

Early Treatment of Failure of Eruption of a Permanent Molar

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ABSTRACT

Failure of eruption of a permanent first molar is a relatively infrequent clinical condition that affects the normal development of dentition and may cause malocclusion. There are two conditions that might result in failure of eruption: (1) mechanical failure (ankylosis) and (2) primary failure of eruption, with different clinical features and therapeutic approaches for each. It is often challenging for orthodontists and pediatric dentists to establish differential diagnoses of these conditions to ensure a successful treatment outcome. The purpose of this case report is to discuss the diagnosis and treatment of a failure of eruption of a permanent first molar.

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Delayed tooth eruption is the most frequent eruption disturbance and is defined as the eruption of a tooth into the oral cavity after the expected age, at a moment that deviates significantly from the norms established for a particular race, ethnicity, and sex.¹ Delayed eruption of specific teeth (either with normal or delayed root formation), without the presence of

physical barriers obstructing the eruptive pathway, is infrequent and defined as failure of eruption. Failure of eruption has an estimated prevalence of 0.01 percent and 0.06 percent for the first and second permanent molars, respectively.^{2,3}

There are two well-defined but often misdiagnosed conditions that might result in failure of eruption: (1) mechanical failure of eruption (MFE) and (2) primary failure of eruption (PFE). MFE (ankylosis) occurs when there is absence of periodontal ligament connecting cementum to alveolar bone.⁴ It generally affects one tooth, and those distally positioned to it are usually unaffected.⁵ On the other hand, PFE refers to non-ankylosed teeth that present total or partial failure of eruption in the absence of mechanical barriers.⁶ The main feature is that they may respond partially, if at all, to orthodontic loading, which sometimes results in

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ankylosis in a previously unaffected tooth.^{6,7} It is now recognized that FPE could be inherited by autosomal dominant transmission.⁷

Differential diagnosis for both conditions is often complex, depending on the availability of tests and examinations (i.e., genetic tests or tomographic evaluations). The percentage of misdiagnosed cases may be relatively high,⁵ which often makes it difficult to adequately respond to the established therapy.

The purpose of this case report is to discuss the diagnosis and treatment of a failure of eruption of a permanent first molar.

CASE DESCRIPTION

A nine-year, five-month-old healthy female patient was referred by a general dentist for orthodontic evaluation at the clinic of Orthodontics of the School of Dentistry of Ribeirão Preto, University of São Paulo, due to eruption failure of the maxillary right permanent first molar (Figure 1). All other permanent teeth presented normal development, with the exception of agenesis of the mandibular left second premolar. The maxillary right permanent first molar had complete formation (closed root apex) with apparently intact periodontal space. There were no mechanical barriers affecting the normal eruptive pathway of this tooth (Figure 2), with the exception of the presence of a thin gingival tissue partially covering the occlusal surface of the affected tooth (Figure 1). A

definitive diagnosis was not possible at this point. Initial treatment planning was based on diagnostic presumption of failure of eruption without apparent ankylosis.

Treatment planning included fabrication of a modified Nance palatal arch (with a distal extension) and bonding of an orthodontic button on the maxillary right permanent first molar for traction with elastomeric chains. Before that, the gingival tissue covering the occlusal surface of the tooth was surgically removed (Figure 3). The tooth, however, did not respond to the orthodontic loading. A follow-up periapical radiograph, taken after six months, showed small areas of absence of periodontal space on the mesial and distal root surfaces (Figure 4). The patient was referred to the oral surgery clinic at the School of Dentistry of Ribeirão Preto, University of São Paulo, Ribeirão Preto, São Paulo, Brazil, with the presumptive diagnosis of ankylosis. A surgical subluxation was performed, which was followed by immediate orthodontic loading (150 gF) for traction. Although initially the tooth began to move, a continuous orthodontic movement was not observed and a new surgical subluxation was performed five months later. After that, the tooth responded favorably. The orthodontic button bonded on the occlusal surface of the tooth was distally repositioned to obtain a more extrusive loading vector (Figure 5).



Figure 1. Delayed eruption of the maxillary right permanent first molar.



Figure 2. Initial panoramic radiograph.



Figure 3. Modified Nance palatal arch (with distal extension) for orthodontic traction.



Figure 4. Periapical radiography evidencing apparent absence of periodontal space on the mesial and distal root surfaces.

The first molar reached its proper position after six months, and the orthodontic appliances were removed (Figure 6).



Figure 5. Favorable response to orthodontic movement after the second subluxation.



Figure 6. Tooth positioning after appliance removal.

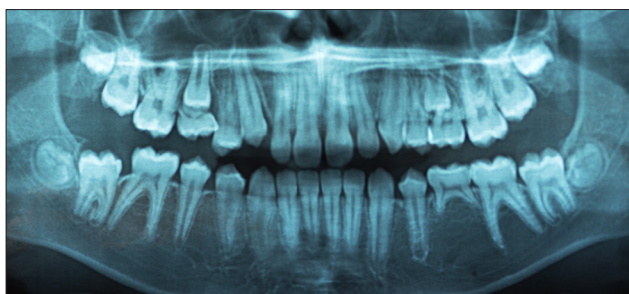


Figure 7. Final panoramic radiograph.



Figure 8. Intraoral photography after four years of follow-up.

In the 12-month follow-up radiograph, the tooth was on the same occlusal plane of the adjacent teeth, apparently maintaining the integrity of the dental and periodontal structures (Figure 7). At the four-year follow-up, the tooth maintained a desired position, occluding with its antagonist (Figure 8).

DISCUSSION

This case presented some difficulties during treatment due to the impossibility of establishing a definitive diagnosis at the first examination, the urgency of intercepting a posterior problem in occlusion and the initial attempt to perform the most conservative treatment possible. After the initial evaluation, it was determined that the patient had delayed eruption of the maxillary right permanent first molar. She was in mixed dentition and had all permanent incisors and first molars, except for tooth in question. Although it was partially erupted, the tooth clearly presented a delayed eruptive trajectory, considering the patient's age and complete eruption of the contralateral tooth. The diagnostic algorithm proposed by Suri et al.¹ suggests that, once a delay in the chronology of eruption is determined, the degree of dental development or root formation should be evaluated. For the eruptive stage of the maxillary right permanent first molar, it should be up to three quarters of the total length of the root; however, the tooth was fully formed and the root apex had already closed.

Issue such as preterm birth, low birth weight, hypopituitarism, systemic problems and syndromes were not reported by the patient's parents and were discarded as the cause of the problem. Obstructive barriers in the eruptive path, such as supernumerary teeth, cysts, tumors, trauma history, or lack of space in the maxillary arch were not present. A diagnosis of fibrous dysplasia was also discarded due to the absence of pathognomonic radiological characteristics or clinical deformation/asymmetry of the maxilla. Thus, we determined there was a failure of eruption with no apparent local (physical barrier) or systemic factors involved. Potential causes for the delayed eruption of the tooth were ankylosis (MFE) or PFE.

In the case of ankylosis (MFE), even if radiographic evaluation does not reveal any obliteration of the periodontal space, it is known that the defect often occurs on the buccal or lingual surfaces that are not detectable by conventional radiography.⁸ In fact, computed tomography is indicated to define the diagnosis but such imaging is generally not requested for the evaluation of this condition. Percussion test was negative for the characteristic metallic sound of an ankylosed tooth. Even though radiographic and clinical evaluations were negative, they were also insufficient to rule out ankylosis.

Due to the patient's early age at the first evaluation, it was not possible to determine if the teeth distally positioned to the involved tooth were affected, since

they would only erupt later. Because of the high cost, a genetic test was not performed to determine the presence of variants in the *PTH1R* gene, as suggested in the literature.^{7,9,10} On the other hand, although the presence of hypodontia in association with PFE has been reported,¹¹ it may also be associated with MFE.⁵ Therefore, our diagnosis was limited to failure of eruption of the maxillary right permanent first molar.

The initial treatment of choice was based on the failure of the eruptive process, with the presence of gingival tissue partially covering the occlusal surface of the involved tooth, absence of periodontal space obliteration, and the impossibility of confirming the PFE diagnosis. It was then decided to perform an excision of the gingival tissue covering the tooth and begin traction in an attempt to rule out any mechanical etiology (i.e., gingival hyperplasia). Due to the marked delayed eruption of the tooth, it was not possible to wait for its spontaneous eruption after the gingival excision. We could not rule out that gingival hyperplasia may have contributed to the problem.

We chose to do orthodontic traction of the tooth. After six months of no movement, new radiographic and clinical evaluation indicated probable ankylosis, since the tooth had no mobility and had focal regions indicating absence of periodontal space. Although dental ankylosis was eventually confirmed, we could not agree on it initially, since MFE could have been present from the beginning or could have developed after the initial orthodontic loading. The least invasive treatment option was an appropriate choice due to the absence of a definitive diagnosis at the time. While MFE might often be corrected with exodontia and subsequent rehabilitation, or subluxation with or without orthodontic traction,^{12,13} these alternatives could be useless for PFE. After two subluxation procedures, the tooth finally responded to orthodontic traction and reached its proper position in the dental arch. This procedure was previously reported to have considerable clinical success.^{14,15} Although the biological response may not always be favorable, it has been established that, if tooth extrusion is enough to disrupt the area of ankylosis maintaining the apical blood supply, the subsequent biological reaction could favor the formation of a new periodontal ligament in the affected area.¹⁵

The successful response to the established treatment confirmed the diagnosis of MFE once the problem was resolved. The patient's follow-up confirmed this, since the teeth distally positioned to the involved tooth presented normal development in their eruptive pathways.

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