*Int. J. Odontostomat.,*
***18(3)***:292-297, 2024.

# Use of Bioceramic Repair Material as Root Canal Sealer for Management of Bilateral Dens Invaginatus: A Case Report with a 7-Year Follow-Up

## Uso de Cemento de Reparación Biocerámico como Cemento Sellador para el Manejo de Dens Invaginatus Bilateral: Reporte de Caso con 7 Años de Control

**Nathaly Macedo-Serrano[1]; Hernán Coaguila-Llerena[2]; John Torres[3] Hair Salas[1†]; Luis Fernando Linares-Zapata[4] & Gisele Faria[5]**

**MACEDO-SERRANO, N.; COAGUILA-LLERENA, H.; TORRES, J.; SALAS, H.; LINARES-ZAPATA, L. F. & FARIA, G.** Use of bioceramic repair material as root canal sealer for management of bilateral Dens Invaginatus: A case report with a 7-year follow-up. *Int. J. Odontostomat., 18(3)*:292-297, 2024.

**ABSTRACT:** The malformation characterized by the invagination of the enamel organ into the dental papilla is called Dens Invaginatus or Dens in Dente, and may compromise both the canal access and the disinfection, depending on the degree of the anomaly. Considering that its management is difficult, different treatment strategies have been proposed. A 17-year old male patient presented bilateral Dens Invaginatus in the maxillary 1.2 and 2.2 lateral incisors. The diagnosis for tooth 1.2 was normal pulp and asymptomatic apical periodontitis, the latter caused by the invagination. As for tooth 2.2, the diagnosis was pulp necrosis and chronic apical abscess. Teeth 1.2 and 2.2 presented Type III and Type II Dens Invaginatus, respectively. Both teeth were treated by applying a conventional non-surgical approach using bioceramic repair material as root canal sealer. The clinical and radiographic assessment after 7 years showed favorable evolution, and no evidence of apical radiolucencies. It can be concluded that the treatment of bilateral Dens Invaginatus by a non-surgical approach can yield long-term favorable results, despite the complexity of the case.

**KEY WORDS: dens in dente, endodontics, root canal filling materials, tooth abnormalities, tooth resorption.**

## INTRODUCTION

Dens Invaginatus, also called Dens in Dente, dilated composite odontome, or even gestant odontome, is a dental malformation resulting from epithelial invagination of the dental papilla during tooth development, before calcification (Oehlers, 1957; Hülsmann, 1997). Of all the possible terms, Dens Invaginatus appears to be the most appropriate, because it represents an infoldings of the outer portion (enamel) of the tooth into the inner portion (dentine), leading to the formation of a pocket or dead space (Alani & Bishop, 2008). This invagination can predispose to the passage of microorganisms and/or irritants to the pulp, factors that cause inflammation and necrosis. Additionally, abscess formation, internal resorption, tooth displacement, retention of neighboring tooth, and cysts are other problems associated with Dens Invaginatus (Kirzioglu & Ceyhan, 2009). The etiology is still not clear, despite the various theories proposed; however, factors such as trauma, infection, or genetics may also play a role (Hülsmann, 1997; Siqueira *et al*., 2022). The prevalence of Dens Invaginatus has been described as ranging between less than 1 % and 10 %; however, a study showed that the rate in anterior teeth increases to 12 % (Kirzioglu & Ceyhan, 2009).

[1] Department of Endodontics, Catholic University of Santa Maria - UCSM, Arequipa, Peru.
[2] Department of Endodontics, Universidad Peruana Cayetano Heredia – UPCH, Lima, Peru.
[3] Department of Endodontics, Universidad Privada San Juan Bautista – UPSJB, Lima, Peru.
[4] Private practice, Arequipa, Peru.
[5] Department of Restorative Dentistry, Araraquara School of Dentistry, São Paulo State University - UNESP, Araraquara, 14801-903 SP, Brazil.
FUNDED. Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) - [Grant number 18/24662-6].

Received: 2023-01-11 Accepted: 2024-05-11

Although Oehlers (1957) classification is based on a two-dimensional analysis, it is the most commonly used due to its simplicity and utility for treatment planning. The classification describes 3 types of Dens Invaginatus lesions. Type I is a partial invagination within the confines of the crown, and does not extend beyond the level of the external amelocemental junction. Type II is an enamel-coated invagination that invades the root, but remains confined like a blind sac. It obviously goes beyond the amelocemental junction, and may or may not communicate with the dental pulp. Type III extends through the root and either communicates with the periodontal ligament to form a "second foramen," or else ends laterally at the apical foramen. The invagination may be completely covered by enamel, but it is not uncommon to find cement over the invagination (Oehlers, 1957).

Treatment can be difficult due to abnormal anatomy (Alani & Bishop, 2008), and may include preventive sealing/filling of intussusception, non-surgical root canal treatment, apexification or regenerative endodontic procedures, periradicular surgery, intentional replantation, or extraction. However, each case is different; therefore, any treatment approach attempting to standardize the procedure would be very complex, and not likely to treat the different conditions adequately (Siqueira *et al*., 2022). Although the number of case reports is extensive, those with a long-term follow-up are still scarce. In the present case, the report describes a patient that presented a bilateral Dens Invaginatus that was treated by applying a conventional non-surgical approach using bioceramic repair material as root canal sealer.

## CASE REPORT

A 17-year-old patient under orthodontic treatment was admitted to the dental clinic for routine examination. The medical history was non-contributory. The intraoral examination showed a deciduous maxillary right canine instead of the permanent maxillary right canine (FDI 13), and irregular anatomy of both maxillary lateral incisors (Fig. 1A & B). Clinically, both teeth 1.2 and 2.2 showed dilated crown morphology and previous incisal restorations; in addition, tooth 2.2 had a sinus tract in the buccal mucosa. Tooth 1.2 responded normally to sensitivity tests. The radiographic examination revealed Type III and Type II Dens Invaginatus in teeth 1.2 and 2.2, respectively, presenting as an external root resorption in the apical third of tooth 1.2 (close to tooth 1.3, an impacted permanent maxillary right canine in the alveolar bone), apical periodontitis in tooth 1.2, and confirming the sinus tract traced to tooth 2.2 (Figs. 1C, 2A, 3A, 3B). The Cone Beam Computed Tomography (CBCT) analysis confirmed that the apical periodontitis in tooth 1.2 was associated with the invagination (Fig. 2B). Regarding tooth 2.2, a communication of the main canal with the buccal bone plate caused a periapical lesion. Additionally, the restoration had a close relationship with the main canal (Fig. 3C). The diagnosis for tooth 1.2 was normal pulp and asymptomatic apical periodontitis, and that of tooth 2.2 was pulp necrosis" and "chronic apical abscess." Both the parents and patient were informed of the case, and consented to the treatment and its publication in the scientific literature.

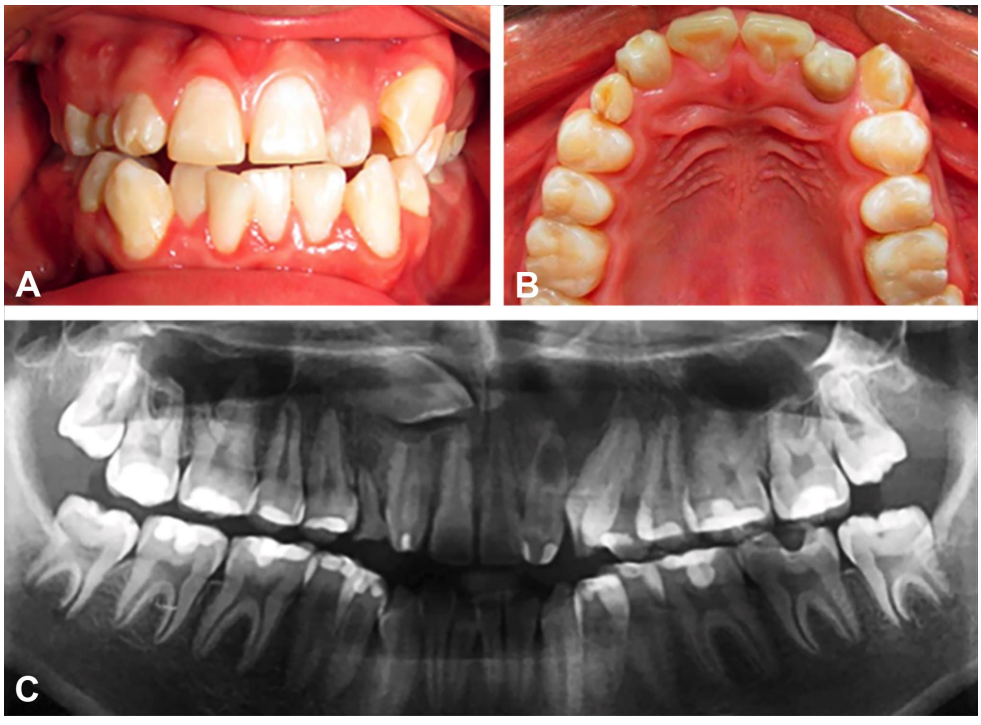


Fig. 1. Clinical and radiographic general presentation of the case. Front (A) and occlusal (B) photos. Panoramic radiograph (C).

**Treatment of tooth 1.2.** The tooth was diagnosed with apical periodontitis even though it was vital, and conventional root canal treatment was conducted after surgical extraction of both the deciduous maxillary right canine and the impacted tooth 1.3. Local anesthesia was administered by infiltration of 2 % lidocaine with 1:80,000 epinephrine (New Stetic, Guarne, Antioquia, Colombia) before rubber dam isolation. The access was performed using a sterilized, small round diamond bur to expose the invagination. A diamond fissure bur was then used to enhance the separation between the tooth and the anomaly (Fig. 2C). All procedures were performed using an operating microscope (OMS2300, Zumax Medical, Suzhou, China). An ultrasonic device (UDS-A, Guilin Woodpecker Medical Instrument, China) coupled to an E4D tip (Woodpecker Medical Instrument Co, Guilin, China) were used to remove the invagination, resulting in a wide root canal (Fig. 2D).

The instrumentation was performed up to F3 ProTaper file (Dentsply Sirona Endodontics, Ballaigues, Switzerland) under 2 % chlorhexidine irrigation. Then, calcium hydroxide (Apexcal, Ivoclar Vivadent, Schaan, Liechtenstein) intracanal medication was inserted and retained for 2 weeks. The irrigating solution was activated with an ultrasonic tip (E1 Irrisonic Tip; Helse, Santa Rosa do Viterbo, SP, Brazil) in three cycles of 20 s each, before and after applying the intracanal medication. Considering that the canal was wide and the walls were thin, Biodentine (Septodont, St. Maur-des-Fossés, France) was used to reinforce the teeth structurally. Immediately afterwards, an adapted F3 ProTaper guttapercha cone was placed in the canal to serve as the core of the Biodentine obturation (Fig. 2E), and as a guide for the later fiberglass post placement (Fig. 2F). A temporary metal-free crown was then

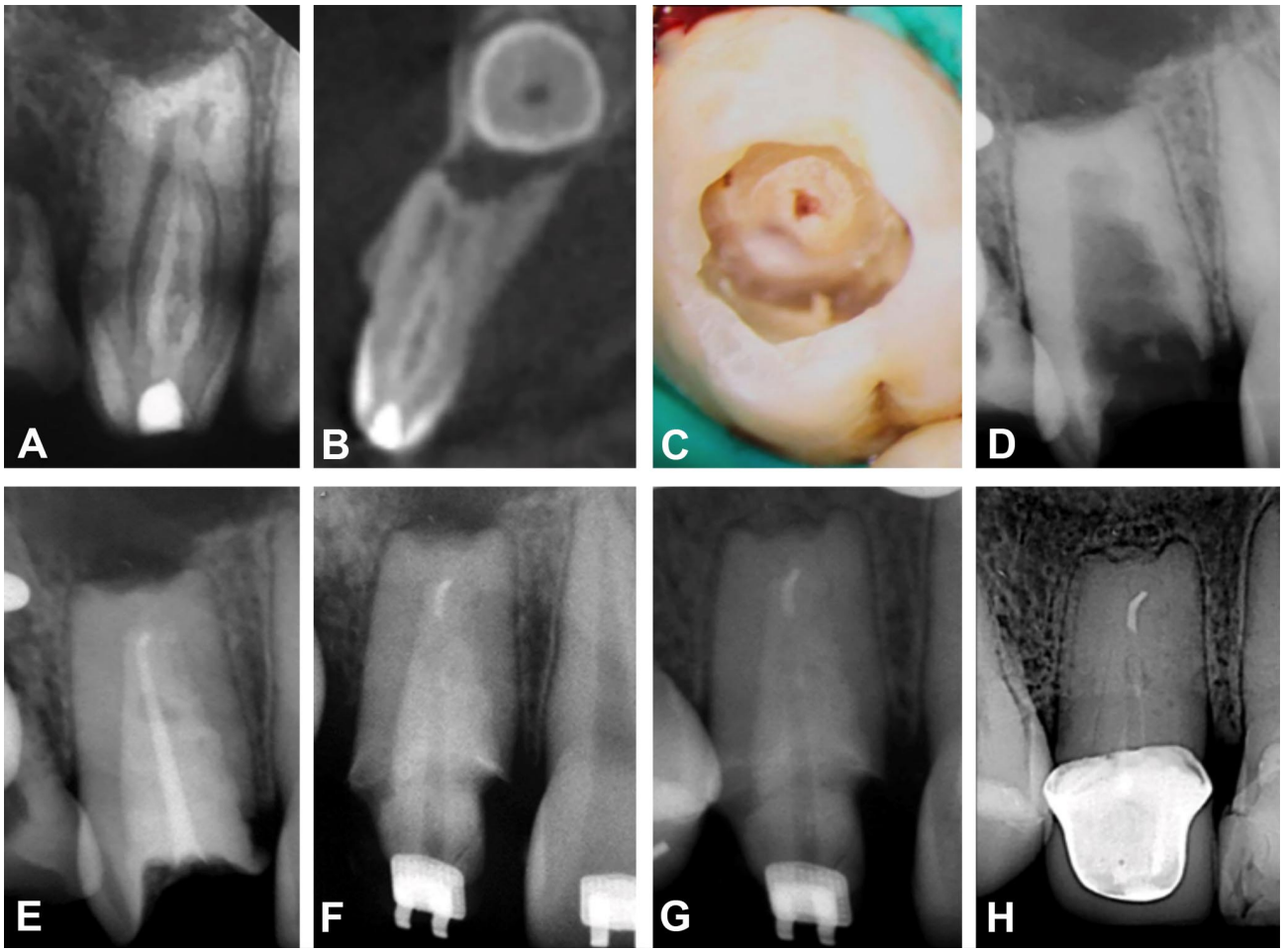


Fig. 2. Clinical and radiographic management of tooth 1.2. Preoperative radiograph (A). CBCT coronal plane showing the close relationship of tooth 1.2 and the periapical lesion with the impacted tooth 1.3 (B). Clinical aspect of the access to and exposure of the invagination (C). Radiographs showing, sequentially: invagination removal (D), root canal obturation with Biodentine, F3 ProTaper gutta-percha cone applied as a core (E), the fiber post in place (F), 1-year follow-up (G), and 7-year follow-up (H).

fitted, so that the patient could continue with the orthodontic treatment. It was later replaced by a permanent porcelain crown.

**Treatment of tooth 2.2.** During the first appointment, after local anesthesia and rubber dam isolation, access was gained first to the invagination, and then to the canal. All procedures and chemo-mechanical preparation were performed, as was described for tooth 12. The invagination was removed so as not to compromise proper disinfection (Fig. 3D). The instrumentation was performed up to ISO #80 K-file. Then, calcium hydroxide (Apexcal, Ivoclar Vivadent) intracanal medication was applied for 3 weeks (Fig. 3E).

During the second appointment, no sinus tract was observed, thus allowing the intracanal medication to be removed with copious irrigation of 2% chlorhexidine. The irrigating solution was activated with an ultrasonic tip (E1 Irrisonic Tip; Helse, Santa Rosa do Viterbo, SP, Brazil) in three cycles of 20 s each, before and after applying the intracanal medication. Biodentine (Septodont) was used as obturation material in tooth 2.2, in the same manner as tooth 1.2; however, an ISO #80 gutta-percha cone was placed as a core. The final restoration was performed using composite resin (Fig. 3F).

After 1 year, the clinical and radiographic examination showed no symptoms, and there was bone healing in both teeth (Fig. 2G, 3G). The 7-year follow-up showed a favorable evolution, and no evidence of periapical radiolucencies. A fiberglass post and a crown were placed in the tooth 2.2 (Fig. 2H, 3H).

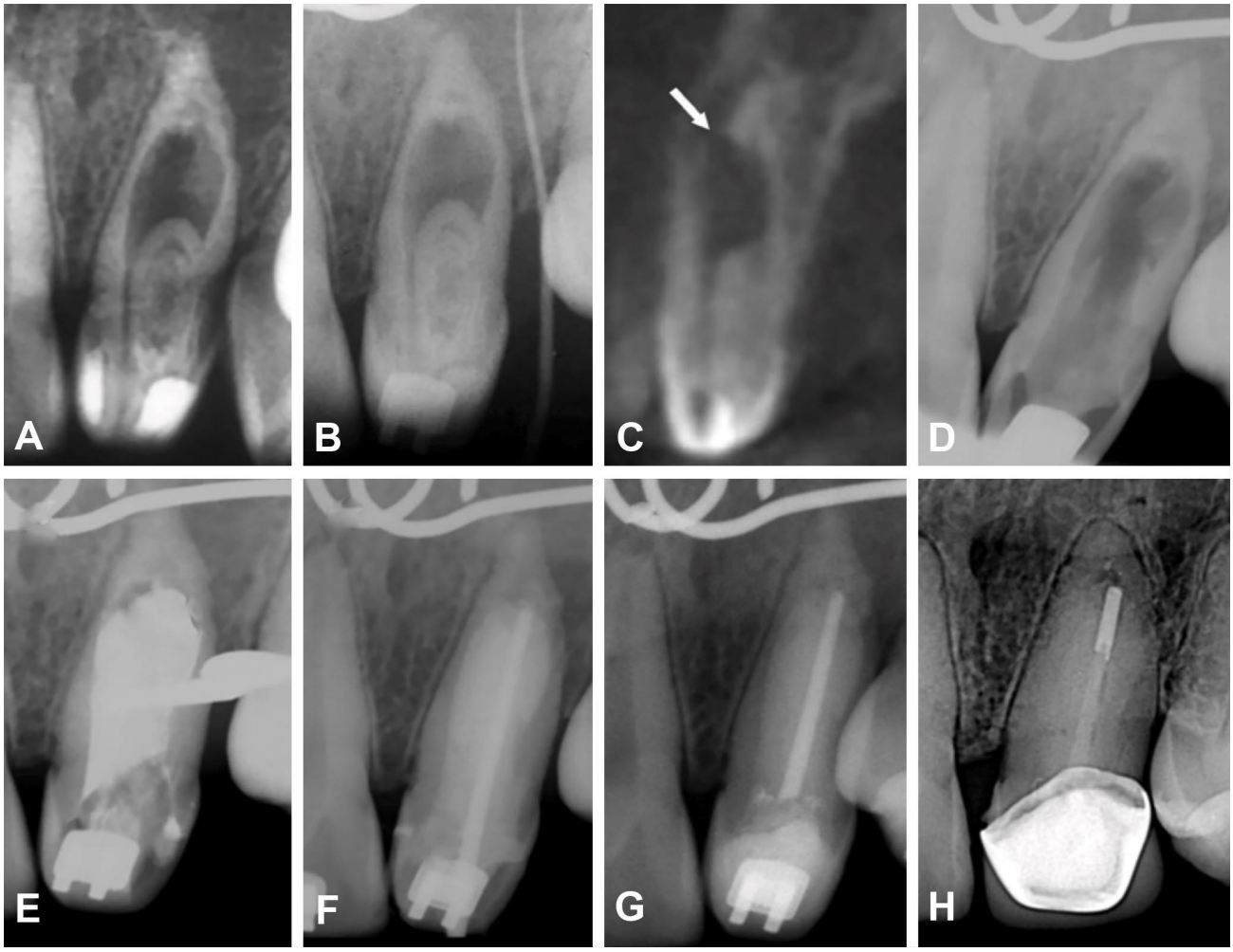


Fig. 3. Clinical and radiographic management of tooth 12. Preoperative radiograph (A). Sinus tract trace using an ISO #25 gutta-percha cone (B). CBCT coronal plane showing the communication of the main canal with the buccal bone plate, through the sinus tract, ultimately causing a periapical lesion – white arrow (C). Radiographs showing, sequentially: invagination removal (D), intracanal medication (E), obturation with Biodentine, ISO # 80 gutta-percha cone applied as a core (F), 1-year follow-up (G), and 7-year follow-up (H).

## DISCUSSION

The present case report described a case of bilateral Dens Invaginatus treated by applying a conventional non-surgical approach. Teeth affected by Dens Invaginatus are susceptible to caries, because its characteristic pits or grooves act as stagnation sites that eventually lead to caries (Er *et al*., 2007). The anterior teeth are the most affected by this malformation. A study performed on anterior teeth revealed that the prevalence of Dens Invaginatus is 90 %, 50 % and 4 % in maxillary lateral incisors, central incisors and canines, respectively. Furthermore, this same study showed that 82 % of the affected patients had Dens Invaginatus bilaterally (Kirzioglu & Ceyhan, 2009). Clinically, an affected tooth may present with a palatal pit or groove, barrel or cone-shaped configuration, dilated crown, microdontia, talon cusp, or labial groove (Zhu *et al*., 2017). In both of the affected teeth, the crown was dilated, which is uncommon, considering that a study revealed that 95% of anterior teeth have a normal crown morphology (Kirzioglu & Ceyhan, 2009).

Regarding the management of tooth 1.2, although it responded normally to the sensitivity tests, the periapical tissues were found to be compromised. It has been described in the literature that invagination causes periapical lesions, and should be cleaned, shaped, disinfected, and filled like a true root canal (Siqueira *et al*., 2022). In the case of tooth 2.2, its necrotic status called for administering root canal treatment, as previously recommended (Siqueira *et al*., 2022). The invaginations were completely removed, as previously described (Chung *et al*., 2019). This procedure used an operating microscope and ultrasonic tips, an association described previously as one that allows adequate management of this type of anomaly (Girsch & McClammy, 2002). Likewise, the use of calcium hydroxide as intracanal medication, and chlorhexidine as a single irrigating solution have been previously described for treating Dens Invaginatus (Siqueira *et al*., 2022). The long-term follow-up of 7 years showed that the case evolved favorably, and constitutes the main strength of the present case report.

Although periapical radiographs are very useful in performing endodontic diagnoses, they allow only a two-dimensional assessment of oral structures. On the other hand, CBCT allows a three-dimensional and undistorted assessment, which provides valuable information to manage complex clinical situations, such as that of Dens Invaginatus (Vier-Pelisser *et al*., 2012; Ricucci *et al*., 2020). In the present case report, CBCT was used to achieve a more accurate diagnosis for teeth 1.2 and 2.2, by providing information about the degree invagination. In tooth 2.2, the coronal plane allowed visualization of the communication between the main canal and the buccal bone plate through the sinus tract, ultimately causing apical periodontitis. Additionally, CBCT confirmed the close relationship of the restoration with the main canal, in tooth 2.2.

The use of bioceramic repair materials, such as orthograde root filling materials, has been previously reported in the literature (Alsulaimani, 2016). Both teeth in the present case report were obturated using iodentine to reinforce the canal walls. This bioceramic material has low radiopacity, compared with other cements, such as mineral trioxide aggregate (MTA) (Coaguila-Llerena *et al*., 2020). This might not be a very desirable aspect, considering that radiopacity is an important requirement for any obturation material. However, biodentine has high mechanical properties, such as compressive strength and Vickers hardness (Grech *et al*., 2013). On the other hand, the gutta-percha core was very useful for performing the obturation and placing the fiberglass post. It is important to note that biodentine has greater color stability than white or gray MTA (Vallés *et al*., 2013). a feature which can be critical in anterior teeth. We can conclude tha the treatment of bilateral Dens Invaginatus through a non-surgical approach yielded long-term favorable results, despite the complexity of the case.

**ACKNOWLEDGEMENTS.** Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) - [Grant number 18/24662-6].

---

**MACEDO-SERRANO, N.; COAGUILA-LLERENA, H.; TORRES, J.; SALAS, H.; LINARES-ZAPATA, L.F. & FARIA, G.** Uso de cemento de reparación biocerámico como cemento sellador para el manejo de Dens Invaginatus bilateral: Reporte de caso con 7 años de control. *Int. J. Odontostomat., 18(3)*:292-297, 2024.

**RESUMEN:** La malformación caracterizada por la invaginación del órgano del esmalte en la papila dental se denomina Dens Invaginatus o Dens in Dente, y puede comprometer tanto el acceso al conducto radicular como la desinfección del mismo, dependiendo el grado de la anomalía. Considerando que su manejo es difícil, se han propuesto diferentes estrategias de tratamiento. Un paciente varón de 17 años presentó Dens Invaginatus bilateral en los dientes 1.2 y 2.2. El diagnóstico del diente 1.2 fue pulpa normal y periodontitis apical asintomática, esta última causada por la invaginación. En cuanto al diente 2.2, el diagnóstico fue necrosis pulpar y absceso apical crónico.

Los dientes 1.2 y 2.2 presentaban Dens Invaginatus tipo III y tipo II, respectivamente. Ambos dientes fueron tratados aplicando un abordaje convencional, no quirúrgico utilizando cemento biocerámico como parte de la obturación. La evaluación clínica y radiográfica a los 7 años mostró evolución favorable, sin evidencia de radiolucidez apical. Se puede concluir que el tratamiento de los Dens Invaginatus bilaterales por vía no quirúrgica puede mostrar resultados favorables a largo plazo, a pesar de la complejidad del caso.

**PALABRAS CLAVE: anomalías dentarias, dens in dente, endodoncia, materiales de obturación del conducto radicular, resorción dentaria.**

## REFERENCES

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

Alsulaimani, R.S. Single-visit endodontic treatment of mature teeth with chronic apical abscesses using mineral trioxide aggregate cement: a randomized clinical trial. *BMC Oral Health, 16(1)*:78, 2016.

Chung, S.H.; Hwang, Y.J.; You, S.Y.; Hwang, Y.H. & Oh, S. A case report of multiple bilateral dens invaginatus in maxillary anteriors. *Restor. Dent. Endod., 44(4)*:e39, 2019.

Coaguila-Llerena, H.; Ochoa-Rodriguez, V.M.; Castro-Núñez, G.M.; Faria, G.; Guerreiro-Tanomaru, J.M. & Tanomaru-Filho, M. Physicochemical properties of a bioceramic repair material - BioMTA. *Braz. Dent. J., 31(5)*:511-5, 2020.

Er, K.; Kustarci, A.; Özan, Ü. & Tasdemir, T. Nonsurgical endodontic treatment of dens invaginatus in a mandibular premolar with large periradicular lesion: a case report. *J. Endod., 33(3)*:322-4, 2007.

Girsch, W.J. & McClammy, T. V. Microscopic removal of dens invaginatus. *J. Endod., 28(4)*:336-9, 2002.

Grech, L.; Mallia, B. & Camilleri, J. Investigation of the physical properties of tricalcium silicate cement-based root-end filling materials. *Dent. Mater., 29(2)*:20-8, 2013.

Hülsmann, M. Dens invaginatus: Aetiology, classification, prevalence, diagnosis, and treatment considerations. *Int. Endod. J., 30(2)*:79-90, 1997.

Kirzioglu, Z. & Ceyhan, D. The prevalence of anterior teeth with dens invaginatus in the western mediterranean region of Turkey. *Int. Endod. J., 42(8)*:727-34, 2009.

Oehlers, F.A.C. Dens invaginatus (Dilated composite odontome): II. Associated posterior crown forms and pathogenesis. *Oral Surg. Oral Med. Oral Pathol., 10(12)*:1302-16, 1957.

Ricucci, D.; Milovidova, I. & Siqueira, J.F. Unusual location of dens invaginatus causing a difficult-to-diagnose pulpal involvement. *J. Endod., 46(10)*:1522-9, 2020.

Siqueira, J.F.Jr.; Rôças, I.N.; Hernández, S.R.; Brisson-Suárez, K.; Baasch, A.C.; Pérez, A.R. & Alves, F.R.F. Dens Invaginatus: Clinical implications and antimicrobial endodontic treatment considerations. *J. Endod., 48(2)*:161-70, 2022.

Vallés, M.; Mercadé, M.; Duran-Sindreu, F.; Bourdelande, J.L. & Roig, M. Influence of light and oxygen on the color stability of five calcium silicate-based materials. *J. Endod., 39(4)*:525-8, 2013.

Vier-Pelisser, F. V.; Pelisser, A.; Recuero, L.C.; Só, M.V.R.; Borba, M.G. & Figueiredo, J.A.P. Use of cone beam computed tomography in the diagnosis, planning and follow up of a type III dens invaginatus case. *Int. Endod. J., 45(2)*:198-208, 2012.

Zhu, J.; Wang, X.; Fang, Y.; Von den Hoff, J.W. & Meng, L. An update on the diagnosis and treatment of dens invaginatus. *Aust. Dent. J., 62(3)*:261-75, 2017.

Corresponding author:
Hernán Coaguila-Llerena
Rua Humaitá 1680
Araraquara
14801-903 SP
BRAZIL

E-mail: ehernanco@gmail.com