CASE REPORT

Aesthetic management of non-syndromic secondarily retained permanent mandibular canine

Richa Khanna,¹ Ankit Bahal,² Ramesh Kumar Pandey³

¹Department of Pedodontics with Preventive Dentistry, King George's Medical University, Lucknow, Uttar Pradesh, India

²Vijay Dental Clinic, Lucknow, Uttar Pradesh, India

³Department of Pediatric and Preventive Dentistry, King George's Medical University, Lucknow, Uttar Pradesh, India

Correspondence to

Dr Richa Khanna,
richa.bahal@gmail.com

SUMMARY

Primary failure of eruption (PFE) is a rare eruption anomaly, incorporating two independent conditions—primary retention and secondary retention. Primary retention is a localised cessation of eruption before gingival emergence without any identifiable cause. Secondary retention is a localised cessation of eruption after gingival emergence with no identifiable cause. Early diagnosis and treatment planning of this condition are important to avoid orthodontic and prosthodontic complications. With this background, the present case of PFE affecting a single permanent mandibular canine in a girl, aged 15 years is presented. Sequential diagnosis, treatment planning and possible aetiologies are discussed.

BACKGROUND

Eruption of permanent teeth is the result of a complex interaction of signals between the erupting teeth and the surrounding structures. This complexity accounts for many of the eruption disturbances seen in the permanent dentition that yet need more sophisticated understanding. Eruption disorders in permanent teeth can be classified according to the aetiology.¹ The manifestations may be ectopic eruption, delayed eruption or arrested eruption. Arrested eruption can be further categorised for diagnostic purpose under three conditions, namely, impaction, primary retention and secondary retention.²

Primary retention is defined as a localised cessation of eruption before gingival emergence without any identifiable local or systemic involvement. Secondary retention is defined as a localised cessation of eruption after gingival emergence with no identifiable cause.^{2,3} These two independent conditions are together called as primary failure of eruption (PFE). The term PFE must be differentiated from the term 'Impaction' that is defined as cessation of eruption of a tooth caused by a clinically or radiographically detectable physical barrier in the eruption path or by an ectopic position of the tooth.⁴ PFE is one such eruption anomaly that is rare, is poorly characterised, and one of the most difficult problems to diagnose and treat. A delay in diagnosis and treatment planning may cause malocclusion problems to increase with time as the ability of remaining dentition to adjust reduces. With this background, the present case of PFE affecting a single permanent mandibular canine in girl, aged 15 years is presented.

Figure 1 Intraoral preoperative view.

CASE PRESENTATION

The patient, a 15-year-old girl, reported with the chief complaint of aesthetic concerns for the spaces between her lower front teeth.

Intraoral examination

Intraoral examination revealed the presence of spaces distal to the permanent mandibular lateral incisors in both right and left quadrants (figure 1). In the lower left quadrant, a partially erupted tooth was visible in the FDI tooth number '33' region (figure 2). A small amount of white material (dental bonding cement) was seen on a few teeth.

Dental history

The patient gave history of a retained left mandibular deciduous canine (FDI tooth number '73') which exfoliated at the age of 11.5 years. According to the history given by her, the left mandibular permanent canine did not erupt completely after the exfoliation of deciduous precursor. The

Figure 2 Intraoral view of the primary failure of eruption affected tooth (left permanent mandibular canine).

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Figure 3 Orthopantomogram showing the presence of fully developed left permanent mandibular canine.

eruption was arrested at the present status of the tooth. The patient then opted for orthodontic extrusion of the concerned tooth for a period of 2 years. The orthodontic treatment failed to successfully extrude the left mandibular permanent canine. Patient left the orthodontic treatment after 2 years and was further not willing to opt for it.

No significant family history or medical history was found.

Radiographic examination

Examination of the orthopantomogram (figure 3) showed the presence of fully developed left mandibular canine (FDI tooth number '33') in the space distal to the left mandibular lateral incisor. Space present on the right side of the mandibular arch showed no presence of any tooth. A lateral cephalogram was also advised before definitive treatment planning.

Diagnosis

On the basis of the history elicited from the patient, and clinical and radiographic examination, it was diagnosed that the FDI tooth '33' was a candidate of secondary retention (a category under the term PFE).

INVESTIGATIONS

Orthopantomogram (figure 3) showed the presence of fully developed left mandibular canine (FDI tooth number '33'). Lateral cephalogram was used for assessment of cessation of growth.

TREATMENT

The treatment options given to the patient were:

To perform a crown-lengthening procedure on FDI tooth number '33', followed by the root canal treatment, postfabrication, core buildup, and a full crown restoration. The space on the mandibular right side was planned to be closed using composite resin/ceramic laminates.

To extract the partially erupted tooth (FDI tooth number '33') followed by replacement with a fixed partial denture. The space on the mandibular right side was planned to be closed using composite resin/ceramic laminates as in the previous option.

The patient refused to accept the second option. A haemogram was advised, and the management was done as follows:

Surgical crown lengthening for FDI tooth number '33'.

Root canal treatment for FDI tooth number '33' (Gutta percha with AH Plus (Dentsply) for obturation) (figure 4).

Postspace creation, post and core buildup using ParaPost system (Coltene Whaledent; figure 5).

Figure 4 Intraoral periapical radiograph showing endodontic treatment of the affected tooth.

Ceram X Duo composite (Dentsply) for space closure between FDI tooth numbers '42' and '43'—cheaper option selected for economic concerns (figure 7).

Porcelain fused to metal crown (Vita three-dimensional master shade) placed finally on FDI tooth number '33'—cheaper option selected for economic concerns (figure 6).

OUTCOME AND FOLLOW-UP

The final results were satisfying to the patient as well as to us (figures 6–8). The patient was followed up at 1 month, 6 months and 1 year. No significant radiographic changes in the position of the affected tooth were observed.

DISCUSSION

PFE is regarded as an eruption defect, manifesting as complete failure or cessation of initial eruption. Affected teeth are not

Figure 5 Post and core buildup following surgical crown lengthening of the affected tooth.

Figure 6 Porcelain fused to metal in the affected tooth.

ankylosed but they fail to follow the eruption path that has been cleared for them.⁵ The condition demonstrates most of the following characteristics⁶: (1) posterior teeth are more commonly involved than anterior; (2) involved teeth may erupt into initial occlusion and then cease to erupt further, or may fail to erupt entirely; (3) both primary and permanent molars may be affected; (4) involvement may be unilateral or bilateral; (5) involved permanent teeth tend to become ankylosed; (6) application of orthodontic force in an attempt to bring the affected teeth into the arch leads to ankylosis; (7) the condition tends to occur in isolation, with an absence of affected family members and (8) although other members of the family may be affected, they are not usually close relatives. Prevalence of this anomaly in the normal population is approximately 0.06%, with a gender distribution of M1 : F2.25.⁷

The two independent clinical situations incorporated under PFE are believed to be caused by different aetiological factors. Primary retention is probably caused by a disturbance of the dental follicle that fails to initiate the metabolic events responsible for bone resorption of the eruption path.⁸ The aetiology of secondary retention of permanent molars has been thoroughly described by Raghoobar *et al*³ who demonstrated that all secondary retained molars showed areas of ankylosis on histological examination. The causative factors of ankylosis, however, are not well understood. Suggested causes are inherited factors⁹;

Figure 7 Composite buildup for space closure between FDI tooth numbers '42' and '43'.

Figure 8 Final intraoral view.

hypercementosis¹⁰; disturbed metabolism¹¹ and infection. Secondary retention due to infection such as that of herpes zoster¹² and mumps¹³ has been described in case reports. This suggests spread of the virus along a nerve branch can cause destruction of the developing teeth innervated by the nerve branches.

In the present case the aetiology was unclear. Involvement of a single permanent tooth in non-syndromic PFE is very rare. The most likely explanation in absence of evidence for other causative factors is disturbance in nerve innervations in the affected area. The lower permanent canines and incisors are supplied by the incisive branch of the inferior alveolar nerve. The mandibular incisors, however, may show supplemental innervations from mental nerve¹⁴ of contralateral side and sensory innervations from mylohyoid nerve¹⁵ of ipsilateral side. Our hypothesis suggested is that disturbance in incisive nerve affects the mandibular canine and incisor region. The supplemental supply of mandibular incisors region may protect the incisors from incisive nerve damage effects, leaving only the permanent mandibular canine affected.

In the absence of any clear aetiology, a definitive diagnosis of PFE is possible retrospectively, where all possible causative factors have been considered and eliminated following the failure of orthodontic extrusion of an affected tooth or teeth.¹⁶ Failure of orthodontic extrusion is a finding that is essentially diagnostic.¹⁷ Our diagnosis of PFE in the present case was based on the clinical and radiographic findings with no evidence of a mechanical, pathological or systemic cause of obstruction and no evidence of successful orthodontic extrusion of the affected tooth. The present case was diagnosed as secondary retention, further classifying the type of PFE, as emergence into the oral cavity was evident.^{2,3} In over half the cases studied in Proffit and Frazier-Bowers⁵ review, some initial eruption of the affected teeth was found. Radiographic and clinical examination had revealed no evidence of ankylosis. This was a possible finding as in the study by Raghoobar *et al*,³ it was found that histologically all secondary retained molars showed areas of ankylosis. Clinically, these ankylosed molars had a metallic percussion sound only in one-third of the subjects. Signs of obliteration of the periodontal ligament (PDL) were also recognised radiographically in only one-third of the cases. The areas of ankylosis were often too small to be detected clinically or radiographically. It was concluded therefore, that infraocclusion was the most reliable sign of secondary retention.³

Lack of association with systematic disease of PFE has led to the belief that there are possible genetic candidates, only active during the eruptive phase, that were most likely expressed in tooth-follicle cells, as well as those in the PDL and surrounding structures.⁶ Shokeir¹⁸ was the first to believe that PFE was a

genetic disorder with the presence of a familial involvement. Bosker *et al*⁹ also came to this conclusion, suggesting an autosomal-dominant inheritance with nearly complete penetrance. That hypothesis was confirmed in follow-up studies.^{19–21} In a review by Frazier-Bowers *et al*²², which claimed to assess by far the largest sample of PFE cases reported till then, found however, that familial cases of PFE accounted for only one-fourth of all cases examined. Raghoobar *et al*¹³ found a familial component in only 10% of their patients. In the present case also, no familial component could be ascertained.

Management strategies suggested for a single tooth affected by PFE includes—extraction followed by orthodontic space closure or by prosthetic replacement; localised bony osteotomy and orthodontic extrusion of the whole segment; or if some eruption of the tooth has occurred, a coronal buildup for achieving occlusion via the restoration.⁶ The last option was considered for the management of the present case as the patient was also not willing for any extraction and a repeated orthodontic treatment. Final restorative treatment should not be carried out until vertical growth has ceased.²³ This was ensured with the help of cervical vertebrae maturation method on the lateral cephalogram.

Limited therapeutic interventions are available today for completely correcting the complications that result from a delay or failure of eruption especially PFE. Future strategies for treatment planning may therefore be directed to the genetic and molecular basis of PFE, which is still not yet very clear. However, unique features of PFE would definitely help in identifying accurately the molecular basis of eruption failure. Treatment modalities based on these advancements may help recreate eruption events.

Learning points

- Primary failure of eruption (PFE) is regarded as an eruption defect, manifesting as complete failure or cessation of initial eruption and must be differentiated from the term 'Impaction'.
- Definitive diagnosis of PFE is possible retrospectively, where all possible causative factors have been considered and eliminated. Failure of orthodontic extrusion is a finding that is essentially diagnostic for PFE.
- Ankylosis may not be evident in every case.
- Evidence of familial involvement may also not be evident in every case.
- Non-surgical restorative treatments are a good choice in non-growing patients.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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