date, no studies have specifically evaluated the prevalence of apical fenestration in primary teeth according to age, sex, or ethnicity.[4] According to Nalbantoğlu

and Yanık, the most frequently observed types of apical fenestration are Type I (38.3%), Type IV (27.08%), and Type III (0.9%).[5] In primary teeth, apical fenestration may occur as a consequence of trauma, causing perforation of the root apex through the labial alveolar bone and overlying gingival tissue.[7] Another possible etiological factor is prolonged retention of primary teeth beyond the expected exfoliation period. The eruption of the permanent successor may induce resorption of the labial alveolar bone, resulting in fenestration and subsequent exposure of the apex of the retained primary tooth.[7]

The most common treatment approach for apical fenestration in primary teeth is extraction.[7,8] In permanent teeth, alternative treatment modalities include root canal therapy followed by apicoectomy and retrograde filling with an appropriate restorative material. In addition, full-thickness flap surgery combined with tissue regeneration procedures and bone grafting may be considered in selected cases.[7]

This article presents a case report of a pediatric patient with apical fenestration involving the maxillary primary first molar, which was successfully managed by extraction under local infiltration anesthesia.

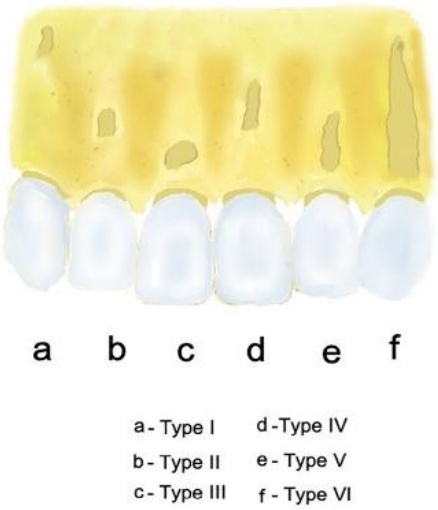

Figure 1. Classification of Apical Fenestration Types[5]

RESULT

A 9-year-old male presented to the Dental Clinic of Batu Brak Community Health Center accompanied by his mother, with a chief complaint of mobility of the upper right posterior tooth and exposure of the root through the overlying gingival tissue. The patient's mother reported concern because the tooth appeared increasingly inclined toward the palate and requested its extraction.

Extraoral examination revealed no abnormalities of the face or lips. Bilateral cervical lymph nodes were non-palpable and non-tender. Intraoral examination demonstrated Grade II mobility of the primary maxillary right first molar, deep dental caries involving the pulp, and a palatally displaced tooth position (palatoversion). The distobuccal root apex had perforated the overlying gingival tissue. In addition, a whitish cusp-like structure consistent with the erupting permanent successor was observed penetrating the gingiva (Figures 2A and 2B).

Based on the patient's history and clinical examination findings, a diagnosis of apical fenestration was established.

Following informed consent obtained from the patient's parent, treatment was planned for extraction of primary maxillary right first molar. Extraction was selected because the tooth exhibited mobility, the patient was approaching the expected eruption period of the permanent successor, and the permanent maxillary right first premolar had already begun to erupt (Figure 3).

The patient was positioned comfortably in a supine position on the dental chair, accompanied by his mother to facilitate behavioral management and maintain cooperation throughout the procedure. The operative field was prepared using 10% povidone-iodine antisepsis around of the primary maxillary right first molar. Topical anesthesia (2% xylocaine) was then applied to the injection site, followed by local infiltration anesthesia administered into the gingival mucosa using 2% lidocaine hydrochloride delivered with a 1-mL syringe. The effectiveness of anesthesia was assessed using a dental explorer, and no pain response was elicited. Tooth mobilization was initiated by separating the periodontal ligament fibers using an excavator. The primary maxillary right first molar was subsequently extracted using extraction forceps with controlled luxation movements until complete removal was achieved. The extraction socket and surrounding tissues were carefully inspected to ensure the absence of retained root fragments or other remnants.

Following extraction, hemostasis was achieved using sterile gauze impregnated with 10% povidone-iodine. The patient was observed briefly until his general condition remained stable. Postoperative instructions were provided to the parent regarding oral hygiene maintenance, postoperative care, and monitoring of the eruption of the permanent maxillary right first premolar.

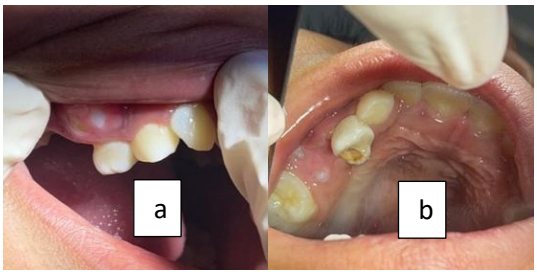

Figure 2: (a) Apical fenestration of the primary maxillary right first molar (tooth 54) with root apex exposure through the gingival tissue; (b) Occlusal view of the maxillary arch demonstrating the affected tooth and the erupting permanent successor.

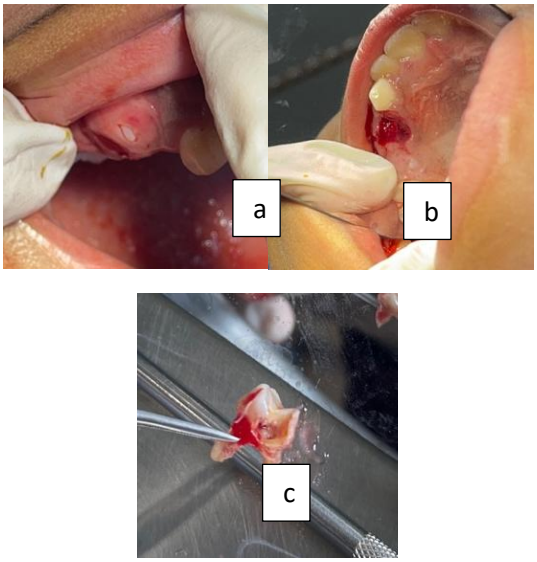

Figure 3. (a, b) Intraoral views after extraction of tooth 54; (c) Extracted primary maxillary right first molar.

RESULTS

The study was conducted on 60 Marine Science students at Universitas Sriwijaya who met the inclusion and exclusion criteria. The validity and reliability tests of the questionnaire indicated that all items were valid (r-calculated ≥ r-table) and reliable (Cronbach's Alpha ≥ 0.60). The frequency distribution of participants by sex and age is presented in Table 1.

Table 1. Frequency Distribution of Participants by Sex and Age

Variable	Frequency (N)	Percentage (%)
Sex		
- Male	32	53.3
- Female	28	46.7
Age (years)		
- 18	24	40.0
- 19	25	41.7
- 20	11	18.3
Total	60	100

The frequency distribution of participants by sex and age showed that the majority of

participants were male and predominantly 19 years old. The frequency distribution of participants according to dental erosion, salivary pH, as well as the assessed intrinsic and extrinsic factors is presented in Table 2.

Table 2. Frequency Distribution of Participants Based on Dental Erosion, Salivary pH, and Intrinsic and Extrinsic Factors

Variable	Frequency (N)	Percentage (%)
Dental Erosion		
Erosion	48	80.0
No erosion	12	20.0
Salivary pH		
6.8	17	28.3
7.0	13	21.7
7.2	10	16.7
7.4	5	8.3
7.6	15	25.0
Gastroesophageal Reflux Disease (GERD)		
Yes	15	25.0
No	45	75.0
Dietary Habits		
Citrus fruit consumption		
0 times/week	19	31.7
1-3 times/week	35	58.3
4-7 times/week	6	10.0
Apple consumption		
0 times/week	30	50.0
1-3 times/week	26	43.3
4-7 times/week	4	6.7
Coffee consumption		
0 times/week	18	30.0
1-3 times/week	29	48.3
4-7 times/week	13	21.7
Citrus tea consumption		
0 times/week	37	61.7
1-3 times/week	21	35.0
4-7 times/week	2	3.3
Carbonated drink consumption		
0 times/week	28	46.7
1-3 times/week	21	35.0
4-7 times/week	11	18.3
Oral Care Practices		
Toothbrushing frequency		
< 2 times/day	15	25.0
≥ 2 times/day	45	75.0
Mouthwash use		
Yes	21	35.0
No	39	65.0
Swimming Habits		
Swimming frequency		
1-2 times/week	54	90.0
≥ 3 times/week	6	10.0

Variable	Frequency (N)	Percentage (%)
Swimming duration		
4-6 hours	53	88.3
≥ 7 hours	7	11.7

Most participants experienced dental erosion (80%), while only 20% showed no signs of erosion. The distribution of unstimulated salivary pH indicated that all participants met the inclusion criteria. Based on the GERDQ score 25% of participants were identified as having GERD symptoms. Dietary habits showed that the majority of participants consumed citrus fruits 1-3 times per week, did not consume apples, consumed coffee 1-3 times per week, rarely consumed citrus tea, and did not consume carbonated beverages. Oral care practices indicated that most participants brushed their teeth at least twice daily and did not use mouthwash. Regarding swimming habits, 90% of participants reported swimming 1-2 times per week with a duration of 4-6 hours per session. The results of Fisher's exact test assessing the association between the intrinsic factor (GERD), and the occurrence of dental erosion are presented in Table 3.

Table 3. Association between Intrinsic Factor and Dental Erosion

Intrinsic Factor	Dental Erosion		*p*-value
	Yes	No	
Gastroesophageal Reflux Disease (GERD)			
Yes	15	0	0.027*
No	33	12	

* *p* value was based on Fisher's exact test with $p < 0.05$ considered significant.

The significance value obtained was 0.027 ($p < 0.05$), indicating a statistically significant association between GERD and dental erosion. The results of the Chi-square test assessing the association between extrinsic factors and the occurrence of dental erosion are presented in Table 4.

Tabel 4. Association between Extrinsic Factors and Dental Erosion

Extrinsic Factor	Dental Erosion		*p*-value[a]
	Yes	No	
Dietary Habits			
Citrus fruit consumption			
- 0 times/week	15	4	
- 1-3 times/week	27	8	0,239
- 4-7 times/week	6	0	
Apple consumption			
- 0 times/week	24	6	0,966
- 1-3 times/week	21	5	

- 4-7 times/week	3	1	
Coffee consumption			
- 0 times/week	14	4	
- 1-3 times/week	22	7	0,392
- 4-7 times/week	12	1	
Citrus tea consumption			
- 0 times/week	28	9	
- 1-3 times/week	18	3	0,413
- 4-7 times/week	2	0	
Carbonated drink consumption			
- 0 times/week	21	7	
- 1-3 times/week	17	4	0,495
- 4-7 times/week	10	1	
Oral Care Practices			
Toothbrushing frequency			
- < 2 times/day	11	4	0,472
- ≥ 2 times/day	37	8	
Mouthwash use			
- Yes	17	4	1,000
- No	31	8	
Swimming Habits			
Swimming frequency			
- 1-2 times/week	44	10	0,590
- ≥ 3 times/week	4	2	
Swimming duration			
- 4-6 hours	42	11	1,000
- ≥ 7 hours	6	1	

[a] *p* value were based on chi-square test (dietary habits) and Fisher's exact test (oral care practices and swimming habits) with $p < 0.05$ considered significant.

All significance values were greater than 0.05 ($p > 0,05$), indicating that no statistically significant association was found between extrinsic factors, such as dietary habits, oral care, and swimming, with dental erosion.

DISCUSSION

This case report describes the management of apical fenestration involving the primary maxillary right first molar in a 9-year-old male with an erupting permanent maxillary right first premolar. The lesion was classified as Type I apical fenestration, characterized by exposure of the distobuccal root apex through the gingival tissue. Among the various types of apical fenestration, Type I has been reported as the most prevalent.[5]

In the present case, the development of apical fenestration was likely associated with pulpal necrosis secondary to extensive dental caries. Non-vital primary teeth may disrupt the physiological root resorption process, adversely affect the eruption and development of the permanent successor, and serve as a source of chronic periapical infection when left untreated.[9] Destruction of the buccal alveolar bone may occur as a consequence of inflammatory mediator activity associated with persistent periapical inflammation.[9,10]

Loss of the bone and mucosal tissues covering the root apex may result in exposure of the apex to the oral environment, producing the characteristic clinical presentation of apical fenestration.[10,11] In addition, pathological conditions affecting primary teeth may influence the development of the underlying permanent dentition because of the close anatomical relationship between the primary tooth roots and the developing permanent tooth germ.[12,13] Chronic inflammatory lesions associated with primary teeth have been linked to enamel hypoplasia, disturbances in eruption pathways, delayed eruption, and developmental defects affecting permanent successor teeth.[12,13]

Extraction of a primary tooth affected by apical fenestration is considered an appropriate treatment approach for eliminating the focal source of infection and preventing potential complications involving the permanent successor.[14] Ideally, treatment planning should be supported by comprehensive radiographic assessment to evaluate the stage of eruption of the permanent tooth and its relationship to the alveolar bone crest.[3,9]

In the present case, extraction was selected because the patient was approaching the expected eruption period of the permanent successor. Furthermore, the clinical visibility of the cusp tip of the erupting permanent maxillary right first premolar through the buccal gingiva suggested that the tooth had already migrated close to the alveolar crest and was likely to erupt in the near future. The favorable position of the erupting successor supported the decision to extract the affected primary tooth.

CONCLUSION

Apical fenestration in primary teeth may occur as a result of traumatic injury or prolonged retention of primary teeth associated with disruption of physiological root resorption, particularly in non-vital teeth. This condition may act as a focal source of infection and potentially interfere with the normal development and eruption of the permanent successor. Early diagnosis and appropriate intervention are therefore important to prevent adverse effects on the developing permanent dentition. In the present case, extraction of the affected primary tooth under local infiltration anesthesia was a simple and effective treatment approach for eliminating the source of infection and facilitating the eruption of the permanent successor.

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