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Case Report

Idiopathic External Cervical Resorption of the Impacted Second Premolar: A Case Report

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Abstract: The tooth impaction of the lower second premolars is an occasional condition but is still seen in clinical practice with a prevalence of 0.6–2.6%. The present case report describes a rare condition of the lower second premolar impaction. An 11-year-old female patient presented with the anteroposterior dental discrepancy, midline shift, and occlusal cant. Intraoral examination revealed the absence of the lower right second premolar with no space available for the eruption. X-ray examination revealed the impaction of tooth #45 in a vertical position, tilting of the adjacent teeth, and two-thirds root length development. The orthodontic treatment plan included space opening using a fixed appliance with a coil spring. The natural eruption of the tooth was expected according to dental age and root development. When the space was opened, no change in the position of tooth #45 was observed. Surgical exposure and active traction were performed. However, the intrusion and tilting of adjacent teeth were observed during the next appointments with no vertical change of tooth #45. Ankylosis was suspected as no tooth movement was recorded. The surgical luxation and osteotomy of the coronal alveolar bone of the impacted tooth were planned for the imminent forced eruption, which was expected due to the young age of the patient. Consequently, the crown of tooth #45 emerged and the bracket was placed. Further traction was planned to use a micro-screw. Following the traction, no vertical displacement of the tooth was observed in the subsequent appointments. Radiographic examination revealed radiolucency in the coronal third of the root. The patient was referred to the endodontist, and CBCT revealed external cervical root resorption in the late reparative stage. ECR in an impacted tooth, mimicking the manifestation of tooth ankylosis, can cause orthodontic treatment failure.

Keywords: external resorption; ankylosis; impacted tooth

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1. Introduction

The tooth impaction is diagnosed when two-thirds of the root's length is developed, and the eruption time has passed [1]. The second mandibular premolars are one of the most frequently affected teeth after mandibular third molars, maxillary canines, with a prevalence of 0.6–2.6% [2,3]. The etiology of this phenomenon is multifactorial [4]. A dental arch shortage due to early loss of the deciduous second molar is a common underlying cause of second premolar impaction in permanent dentition [5,6]. Furthermore, the ankylosis of primary teeth, the ectopic position of the tooth buds, supernumerary teeth, cysts, trauma, and sometimes, the ankylosis of the impacted tooth might be determining factors in the etiology of this anomaly [4,5].

The ankylosis of the impacted tooth has been described only in 0.79% of all impaction cases and is rarely detected in young subjects prior to orthodontic treatment [4,7]. The etiology of a priori ankylosis needs further investigation and might be associated with

dental follicle stem cells, which are able to differentiate into cell types that create ankylosed lacunas in the impacted teeth [7].

The consequences of impacted teeth are malocclusion, poor smile aesthetics, and rarely severe complications such as root resorption of the adjacent teeth or cyst formation [8,9]. The treatment of an impacted tooth is complex, requiring an interdisciplinary team [10]. The treatment method depends on the patient's age, tooth's position, and other individual characteristics [11]. Interceptive treatment, including primary tooth extraction, has been discussed in several studies [12–14]. However, in 42% of such cases, the tooth does not always erupt spontaneously after removing the obstruction [15]. Therefore, surgical exposure and orthodontic traction are often indicated to facilitate the eruption [11]. Outcomes are not always predictable and successful, and sometimes impacted teeth may need to be extracted to avoid complications [11]. The ankylosis of impacted permanent teeth and its significance for the orthodontic treatment outcome is scarcely described in the literature.

The present case report aimed to describe an unusual external cervical resorption (ECR) of an impacted second premolar associated with the ankylosis.

2. Case Presentation

The present case report followed the guidelines of Preferred Reporting Items for Case reports in Endodontics 2020 (PRICE) [16]. Written informed consent was obtained from the patient's parents for reporting the case.

An 11-year-old female presented to the private dental clinic with a chief complaint of an unerupted tooth. The patient had no relevant dental, medical, or family history. Orthodontic examination revealed the absence of the right mandibular second premolar and other occlusal discrepancies, mostly related to the unerupted tooth: mandibular midline shift (2 mm to the right), the cant of occlusal plane, Class I dental relationship on the left side, but Class II canine and Class III molar relationship on the right side and mild crowding of maxillary anterior teeth (Figure 1B–D). An impacted tooth #45 in a vertical position was observed on the panoramic radiograph (Figure 1A). Adjacent teeth were tilted, leaving no space for the impacted premolar to erupt. Two orthodontic treatment alternatives were suggested: (1) space opening for the impacted tooth to erupt spontaneously or surgical exposure and forced eruption; (2) the extraction of all second premolars, including the impacted one, and closing residual spaces using fixed orthodontic appliance [17]. After considering all benefits and risks, the patient's mother chose and agreed to the first treatment option.

Bracket bonding was started in the mandibular dental arch, and an open coil spring was activated between teeth #46 and #44 to open the space for the impacted second premolar (Figure 2A). Subsequently, a bracket system was also bonded in the maxillary dental arch. Although sufficient space was created, the tooth did not erupt spontaneously. The unchanged position of an impacted tooth can be seen in the radiograph (Figure 2B). A decision was made to expose the tooth surgically and start a forced eruption [1]. Tooth #45 was exposed under local anesthesia using a closed surgical technique, and a button with a chain was bonded (Figure 2C). The traction was activated immediately, and during the following appointments, only mild vertical movement was observed in the panoramic radiograph (Figure 2D). The ankylosis of tooth #45 was suspected [18]. For the second time, surgical exposure and luxation were performed to facilitate eruption, as recommended in the literature [19,20]. Immediate vertical traction was activated using the micro-implant, inserted between the roots of #14 and #15. The tooth moved up immediately and emerged through the gingiva. During the next appointment, a bracket was bonded to the impacted tooth, and continued traction using elastics (170 g) was initiated (Figure 2E). Due to the COVID-19 pandemic, online check-ups were performed every 4–6 weeks, and the patient continued the forced traction of tooth #45 towards the micro-implant. The next clinical examination (3 months later) revealed no further vertical movement. Interestingly, no physiological tooth mobility could be observed. Repeated ankylosis was suspected, therefore, the patient and her parents were asked whether they would agree to the additional luxation

of the tooth. After parental consent, the luxation with fibertomy was performed, and elastic traction was continued [19,20]. However, no vertical movement could be observed in the following appointment (Figure 2G,H).

The patient was referred to the endodontist to assess the impacted tooth. The endodontic assessment revealed infraocclusion of tooth #45 and the gingival margin in a lower position than adjacent teeth. The tooth was free of caries. Compared to the other teeth, the observed tooth had neither response to the cold test (Pulp spray, Cerkamed, Stalowa Wola, Poland) nor sensitivity to the percussion or palpation. The periapical x-ray revealed intact *lamina dura,* normal periodontal ligament space, radiolucency in the cervical area and pulp space obliteration (Figure 2K). To confirm the diagnosis, CBCT was performed (Figure 3A–C).

The diagnosis of external cervical resorption was determined according to Patel (2018). The resorption defect showed an extent into the mid-third of the root with the circumferential spread between 90 and 180 degrees and the lesion was confined to dentine (3BD) [21]. As the tooth was asymptomatic, a decision to monitor the tooth annually was made following the recommendations [22].

The patient was tired of the orthodontic treatment; however, satisfied with the treatment outcome and, therefore, it was decided to leave the tooth in infraocclusion and slight lingual position (Figure 2L). The bracket system was debonded, the fixed retainer was bonded canine to canine, and a removable retainer (vacuum formed) was fabricated for the nighttime.

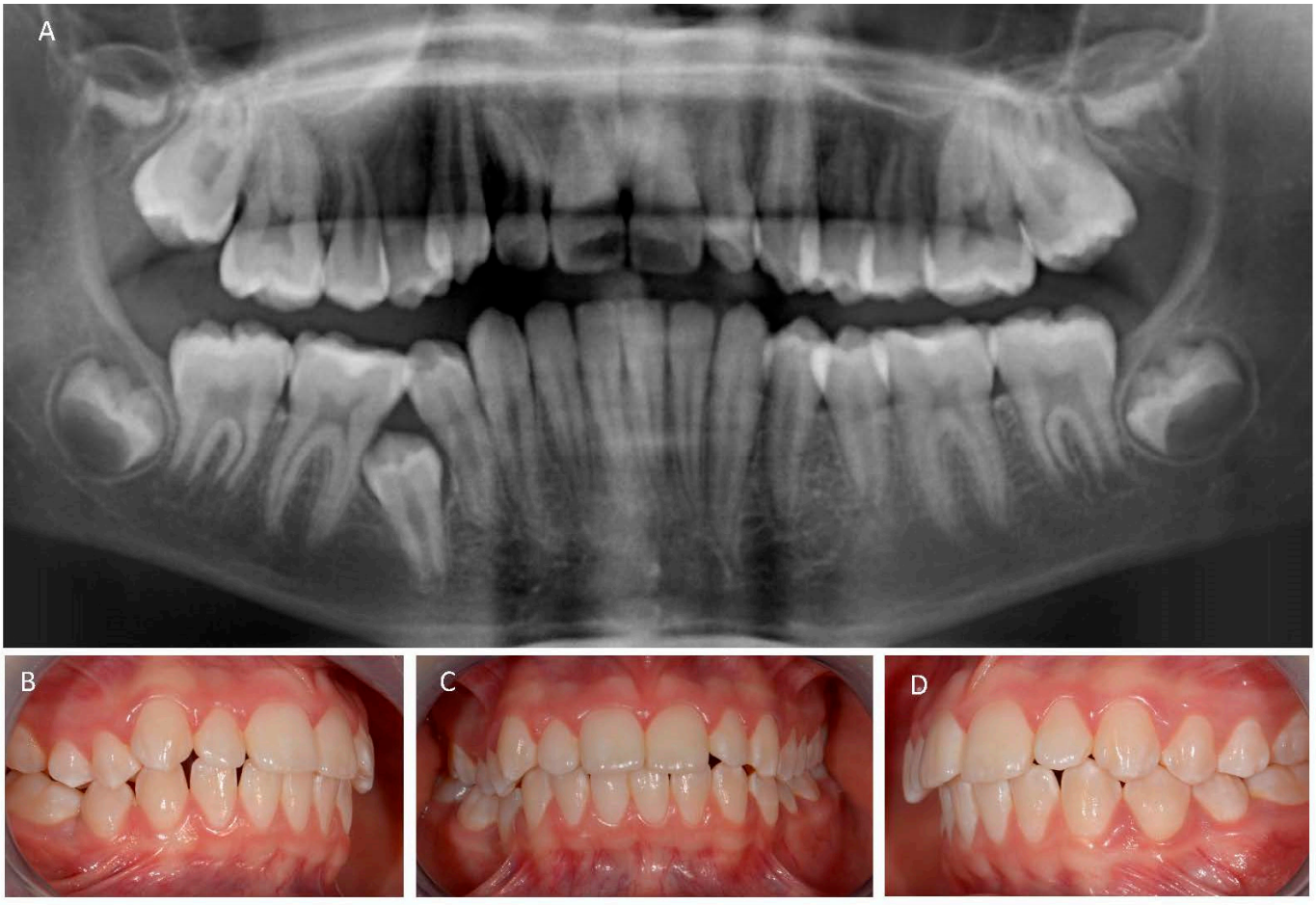

Figure 1. (**A**) Initial panoramic radiograph. (**B**–**D**) Pre-treatment intraoral photographs.

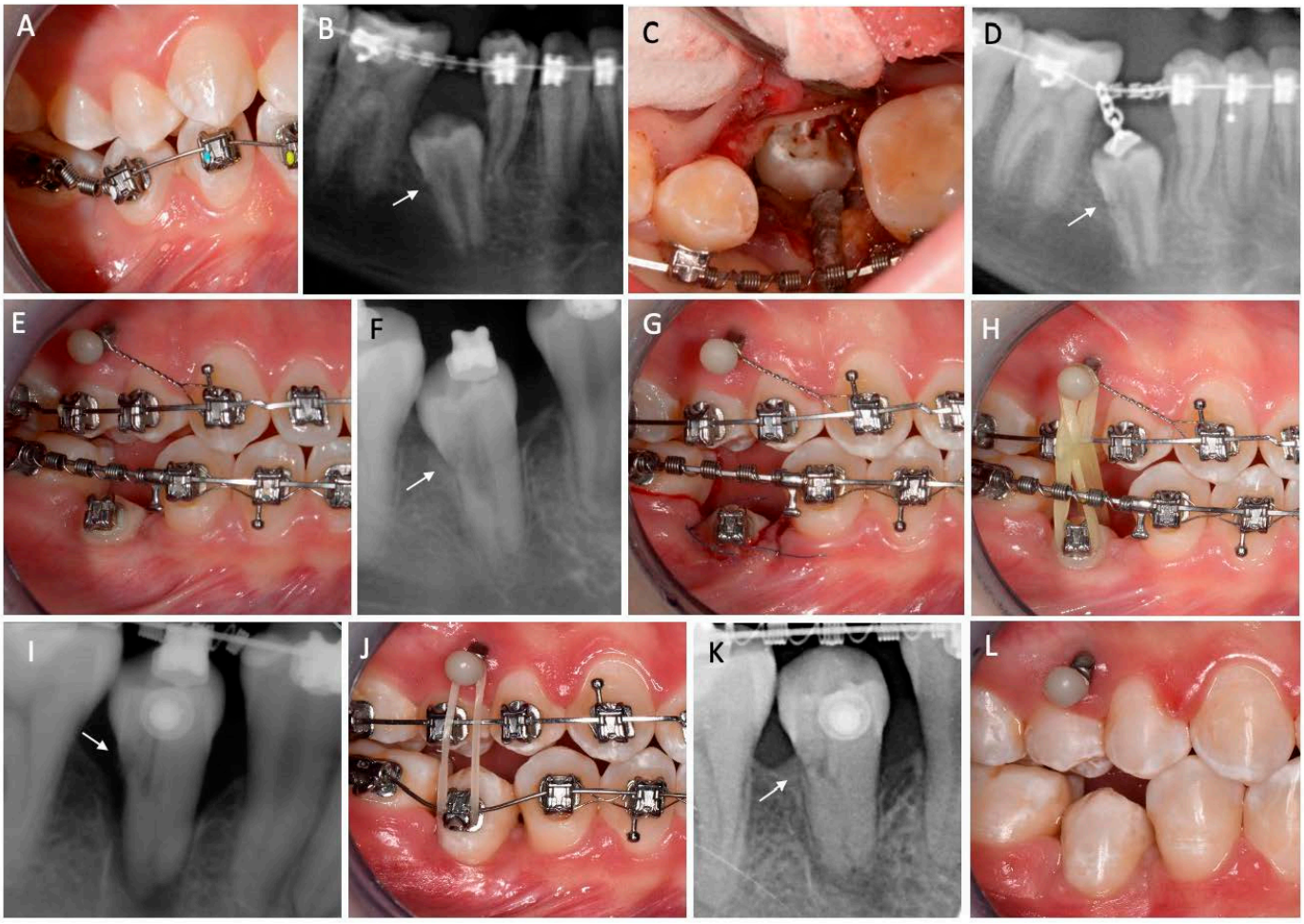

Figure 2. Orthodontic treatment progress of the impacted mandibular second premolar. (**A**) Open coil spring activation. (**B**) Radiograph showing no changes in impacted tooth position after space opening. (**C**) Surgical exposure of the impacted tooth. (**D**) Radiograph after surgical exposure and activation of traction shows no changes in impacted tooth position. (**E**) Next appointment after surgical luxation, bracket was bonded to the impacted tooth and micro-screw was inserted in the maxilla to pull the tooth towards the occlusal plane (**F**) Radiograph after surgical luxation of the impacted tooth, showing eruption. (**G**) The impacted tooth after repeated surgical luxation. (**H**) No visible response to orthodontic traction. (**I**) Radiograph showing the impacted tooth immediately after reimplantation. (**J**) Mandibular second premolar attached to the archwire and traction activated using mini-screw. (**K**) Radiograph taken six months after reimplantation. (**L**) Photo showing the final position of the tooth. (**B**,**D**,**E**,**I**,**K**) White arrows show the site of external cervical resorption (ECR). As the patient expressed her wish to cease the treatment as soon as possible, the tooth was luxated and positioned 6 mm coronally and passively fixed to the archwire (**I**,**J**). During the following two monthly appointments, no vertical movement of the tooth was observed.

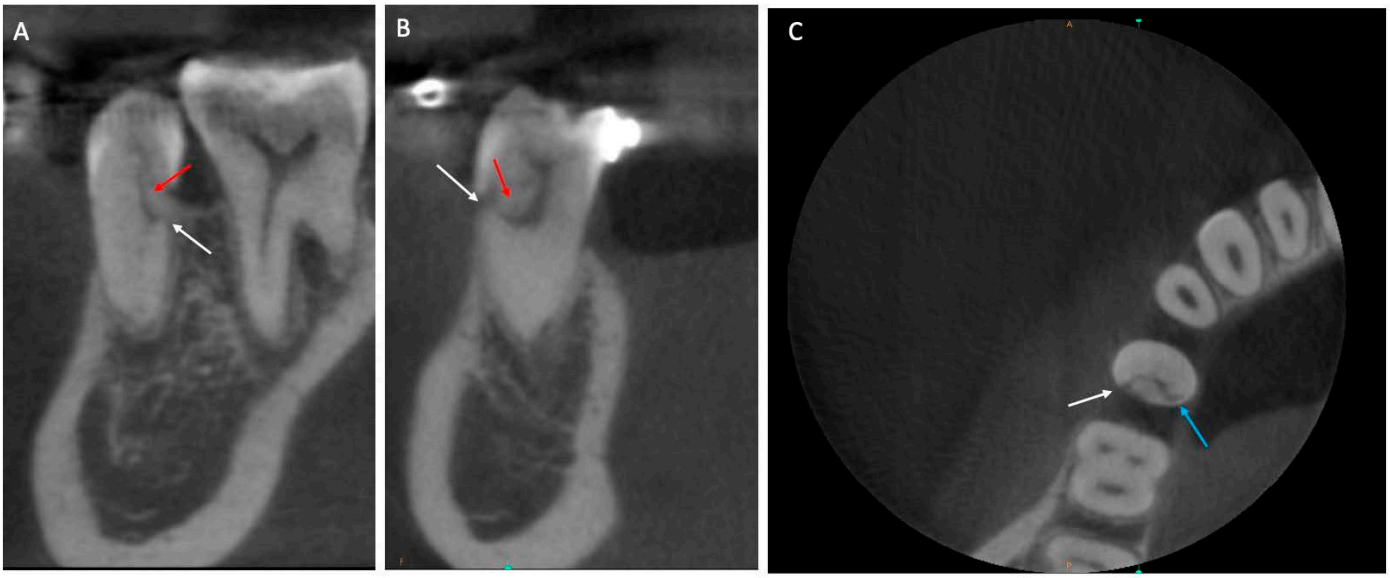

Figure 3. Reconstructed CBCT images of the #45 tooth, showing signs of the external cervical resorption (ECR): portal of entry (white arrows), bone-like tissue apposition (red arrows), the extent of the resorption (blue arrow). (**A**)—coronal; (**B**)—sagittal; (**C**)—axial slices.

3. Discussion

This case report describes the unusual occurrence of ECR of an impacted tooth, mimicking the symptoms of tooth ankylosis. Due to the scarcity of literature, the etiology of this rare phenomenon remains questionable. Root resorption might be classified according to the location of the root surface (internal/external). Further, external root resorption can be subclassified into surface, inflammatory, replacement, cervical, and transient apical breakdown [23]. External cervical root resorption usually manifests in the cervical area of teeth and appears in most cases due to the periodontal ligament and subepithelial cementum damage [24].

The early diagnosis of ECR improves tooth prognosis. However, no specific symptoms or radiographic features can usually be observed in the initial stages [25]. Therefore, CBCT is a *gold standard* in the diagnostics and treatment planning of ECR lesions [21].

The present case confirms the diagnosis of ECR during orthodontic treatment, which was determined through CBCT. While a minor radiolucent shadow was retrospectively observed distally to the impacted second premolar in the pre-treatment panoramic radiograph (Figure 1A), this finding raises doubts about the etiology of ECR, as the initial lesion may have already been present before the orthodontic treatment. Despite surgical exposure, the tooth did not erupt spontaneously, and a subsequent X-ray taken after activation of the traction revealed a radiolucent shadow in the distal cervical area (Figure 2D).

Brezniak and Wasserstein emphasized the importance of orthodontically induced inflammatory root resorptions (OIIRR) in 2002 [26]. Although commonly associated with apical resorption, cervical resorption is also a consequence, and patients who received earlier orthodontic treatment are at a higher risk, according to Heithersay's research [27]. The progression of cervical resorption plays a significant role in its development, and it is subject to bacterial infestation through the sulci, which promotes inflammation and subsequent resorption even after the movement forces have been stopped.

In this particular case, the impacted tooth was considered ankylosed empirically when no tooth mobility was observed, and the adjacent teeth had been intruded during the orthodontic traction instead of extrusion of the affected tooth [28]. As mentioned above, in advanced stages of ECR, bone-like resorptive tissue may be observed at the defect site [29]. This might have resulted in the absence of physiological mobility during following appointments after the surgical exposure of the second premolar. Since the tooth

was identified as ankylosed, surgical luxation was performed to facilitate the eruption of the impacted premolar based on the evidence from the literature [20].

Considering the aforementioned relationship between the ECR and the damage of the cervical tooth region, the following aspects could contribute to the damage of cementoenamel junction (CEJ) structures in the present case: (1) chemical trauma (35% phosphoric acid), (2) mechanical trauma (during luxation), and (3) orthodontic movements [7]. A clinical study by Koutzoglou et al. (2013) showed a higher risk for ankylosis for closed surgical procedure performed compared with an open surgical technique [7]. In the present case, a closed surgical technique and forced eruption were performed. Damage to the CEJ area during surgical exposure of an impacted tooth is described as a potential risk factor for ECR. It should be noted that in our case, the periodontist has not reported any trauma or exposure of CEJ during the first surgical intervention. Surgical luxation may have only exacerbated the lesion, as the procedure was performed when the radiographic findings already showed the shadow in the cervical area. However, no alternative treatment method could be suggested.

Mavridou et al. (2016) described the reparative phase of ECR as repair via the ingrowth of reparative bone-like tissue through the portal of entry and the local fusion of adjacent alveolar bone with dentin [30]. In this specific case, we could observe a bone ingrowth from the adjacent marginal bone into the portal of entry [Figure 3]. It could be speculated to be a reason for the restricted physiological movement of the tooth. This could be explained by histology studies where osteoblast-like cells that secrete osteoid have been observed. Histological analysis showed that these osteoblast-like cells originating from adjacent marginal bone and have been responsible for the formation of bone-like tissue [30]. Later studies have mentioned the observation of localized fusion between the substitution tissue with adjacent bone. It could be argued that the reason might be the absence of periodontal ligament (PDL). In this particular case, the PDL was absent in the cervical area [Figure 3a] [30].

To diagnose tooth impaction, clinical examination is essential. It should be suspected when a permanent tooth's normal time of eruption is exceeded, there is insufficient space for the tooth eruption, malposition, or malformation of the adjacent teeth such as rotations or the over-retention of deciduous teeth [12]. Impacted teeth can sometimes cause harm and complications. If left untreated, impacted teeth can result in several complications, such as the morbidity of the deciduous predecessor and the migration of the adjacent teeth, the development of a dental cyst, the resorption of the crown of an impacted tooth, the resorption of the roots of adjacent teeth, and ankylosis, infraocclusion, and pain/discharge related to infected cysts or tumors [28].

Both replacement and external root resorptions may cause the loss of tooth structure and lead to the orthodontic treatment failure of the impacted tooth [28,31]. However, this problem has not been widely described, and diagnosis is often misleading. Becker and co-authors (2010) analyzed the reasons for failure in the treatment of impacted maxillary canines [31]. Ankylosis was a contributing factor to orthodontic treatment failure in 32.4% of cases [31], but diagnosis was always performed after complete eruption failure. This issue has been addressed in a subsequent article by the same author [28]. Reportedly, ECR lesions were observed in a number of the teeth that were consequently extracted due to unsuccessful orthodontic treatment [28]. Similarly, in the present case, the diagnosis of ankylosis was suspected during orthodontic treatment but was ruled out as the intact lamina dura was observed. CBCT was performed to confirm the diagnosis of ECR.

4. Conclusions

The treatment of an impacted tooth is comprehensive and requires a multidisciplinary approach. Rare invasive external cervical resorption might lead to the orthodontic treatment failure of impacted lower premolars. Clinicians should be aware of the possibility of ECR in the impacted teeth, even at a young age.

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