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Treatment of dens invaginatus: 4-year follow-up

Agnieszka Chamarczuk[1, A], Ariel Chamarczuk[2, B], Damian Lichota[3, C], Mariusz Lipski[1, D] ✉

[1] Pomeranian Medical University in Szczecin, Department of Preclinical Conservative Dentistry and Preclinical Endodontics, Powstańców Wlkp. 72, 70-111 Szczecin, Poland
[2] Private Dental Practice, Ariel Chamarczuk, Kazimierska 3f/22, 71-043 Szczecin, Poland
[3] Pomeranian Medical University in Szczecin, Department of Conservative Dentistry and Endodontics, Powstańców Wlkp. 72, 70-111 Szczecin, Poland

[A] ORCID: 0000-0002-6266-9792; [B] ORCID: 0000-0002-6343-1890; [C] ORCID: 0000-0001-9258-6851; [D] ORCID: 0000-0002-2567-3362

✉ mariusz.lipski@pum.edu.pl

ABSTRACT

Dens invaginatus is a rare developmental defect that can complicate the proper diagnosis and treatment of teeth. The most common location of an invaginated tooth is the second lateral maxillary incisor, while the least common locations are the mandibular incisors and canines. Due to the complicated anatomy of invaginated teeth, the endodontic treatment of these teeth can present many difficulties. The present case report describes the endodontic treatment of the dens invaginatus – permanent second maxillary lateral incisor with a 4-year clinical and radiologic follow-up.

Keywords: dens in dente; invagination; endodontic treatment; cone-beam computed tomography.

INTRODUCTION

Dens invaginatus (*dens in dente*) is a dental developmental defect that occurs as a result of invagination of the enamel-forming organ into the dental papilla prior to mineralization of the tooth tissue [1]. The etiological factors that can influence the formation of an invaginated tooth include external factors that act on the tooth bud during its development, such as injuries, adjacent tooth buds, genetic conditions, infections, and focal acceleration or deceleration of the growth of the tooth bud [2, 3]. Dens invaginatus can occur in any tooth, including permanent teeth, primary teeth, and supernumerary teeth [2]. The prevalence of dens invaginatus in permanent teeth ranges 0.39–13.5%, with the most common location being the upper lateral incisors, followed by the upper central incisors, canines, and upper premolars [4]. Clinically, the teeth may have a normally developed crown, but in most cases, when the invagination is extensive, the crown may be atypical with a conical-barrel morphology or with a blind hole on the palatal surface [5]. In addition, the degree of anatomical complexity, including root canal anomalies, proximity to the pulp chamber, and incomplete rhizogenesis, make affected teeth more susceptible to the development of carious lesions, pulp pathology, and apical periodontitis [6]. The most commonly used classification of dens invaginatus was described by Oehlers in 1957. He divided the dens invaginatus into 3 types according to the depth of penetration and communication with the periapical tissue or periodontal ligament (Fig. 1). The classification is based on 2-dimensional radiographs: type I – invagination is limited to the enamel of the coronal part of the crown, not exceeding the enamel-cementum junction; type II – invagination extends beyond the enamel-cementum junction towards the root apex and ends as a "blind bag"; type III A – invagination extends beyond the enamel-cementum junction and ends laterally, opening into the periodontium as a pseudoforamen; type III B – invagination extends beyond the enamel-cementum junction and has its opening near the apical foramen [2, 4].

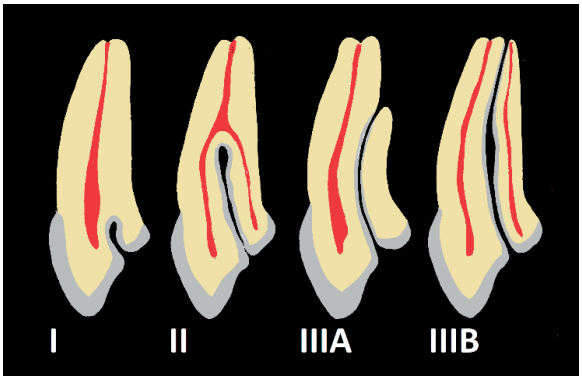

FIGURE 1. Oehlers classification of dens invaginatus

The presented case report describes the treatment of a dens invaginatus in a permanent tooth, by performing endodontic treatment only in the invagination part.

CASE PRESENTATION

An 11-year-old girl accompanied by her parents came to the Conservative Dentistry and Endodontics Clinic of the University Clinic of Dentistry of the Pomeranian Medical University in Szczecin. The patient was referred from another dental clinic for consultation and endodontic treatment of tooth 22. On intraoral examination, tooth 22 had a conical crown structure with

a visible glass ionomer cement filling on the palatal surface. The remaining teeth showed normal anatomic structure, but the panoramic radiograph provided by the patient showed the absence of tooth 12 (Fig. 2).

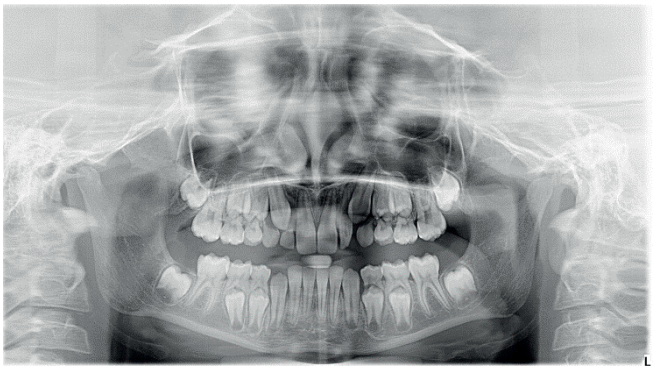

FIGURE 2. Panoramic radiograph provided by the patient's parents. The patient is 8-years-old

The patient also had a recent periapical radiograph and a cone beam computed tomography (CBCT) scan of tooth 22 (Fig. 3, 4 A). Based on the radiographic documentation, the presence of dens invaginatus was diagnosed in the maxillary permanent lateral incisor. The invagination was located centrally in the crown and the coronal ⅓ of the root of tooth 22 without any connection to the periodontium. Radiographic examination showed no connection between the invagination and the root canal (Fig. 4 A, 4 B), and CBCT showed no periapical lesion in tooth 22 (Fig. 4 C).

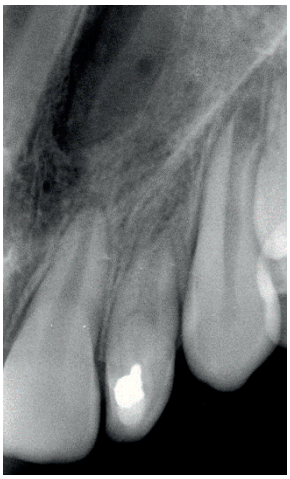

FIGURE 3. Periapical radiograph taken before treatment. Visible filling with strong radiographic contrast

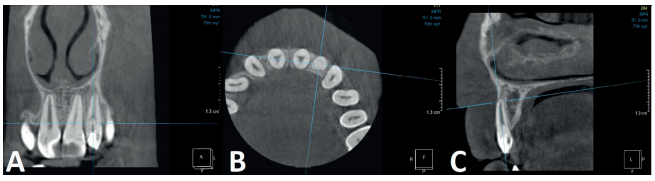

FIGURE 4. Cone beam computed tomography: A. sagittal section view; B. axial view; C. cross-sectional view

In the pulp sensitivity test using an electrical test, the pulp of tooth 22 responded correctly. In the thermal test with the cold stimuli, the tooth responded less than the neighboring teeth, which may have been caused by the significant pulp recession. Under the protection of a rubber dam and using a microscope, the treatment began with the removal of the glass ionomer cement and the filling material with the appearance of iodoform paste, which was additionally confirmed by the strong contrast of the material on the radiograph (Fig. 3). Clinical examination did not reveal any visible connection of the invagination with the root canal. The invaginated part had the character of hard enamel and its probing didn't cause any pain. Due to the difficult cooperation with the patient (his young age and fear of dental treatment) and the correct response of the pulp in the sensitivity test, it was decided to fill only the invagination without performing conventional endodontic treatment. The patient's parents were informed that conventional endodontic treatment would be required in case of treatment failure – pain indicating an inflammatory process in the pulp of tooth 22 or periapical lesions visible on control radiographs. The patient's parents agreed to the proposed treatment. The invagination was prepared with MTWO NiTi rotary files (VDW GmbH, Germany), size 25/06, to a working length of 9 mm – measured from the incisal edge to the bottom of the invagination. During preparation, 2% NaOCl (Chloran 2%, Chema, Poland) was used as an irrigant. For the final rinse, a sequence of 2% NaOCl (Chloran 2%, Chema, Poland), 15% EDTA (Endosal, Chema, Poland) and distilled water was used. The invagination was then dried with paper points and filled using the single cone method with 6% conical gutta-percha points and AH Plus Sealer (Dentsply Maillefer, USA). The access was temporarily filled with Riva Self Cure glass ionomer cement (SDI, Australia) – Figure 5.

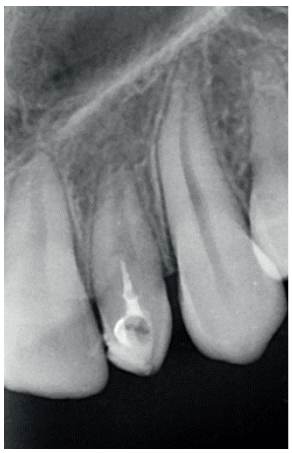

FIGURE 5. Control periapical radiograph after filling the invagination

The patient received a recommendation regarding the need for follow-up visits. The patient and her parents returned for the first follow-up visit after 1 month. The patient reported no pain, and the radiographic examination showed normal periodontal space (Fig. 6). The pulp of tooth 22 responded correctly to an electrical pulp sensitivity test. The patient

and her parents returned for the next follow-up visit 1 year after the completion of the treatment. During this visit, the glass ionomer cement was removed and the cavity was filled with composite material – Estelite Sigma Quick A2 (Tokuyama, Japan), using the bonding agent G-Premio Bond (GC, Japan) – Figure 7.

FIGURE 6. First follow-up visit month after the end of treatment

FIGURE 7. Second follow-up visit. Periapical radiograph before making a new restoration with composite material

The last 2 follow-up visits took place 3 and 4 years after the end of treatment. At these visits, periapical radiographs were taken and pulp vitality was assessed (Fig. 8, 9). There were no significant differences in the results of the electric and cold tests. The clinical and radiographic examination did not reveal any abnormalities in tooth 22. The patient did not report any complaints regarding tooth 22. In addition, the patient and his parents were informed about the possibility of changing the shape of the crown with a composite material and the need for orthodontic consultation. At the last follow-up visit, a panoramic radiograph was also taken for orthodontic indications (Fig. 10).

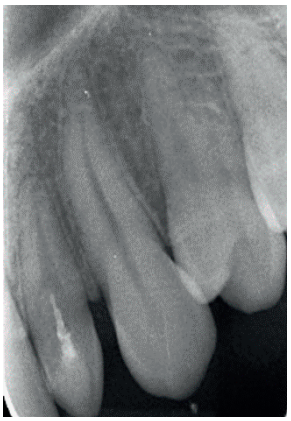

FIGURE 8. Periapical radiograph 3 years after completion of treatment

FIGURE 9. Periapical radiograph 4 years after completion of treatment

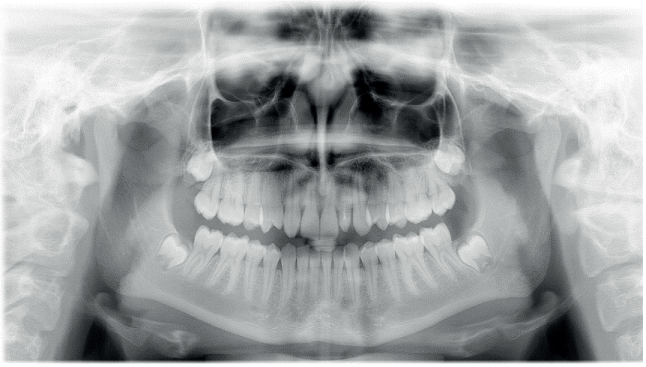

FIGURE 10. Panoramic radiograph made during the last follow-up visit. The patient is 15 years old

DISCUSSION

Treatment of teeth with non-standard anatomy, such as dens invaginatus, is a challenge for the dentist. Hülsmann recommends prophylactic sealing of the blind foramen and deep palatal fissure, but if the entrance to the invagination cannot be detected, periodic clinical and radiologic examination of the dens invaginatus should be performed. The methods of treating a dens invaginatus can be divided according to the extent of carious lesions: conservative treatment, endodontic

treatment, endodontic microsurgical treatment, and extraction of teeth with dens invaginatus. Endodontic treatment can be problematic due to the complicated root canal system. If there is no periapical lesion on the radiograph and there is no connection between the invagination and the root canal of the tooth – root canal treatment of the invaginated part of the tooth is sufficient [7]. The methods of treating a permanent tooth with incomplete root development and inflammation of the periapical tissues include apexification and revascularization [8]. Surgical treatment should be considered in case of failure of endodontic treatment and for teeth that cannot be treated non-surgically due to anatomical problems or lack of access to all parts of the root canal system of the tooth [9]. The development of radiologic tests allows greater diagnostic capabilities and therefore a more reliable and predictable treatment process for teeth with atypical anatomy, such as dens invaginatus [10]. In the described case, a periapical radiograph together with a CBCT examination and a clinical examination made it possible to plan the treatment in the least invasive form for the patient. In this case, it was necessary to shorten the duration of the visit as much as possible because of the difficult cooperation with the patient due to her young age and fear of dental treatment. For this reason, the motorized instruments and single-cone obturation technique were used. Given the current knowledge and availability of bioceramic materials, it would seem more reasonable to use bioceramic sealers such as AH Plus Bioceramic (Dentsply Sirona, USA) or Well-Root ST (Vericom, South Korea) instead of a resin-based sealer. It would also be reasonable and possible to fill the entire invagination or the root part of the invagination with calcium silicate cements, such as MTA or Biodentine (Septodont, France), and then perform a conventional filling in the crown part of the tooth [11]. Undoubtedly, the advantage of using a gutta-percha point as the filling material of the invagination is the easier removal of gutta-percha during retreatment. Possible retreatment would involve reaching the root canal of the tooth and performing conventional endodontic treatment – in the described case, including the root canal visible apically from the invagination.

CONCLUSION

Treatment of dens invaginatus may cause many difficulties, but through the use of CBCT examination, a microscope for endodontic treatment, and appropriate materials for root canal filling, it allows to obtain a good clinical final treatment effect.

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