

ABSTRACT

Primary failure of eruption (PFE) is a rare condition where malfunction of the eruption mechanism causes non-ankylosed permanent teeth to fail to erupt. These teeth become relatively submerged, resulting in a posterior open bite. Teeth with PFE have an abnormal or no response to orthodontic treatment, often necessitating prosthodontic rehabilitation. Accurate and timely diagnosis, radiographic monitoring, and subsequent management can improve patient outcomes and avoid prolonged frustration. This report highlights the assessment, diagnosis, and treatment planning considerations for two cases with failure of eruption of first permanent molars. Here we present the case of a 10-year-old female and an 8-year-old male with a similar presentation of rare conditions and summarize the features that distinguish mechanical failure of eruption from primary failure of eruption and factors related to their successful management.

BACKGROUND

Tooth eruption is a highly regulated and coordinated process that involves the interaction of the dental follicle with the osteoblasts and osteoclasts, resulting in the resorption of the overlying bone, tooth roots, and alveolar mucosa. Once an eruption path is cleared, the tooth moves along the path that has been created for it. Obstacles to tooth eruption may include cysts, other teeth, crowding, tongue pressure, digit habit, fusion of cementum to bone (ankylosis) and malfunction of the eruption mechanism inherent to the tooth.

Disorders of eruption can be syndromic or non-syndromic. There is increasing evidence of a genetic etiology for some of these eruption disruptions (associated with mutation of the PTH1R gene). Eruption disturbances can be divided into two broad categories: biologic dysfunction (primary failure of eruption) and physical obstruction (mechanical failure of eruption).²

Primary Failure of Eruption (PFE):

Malfunction of the eruption mechanism causes non-ankylosed teeth to fail to erupt. The primary characteristic is when a tooth fails to move along the eruption path that has been cleared for it. These teeth may partially erupt then cease to erupt, becoming relatively submerged.³

Clinical findings in PFE include:^{3, 5}

- Only posterior teeth are affected
- All teeth distal to the most mesial affected tooth are affected
- Posterior open bite
- Unilateral or bilateral, rarely symmetrical
- Any or all posterior quadrants may be affected
- Abnormal or complete lack of response to orthodontic force

Mechanical Failure of eruption (MFE):

Replacement of cementoblasts by osteoblasts due to a local disturbance in the periodontal ligament during the repair process of local physiologic resorption.

Clinical findings in MFE include:³

- Radiographic appearance of submergence due to ankylosis
- No clearance of eruption path
- Often unilateral and only affects a single tooth
- Adjacent teeth have normal eruption - may tilt or super-erupt
- Affected teeth might respond to luxation, other teeth respond to orthodontic forces

Modalities of treatment

For PFE, treatment options are limited. Orthodontic forces may cause ankylosis of these teeth. Due to involvement of multiple teeth, patients often end up with premolar occlusion. More invasive techniques are unlikely to succeed.³

- Mild case: onlays and crowns
- Moderately severe cases: extractions, bone grafts, and implants or small segmental osteotomy to surgically reposition the teeth into occlusion
- Severe cases: a significant deficit in alveolar bone height precludes implant restorations.

Often the only feasible option is a removable prosthesis.⁴

For MFE, extraction of the affected tooth at appropriate age or luxation of the tooth to break ankylosis followed by orthodontics are options. May respond to orthodontic forces in short-term but re-ankylosis is likely.

CASE REPORTS

Patient N.M:

8-year 7-month-old male patient with health history significant for asthma and premature birth presented for a recall examination. Patient's medications include Albuterol, Claritin, and Flovent. Patient is allergic to amoxicillin and has seasonal allergies. Patient's family and social history is unremarkable.

Clinical exam findings

EOE – no pathology noted

IOE – All permanent first molars are erupted and in occlusion except #19 (partially erupted and submerged)

Occlusion: Class I R, Mesial Step L

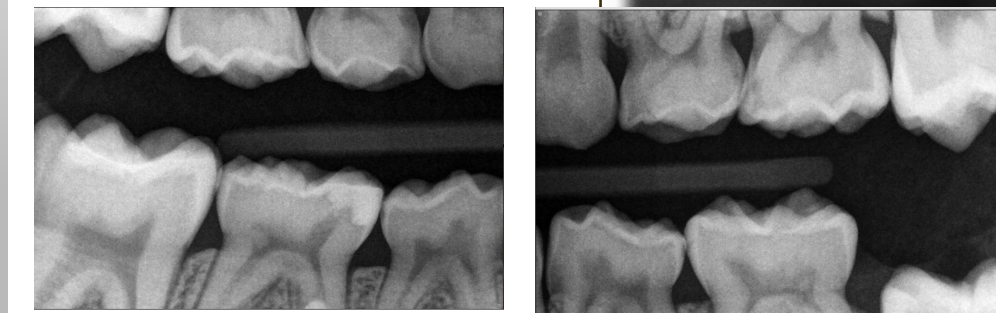
Caries : #I-d, #J-m #14-O

Teeth present: #3, #A, #B, #C, #7 PE, #8, #9, #10 PE, #H, #I, #J, #14, #K, #L, #M, #23, #24, #25, #26, #R, #S, #T, #30, #19 PE



Radiographic Findings

Extraoral PA shows #19 roots >2/3rds developed with dilaceration noted on mesial root
#20 and #18 present



Differential Diagnosis

Mechanical failure of eruption (i.e., ankylosis of #19)
Primary failure of eruption (indeterminate until second molars fail to erupt as well)

Patient K.H:

10-year 2-month-old female patient with no significant past medical history presented for a recall exam. Patient takes no medications and has no allergies.
Patient lives with her grandmother who is also her legal guardian.

Clinical exam findings

EOE – no significant findings

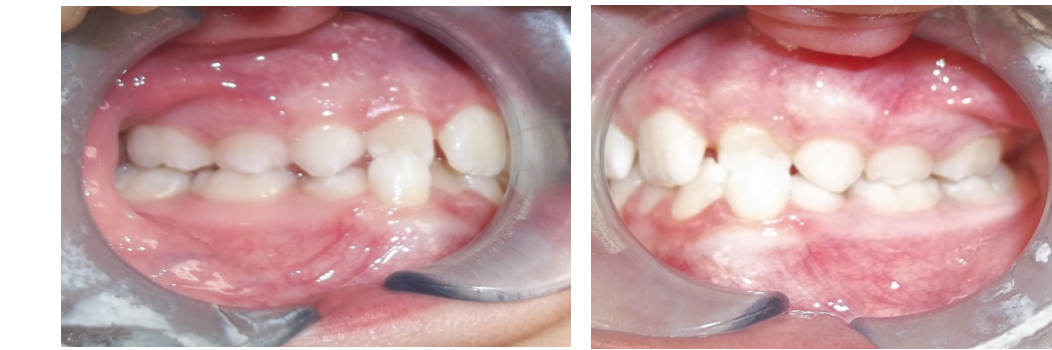
IOE – Lower first permanent molars are erupted to occlusion, upper first permanent molars not yet erupted.

Occlusion: Mesial Step (CI III), Crossbite #7/#R and #10/ #M and #23

Moderate crowding

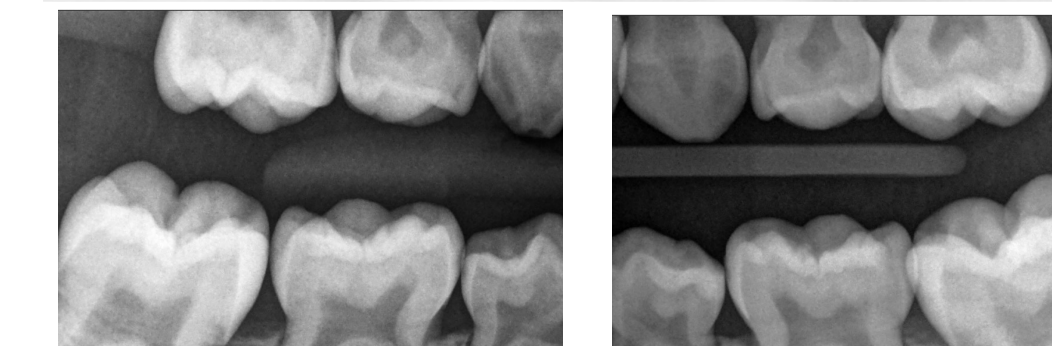
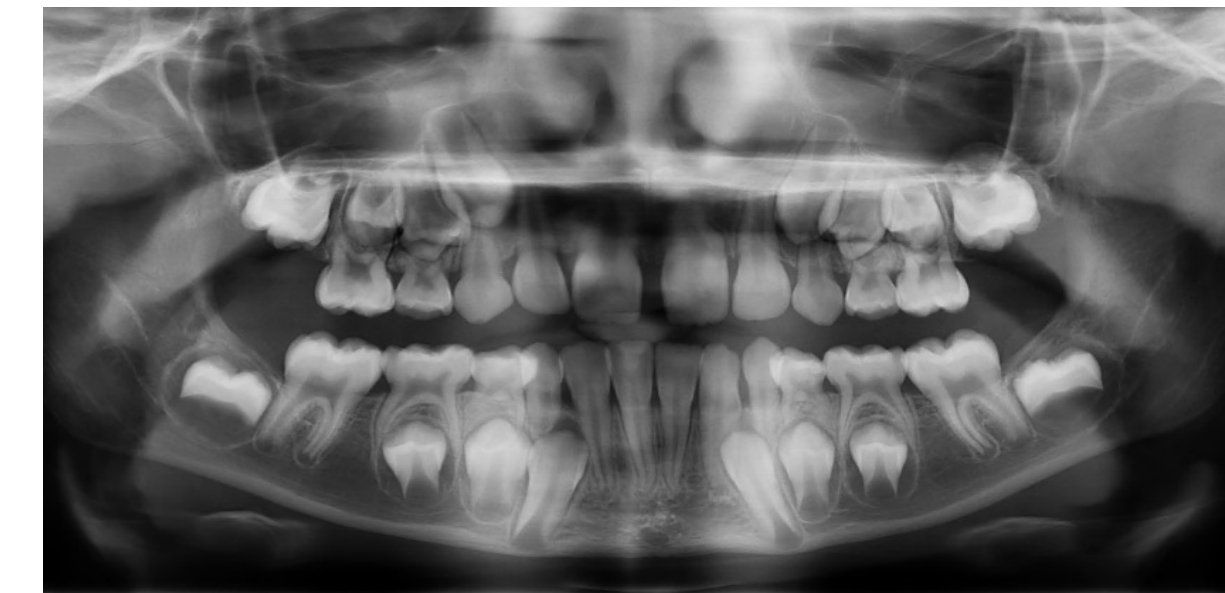
Caries : #I-d, #K-o, #30-ob

Teeth present: #A, #B, #C, #7, #8, #9, #10, #H, #I, #J, #19, #K, #L, #M, #23, #24, #25, #26, #R, #S, #T, #30



Radiographic Findings

#3 and #14 unerupted with incomplete root development
Tooth buds for #2 and #15 absent
#18 and #31 tooth buds present



Differential Diagnosis

Primary failure of eruption of #3 and #14
Agenesis of #3 and #14 and #2 and #15 tooth buds present (unlikely)

Treatment approach

Distinguishing between PFE and MFE as early as possible is critical in the management of patients with failure of eruption of permanent molars as it's key in determining the treatment modalities and the prognosis of the affected teeth. The problem is typically identified/ encountered around 8-9 years of age when lack of eruption progress is noted on affected teeth. The two cases presented here were identified within the same time frame.

We opted for a conservative approach, which is to take a panoramic radiograph and recall the patients in 6 to 12 months to determine the eruption progress. For patient N. M evaluation at recall showed relative submergence of #19. For patient K.H, evaluation at recall showed no change with #3 and #14 showing a lack of eruptive movement.

Patient N.M is early in dental development and the first molar is affected, Our approach is to monitor the eruption of the second molar. If the second molar eruption is unaffected, #19 will be diagnosed with MFE (ankylosis). In consultation with an orthodontist, patient's treatment plan may include no treatment, surgical extraction of the ankylosed tooth followed by alignment of the remaining dentition, luxation of the tooth followed by orthodontic alignment.

Patient K.H is over 10 years of age and given the lack of eruptive progress of her maxillary first permanent molars (#3 & #14) and absent follicles for second permanent molars (#2 and #15), a diagnosis of PFE can be made for #3 and #14. An interdisciplinary approach is needed for K.H's management and will include referral to the orthodontist, oral surgeon, and prosthodontist in the future. In the absence of root formation of #3 and #14 and agenesis of #1, 2, 15 and 16, suggested treatment may include extractions of #3 and #14, orthodontic alignment of remaining dentition followed by prosthetic rehabilitation once growth has ceased.

These cases illustrate the presentation and complexity of management of teeth affected by MFE and PFE. Inaccurate diagnosis or management can lead to inappropriate and extended treatment times, significant financial burden and reduced satisfaction and quality of life for these patients.

CONCLUSIONS

PFE is a rare condition that is difficult to diagnose at a young age and the treatment is difficult due to a lack of response to orthodontic forces. The distinction between PFE and MFE is clinically important because it determines whether all posterior teeth, or only individual affected teeth, will not respond to orthodontic force. Accurate and timely diagnosis, radiographic monitoring, and subsequent management can improve patient outcomes and avoid prolonged frustration. Certain diagnoses require progress radiographs so that the pattern of eruption of teeth distal to the most mesial affected tooth can be observed.

REFERENCES

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