Case report

Long-term follow-up of endodontic microsurgical combined with orthograde retreatment of Oehler's Type III Dens Invaginatus:a case report

ABSTRACT

Aim:

This report describes the management of an unusual case of dens invaginatus in a 48-year-old female patient.

Case description:

Cone beam computed tomography and initial periapical radiograph showed the presence of type III dens invaginatus with inadequate obturation, poor apical seal,andpresence of periapical lesion related to tooth number #22.The case was managed successfully by a combination of nonsurgical and microsurgical endodontic retreatment. Orthograde endodontic retreatment was performed using rotary files and calcium hydroxide paste as intracanal medication. One week later, root canal was obturated withthermoplasticized guttapercha and adsealsealer. Then, microsurgery was done one week later. After3 years follow up, absence of periapical radiolucency and satisfactory healing was observed.

Conclusion:

Microsurgical retrograde with orthograde retreatment of dens invaginatus should be considered to promote periapical healing with complete reconstitution of bone

and periodontal ligament regeneration without signs of recurrence over a period of 3 years. Additionally, it preserves the entire tooth.

Keywords: Cone beam CT, Dens invaginatus, Microsurgical endodontics, Periapical lesion, Retreatment.

Introduction

Dens invaginatus, is a developmental dental anomaly characterized by the invagination of the dental papilla before the mineralization stage [1], resulting in the formation of a lateral or accessory canal within the tooth. The precise etiology of DI remained unclear but it tends to include genetic with environmental factors. Numerous theories have been suggested, including infection, trauma, changes in tissue pressure, or local discrepancies in cellular hyperplasia [2]. Nevertheless, the exact etiology is still indistinct. Dens invaginatus is considerably common condition, it's incidence between 0.3% and 10% in all teeth [3], with maxillary lateral incisors being the most usually affected, and subsequently by the maxillary central incisors, but it is rarely found in the mandibular incisor [4]. Multipleclassification systems for dens invaginatus have been supposed, including dens in dentes, dentoids in dentes, invaginated odontomes, and dilated composite odontomas [5], but the most widely used and clinically relevant classification system was proposed by Oehlers[6]. This classification system divides invagination into three types, according to the depth of enamel invagination observed radiographically. In type I, there is minimal invagination that is limited to the crown; in type II, the invagination extends beyond the cementoenamel junction (CEJ) in the inform of a blind sac. Type III, the invagination invades throughout the root and laterally extends to the periodontal tissues and penetrates through the root and apically opens in the periapical tissues but does not communicate with the pulp. So that, infection in a type III invagination could result in an inflammatory response within the periodontium and periapical tissues, leading to periapical periodontitis [7, 8]. Endodontic treatment of dens invaginatus can be challenging because of the complex anatomy of the tooth, and treatment failure is common. This case report describes a 48-year-old female patient who had failed endodontic treatmentbefore for Oehler's Type III dens invaginatus.The patient reported a periapical lesion on the maxillary lateral incisor, which had previously undergone endodontic treatment twice, 10 and 5 years ago, respectively. Despite previous treatments, a repeated intraoral fistula appeared buccally with pain on percussion.

Case Description:

A 48-year-old female patient with a medical history free of any significant conditionsreferred to my clinic withchief complaindull pain and discomfort in the maxillary lateral incisor, tooth number #22 (According to the FederationDentairInternationale (FDI) dental numbering system), and repeated fistula on the buccal gingiva opposite to its root apex. The patient claimed that endodontic treatment was done for this tooth twice before, 10 and 5 years ago. Upon clinical examination, a repeated intraoral fistula appeared buccally, pain on percussion with degree-I tooth mobility. Despite previous treatments, the patient continued to experience pain and discomfort in the affected tooth, leading to the current presentation.

Radiographic digital examination (Vatech, Scientific zone, Korea) showed periapical radiolucency as well as an invagination which had a central invaginated canal extending from the pulp chamber throughout the apical foramen in the maxillary lateral incisors with inadequate old root canal filling (Figure 1). This type of anatomy was consistent with a DI Odhlers type III. Cone-beam computed tomography (CBCT) (Vatech, Pax-i3D Smart, Korea) was taken at standardized settings (90 kV, 6 mA, 5 cm × 5 cm, 18 s) as a complementary examination to reach an accurate diagnosis and to assess the information on periapical lesion extent and the proximity to anatomic structures. The preoperative measurements of the lesion extent were viewed in different planes; the sagittal section; coronal section, and axial section (Figure 2). The CBCT images showed an invagination of the lateral incisorextending from the crown throughout to the root canal apex; however, that not communicate with the main root canal. The apical foramen was incomplete and had aperiapical radiolucency of approximately 2.2×3.8 mm in the maxillary lateral incisor#22 (Fig. 2). The failure of treatment was attributed to inadequate obturation and inadequate apical seal, leading to leakage of bacteria and microorganisms, that resulted in failure of the endodontic outcome with the appearance of apical lesion.

Therapeutic interventions:

Orthograde retreatment combined with endodontic microsurgery was planned for treatmentofmaxillary lateral incisor #22. The patient was informed about the risks and benefits of the procedure and a written consent was taken.

Local anesthesia (2% lidocaine with 1: 1,00,000 epinephrine) was applied for the patient comfort. Rubber dam isolation was added. Theaccess cavity was opened

using round carbide bur #008 (LusterDent, France). Old gutta-percha was removed from the coronal area with a gates glidden size #2 (VDW, Munich). The previous canal filling in the middle third was eliminated by moving H files ISO #30 (FKG Dentaire, Switzerland)up and down. The H file was utilized once again for the apical section with gutta-percha solvent (Eucaliptol, Maquira Industry of Dental Products, Brazil). A radiograph was performed to confirm the complete removal of the gutta-percha. The canal was mechanically prepared utilizing rotary instruments (A3 Azure, endostar Ni-Ti rotary files taper 0.04, Poland). The working length (WL) was 20mm, which was validated both by apex locator (Geosoft, Russia) and radiologically, (Figure 3). Apical gauging was performed with a 0.02 manual K-file NiTi ISO 80, yielding a diameter of 0.80 mm for the apical foramen.Between each instrument change, the root canal was irrigated with 5ml of Dual Rinse HEDP solution. According to the manufacturer's instructions, a Dual Rinse HEDP-based solution was made by mixing 10 mL of 3% NaOCl with one capsule of Dual Rinse etidronic acid (HEDP) powder (Medcem, GmbH, Vienna, Austria) using a syringe with a 28gauge side vented needle. The depth of the irrigation needle was always 2 mm from the apex. Moreover, an ultrasonic activation (woodpecker, UDS K (LED), china) was employed to attain a more effective debridement. Paper points were used to dry the invaginated canal, followed by application ofcalcium hydroxide paste, and then temporary filling material (Caviton; GC Co., Tokyo, Japan) was employed to seal the access cavity. During the second appointment after one week, the patient felt well, and the fistula had disappeared. Abundant irrigation using Dual Rinse HEDP solution and ultrasonic activation wereused to remove the intracanal medication of the invagination. After that, paper points were employed to dry the invaginated canal, which was then obturated usingthermoplasticized gutta percha and adseal sealer (Meta Biomed, korea). Finally, the access cavity was sealed using GIC and composite resin (Z350; 3M ESPE, St Paul, MN, USA).

In the third appointment, one week later, the microsurgery was done under dental operating microscope DOM (Zumax, China) with magnification 1.2x. After administration of local anaesthesia using 2% lidocaine with 1: 1,00,000 epinephrine, crevicular and vertical releasing incisions were done then reflection of a full-thickness flap. Diseased granulation tissue surrounding the root apices was thoroughly removed using ultrasonic piezo scalpel (US4, SOGA, Shenzhen Soga technology co., Ltd, China), the following parameters were set: 120 VA, working frequency 30KHZ, with physiological saline for cooling, revealing the extent of

bone loss. Apicoectomy was done by removing 3 mm from the root apex of #22, using piezoelectric device tips XM-NINJA (SOGA, Shenzhen Soga technology co., Ltd, China), then retro-grade cavity preparation was performed using ultrasonic tips (UE2) and retrograde filling was addedusing Mineral Trioxide Aggregate (MTA Angelus® Brazil), Figure (4).Surgical site was irrigated with normal saline 0.9%, flap repositioned, and sutured with 4-0 nylon suture (Ethicon; Johnson & Johnson). Antibiotics and nonsteroidal inflammatory drugs as well as 2% chlorhexidine

mouthwash was prescribed.

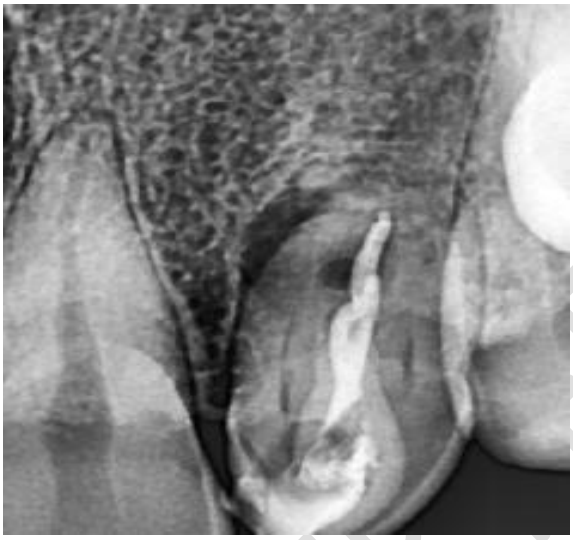


Fig. 1: Initial periapical radiograph showing a poor quality Obturation with periapical radiolucency

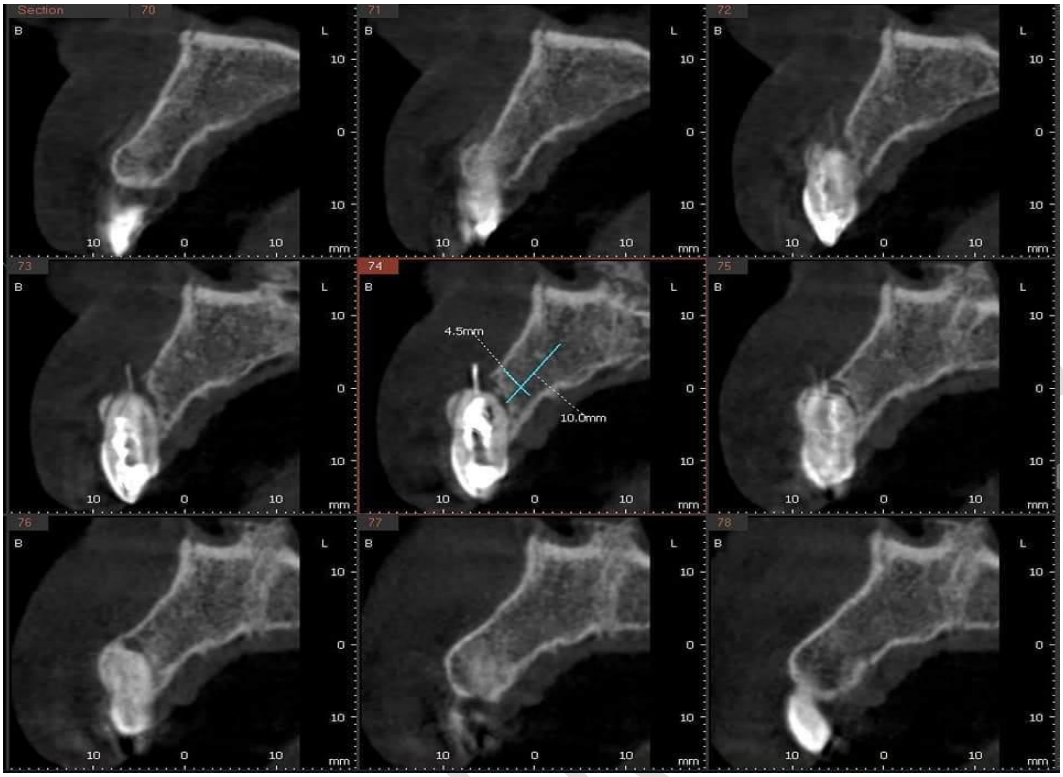


Fig. 2: Cone Beam Computed Tomograpgy: Sagittal view

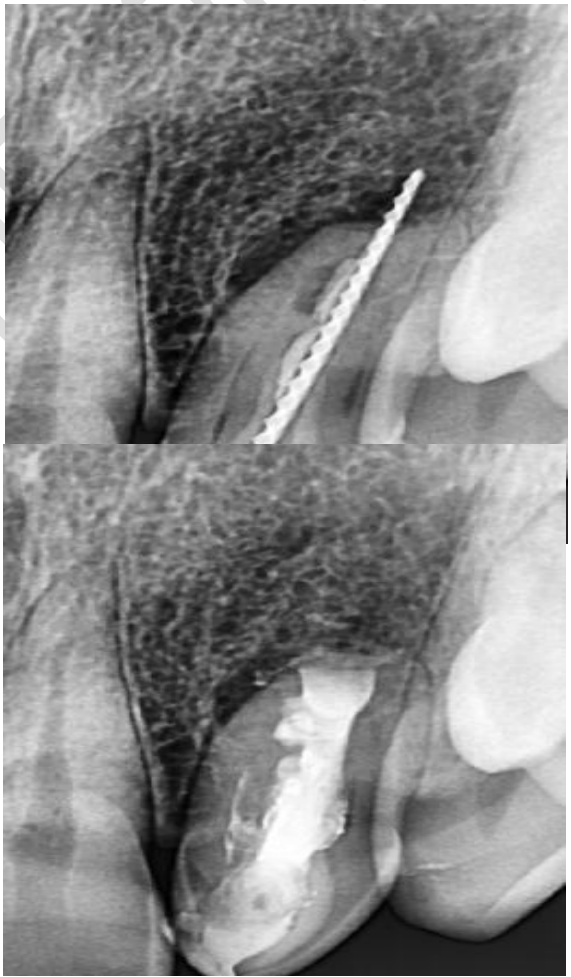
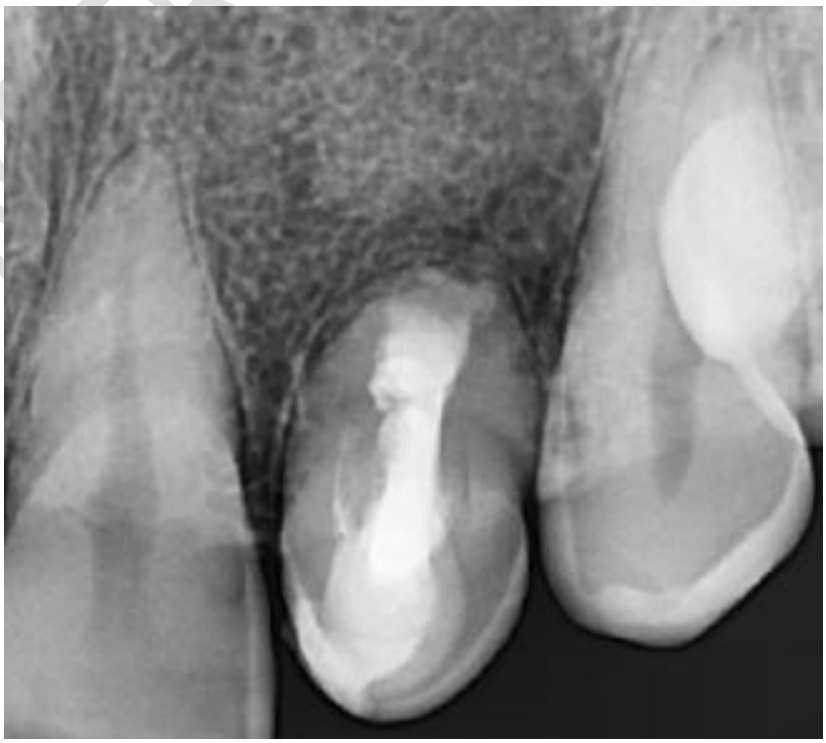


Fig. 3: working length determination

Fig. 4: Periapical radiograph after root canal obturation

Follow-up and Outcomes:

The patient was followed-up 7days post-surgery, sutures were removed.After one week, an intraoral check confirmed that healing had progressed. On palpation, the gingiva was smooth, pink, and humid, with no discomfort. The tooth's movement was within physiological limitations (Grade 1 Miller mobility index). The treated teeth reacted negatively to vertical and horizontal percussion. PD max = 2 mm. Follow-up appointments were scheduled six months, a year, two and three years. The last visit was scheduled three years after the procedure was completed, (Figure 5).



(Figure 5): satisfactory healing of periapical lesion

Discussion:

Dental anomalies such as Dens Invaginatus (DI) exhibit a wide range of morphologic changes and can lead to dental caries, pulpitis, and apical periodontitis in more severe cases [9, 10]. According to the case report, Oehler's Type III Dens Invaginatus is the most severe form of the anomaly, characterised by a deep infolding of the enamel and dentin in the affected tooth that extends into the root and forms a pseudo foramen to communicate laterally with the periodontal space [11, 12]. The enamel lining in these defects is frequentlyhypomineralized and incomplete with various channels that communicate with the pulp thereby allowing easy access for irritants from the invagination to reach the pulp space [13, 14]. Treatment options include preventive sealing of the invaginated pit in teeth that are asymptomatic as well as regular evaluations. Endodontic therapy of the invaginated area alone or of the invaginated section and the root canal has been recommended in cases of pulp necrosis [15]. When nonsurgical methods fail to address significant periapical lesions or when gaining a coronal access prevents nonsurgical treatment, surgical endodontics should be considered in addition to conventional endodontics. The apical part of the invagination and/or root canal will be disinfected and retrogradely sealed during surgery, eliminating the possibility of an infection source [9, 16–20]. Because Type III DI is frequently linked to modifications in the root canal's morphology, endodontic procedures are challenging because of the abnormal anatomy in the invaginated track and pulp space. Furthermore, as this case report illustrates, if the invagination expands into the periodontal space (Figure 1), there may not be a real apical constriction, which adds to the complexity of endodontic procedures [9, 17]. Cases of DI with its complicated anatomy always pose a diagnostic and treatment challenge to the clinician. Due to the intrinsic limitations of the conventional radiographs, they are unable to reveal the details of the DI three-dimensionally. In cases of DI, CBCT images show the details in terms of type, extension, and morphologic changes in the tooth [21, 22]. CBCT uses low effective radiation dose and besides generating undistorted 3D reconstruction of the teeth and surrounding soft tissues provides interrelational images in three orthogonal planes: axial, sagittal, and coronal [23,

24]. Based on these CBCT images we decided to retreat the main root canal with nonsurgical endodontic therapy and do a surgical endodontic approach with retrograde filling for theapical portion of the invagination. A similar combination of conventional and surgical endodontics has also been reported in a case report by Vier-Pelisser et al. [25]. Since calcium hydroxide's high alkalinity promotes healing in necrotic teeth with periapical lesions, it was utilised as an intracanal medication in the root canal for a week. Even though MTA has been the preferred root end material, It was first developed for the endodontic treatment of root perforations. Nevertheless, MTA®'s application has grown over time [26]. Because of its bioactive qualities, excellent sealing ability, antibacterial effect, and osseoinductive and conductive power that promotes tissue regeneration when it comes into touch with the pulp and periradicular tissues, it is currently regarded as the gold standard [27]. Moreover, it is readily detectable on control radiographs due to its radiopacity [28].

Conclusion:

Endodontic treatment of dens invaginatus can be challenging because of the complex anatomy of the tooth.

Inadequate obturation and inadequate apical seal are common causes of treatment failure in dens invaginatus.

Orthograde retreatment combined with endodontic microsurgery is an effective treatment option for failed endodontic treatment of the dens invaginatus.

References:

[1] Alani A, Bishop K. Dens invaginatus. Part 1: classifcation, prevalence and aetiology. Int Endod J. 2008;41(12):1123–36.

[2] Zhu J, Wang X, Fang Y, Von den Hof JW, Meng L. An update on the diagnosis and treatment of dens invaginatus. Aust Dent J. 2017;62(3):261–75.

[3]Hamasha AA, Alomari QD. Prevalence of dens invaginatus in Jordanianadults. Int Endod J. 2004;37(5):307–10.

[4] Zhang P, Wei X. Combined therapy for a rare case of type III densinvaginatus in a mandibular central incisor with a periapical lesion: a casereport. J Endod. 2017;43(8):1378–82.

[5] Kirzioglu Z, Ceyhan D. The prevalence of anterior teeth with densinvaginatus in the western Mediterranean region of Turkey. Int Endod J.2009;42(8):727–34.

[6] Oehlers FA. Dens invaginatus (dilated composite odontome). I. Variationsof the invagination process and associated anterior crown forms. OralSurg Oral Med Oral Pathol. 1957;10(11):1204–18.

[7] Carvalho-Sousa B, Almeida-Gomes F, Gominho LF, Albuquerque DS.Endodontic treatment of a periradicular lesion on an invaginated type IIImandibular lateral incisor. Indian J Dent Res. 2009;20(2):243–5.

[8] Keles A, Cakici F. Endodontic treatment of a maxillary lateral incisor withvital pulp, periradicular lesion and type III dens invaginatus: a case report.Int Endod J. 2010;43(7):608–14.

[9] M. Hulsmann, "Dens invaginatus: aetiology, classification, ¨prevalence, diagnosis, and treatment considerations," International Endodontic Journal, vol. 30, no. 2, pp. 79–90, 1997.

[10] A. Alani and K. Bishop, "Dens invaginatus. Part 1: classification, prevalence and aetiology," International Endodontic Journal, vol. 41, no. 12, pp. 1123–1136, 2008.

[11] W. G. Shafer, M. K. Hine, and B. M. Levy, Shafer's Textbook ofOral Pathology, section I, Elsevier, 6th edition, 2009.

[12] F. A. C. Oehlers, "Dens invaginatus (dilated composite odontome): I. Variations of the invagination process and associated anterior crown forms," Oral Surgery, Oral Medicine, Oral Pathology, vol. 10, no. 11, pp. 1204–1218, 1957.

[13] M. Yamada, M. Nagayama, A. Katsumata et al., "Hypomineralized Enamel of Dens Invaginatus: its distinct images and pathogenesis of the type III invagination using micro-focusing computed tomography," Journal of Hard Tissue Biology, vol. 23, no. 4, pp. 449–453, 2014.

[14] K. T. Ceyhanli, D. C¸ elik, S. H. Altintas, T. Tas¸demir, and O. ¨Sezgin, "Conservative treatment and follow-up of type III dens invaginatus using cone beam computed tomography," Journal of Oral Science, vol. 56, no. 4, pp. 307–310, 2014.

[15] A. H. Borges, A. S. Segundo, M. R. Nadalin, F. L. M. Pedro, A.M. D. Filho, and M. D. Sousa-Neto, "Conventional treatment of maxillary incisor type III dens Invaginatus with periapical lesion: a case report," ISRN Dentistry, vol. 2011, Article ID 257609, 5 pages, 2011.

[16] K. Bishop and A. Alani, "Dens invaginatus. Part 2: clinical, radiographic features and management options," International Endodontic Journal, vol. 41, no. 12, pp. 1137–1154, 2008.

[17] U. X. da Silva Neto, V. H. G. Hirai, V. Papalexiou et al., "Combined endodontic therapy and surgery in the treatment of dens invaginatus type 3: case report," Journal of the Canadian Dental Association, vol. 71, no. 11, pp. 855–858, 2005.

[18] E. R. Fregnani, L. F. B. Spinola, J. R. O. Sonego, C. E. S. Bueno, and A. S. De Martin, "Complex endodontic treatment of an immature type III dens invaginatus. A case report," International Endodontic Journal, vol. 41, no. 10, pp. 913–919, 2008.

[19] H. Ozbas, "Rustem Kemal Subay, Melike Ordulu, Surgical Retreatment of an invaginated maxillary central incisor following overfilled endodontic treatment," European Journal of Dentistry, vol. 4, p. 324, 2010.

[20] G. Sauveur, F. Roth, M. Sobel, and Y. Boucher, "Surgical treatment of a periradicular lesion on an invaginated maxillary lateral incisor (dens in dente)," International Endodontic Journal, vol. 30, no. 2, pp. 145–149, 1997.

[21] H. Kato, "Non-surgical endodontic treatment for dens Invaginatus type III using cone beam computed tomography and dental operating microscope: a case report," The Bulletin of TokyoDental College, vol. 54, no. 2, pp. 103–108, 2013.

[22] D. D. A. Decurcio, J. A. Silva, R. D. A. Decurcio, R. G. Silva, andJ. D. Pecora, "Influence of cone beam computed tomography on dens invaginatus treatment planning," Dental Press Endodontics,vol. 1, no. 1, pp. 87–93, 2011.

[23] C. William Scarfe, M. D. Levin, D. Gane, and G. Allan Farman, Use of cone beam computed tomography in endodontics. International Journal of Dentistry, vol. 2009, Article ID 634567,20 pages, 2009.

[24] S. Patel, A. Dawood, T. Pitt Ford, and E. Whaites, "The potentialapplications of cone beam computed tomography in the management of endodontic problems," International EndodonticJournal, vol. 40, no. 10, pp. 818–830, 2007.

[25] F. V. Vier-Pelisser, R. D. Morgental, G. Fritscher, A. C. Ghisi, M.G. de Borba, and R. K. Scarparo, "Management of type III dens invaginatus in a mandibular premolar: a case report," Brazilian Dental Journal, vol. 25, no. 1, pp. 73–78, 2014.

[26] Agrafioti A, Tzimpoulas N, Chatzitheodoridis E, Kontakiotis EG. Comparative evaluation of sealing ability and microstructure of MTA and Biodentine after exposure to different environments. Clin Oral Investig. 2016; 20:1535–40.

[27] Aydemir S, Cimilli H, Gemi PM, Bozkurt A, Orucoglu H, Chandler N. Comparison of the sealing ability of Biodentine, Iroot BP Plus and mineral trioxide aggregate. CDJ. 2016; 19:166–71.

[28] Biočanin V, Antonijević Đ, Poštić S, Ilić D, Vuković Z, Milić M. Marginal gaps between 2 calcium silicate and glass ionomer cements and apical root dentin. J Endod. 2018; 44:816–21.