CASE REPORT

Clinical management of a dens in dente type 3, with five canals and acute apical periodontitis in a maxillary lateral incisor

ABSTRACT

Aim: *This report describes the clinical management of a dens in dente type 3 in a maxillary lateral incisor with five canals and acute apical periodontitis in a ten years old child.*

Summary: *An upper lateral incisor presenting dens in dente type III necrotic pulp and acute apical periodontitis was treated. After antibiotic therapy, root canal treatment was initiated and five root canals were located, four converging to an apical pulp chamber. All canals were enlarged using hand files, irrigated with sodium hypochlorite ultrasonically activated. Calcium hydroxide was placed into the canals. The patient missed his next appointment. Eight months after, the canals were re-instrumented, and calcium hydroxide was placed again. Three weeks later the five canals were filled with gutta-percha and an epoxy resin sealer, using a warm technique. Four of the canals were interconnected. Dens in dente was restored with a metal cast post with three retainers and a full porcelain crown. After three years, the periapical lesion showed healing.*

Key learning points:

- *Despite its very complex anatomy type III dens in dente can be successfully treated with conventional root canal treatment.*
- *To achieve success in each particular case when root canal therapy is needed, the clinician should be aware of the diverse clinical techniques available. The use of magnification with clinical microscope, ultrasonic activated irrigation, use of intracanal medication, and warm filling technique are encouraged.*
- *A restoration with a specific cast post, with three retainers, was used due to its particular root anatomy.*

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Introduction

Dens in dente is a development anomaly resulting in abnormal morphodifferentiation of tooth structure (1). This anomaly has also been described as dens invaginatus, dilated gestant odontome and invaginated odontome. Dens in dente shows a broad spectrum of crown and root morphological variations. Can present a bigger cingulum that sometimes appears as another cusp or a small and deep pit in the cingulum. Crown variations of the affected tooth can go from microdontia to macrodontia, having peg or barrel shaped (2, 3).

Radiographically, the dens in dente is observed as a radiopaque mass with a density similar to that of enamel or dentine. It invaginates from the cingulum towards the inside of the root canal, leaving a communication from the oral cavity to the pulp space. Having a great variety in shape and size, it has the appearance of a loop, a pear or a tooth inside another tooth (1, 3). Several causes are considered as etiology: increased growth pressure on the affected bud tooth, fast proliferation or focal growth retardation of specific areas of internal enamel epithelium[4]. This defect on dental bud leaves to a folding of the foramen coecum before calcification occurs (3, 4). Histologically, a dens in dente is a structure composed of enamel, dentine and connective tissue. The interior enamel is hypomineralized, but the dentine can be uniformly mineralized or irregularly structured, that may contain strains of connective tissue or thin communications to the dental pulp (3, 5).

Oehlers (6) developed a classification for these anomalies based on the extension of the dental structure involved as follows: type one, an enamel invagination in the crown only; type two, an enamel-lined invagination that invades the root but remains confined within it as a blind sac, and may communicate with the dental pulp; and type three, an invagination that extends from the crown to the apex and can communicate laterally or apically as a second foramen.

The reported incidence of dens in dente is from 0.3% to 10%, and the most affected tooth is the maxillary lateral incisor (3, 7, 8).

Many treatment modalities for dens in dente are suggested, such as preventive and conservative treatment (9, 10, 11), non-surgical root canal treatment (5, 11-14), a non-surgical-surgical combination (2, 15-17), or tooth extraction7. Besides instrumentation of the root canals, some cases are treated with calcium hydroxide as intracanal medication to induce closure and promote periapical repair (5, 7, 12, 18).

The objective of this case report is to present the non-surgical endodontic root canal treatment and restoration of a maxillary lateral incisor dens in dente type 3, five root canals, and periapical lesion.

Report

A 10-year-old male patient from western México, presented with swelling and pain in the right infraorbital area (Figure 1A). He had no systemic disease or medical history relevant to the case. He reported direct trauma to the area with a soccer ball six months before the appointment. Right central and lateral permanent incisors and temporal canine were very sensitive to chewing by four days, which was decreasing until disappearing at the second week after the trauma. Clinically, the right maxillary lateral incisor had a barrel shape (Figures 1B and 1C). Thermal and electric tests were negative while neighbor teeth were positive. Radiographically, a dens in dente type 3 with a radiolucent periapical lesion was observed (Figure 2A). Necrotic pulp with an apical acute periodontitis diagnosis was made. As a first therapeutic option, conventional endodontic treatment was suggested. Periapical surgery was considered if no healing was observed with conventional treatment. After explaining to the patient´s mother the clinical conditions, she gave the required informed consent for the procedure. It was prescribed 400,000 units of oral Penicillin every 8 h for eight days and 200 mg of oral Ibuprofen every eighth for three to five days.

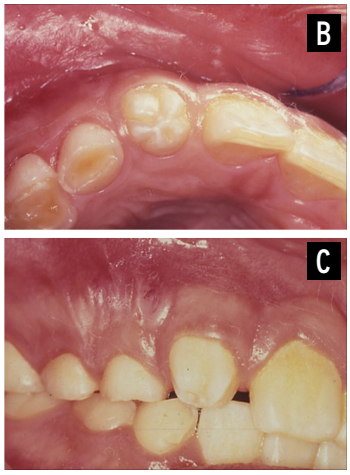

Figure 1
A) Clinical image of the patient, with inflammation in the suborbital region. **B, C)** The inflammation extends in the vestibule. Incisal and vestibular view of the lateral incisive, with its "barrel shape".

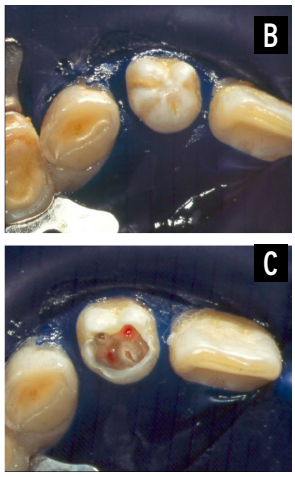

Figure 2
A) Preoperative radiograph showing a triple dens in dente and apical periodontitis. Note the apical pulp chamber. **B)** Barrel shaped crown with five tubercules. **C)** After endodontic access, two root canals presented bleeding.

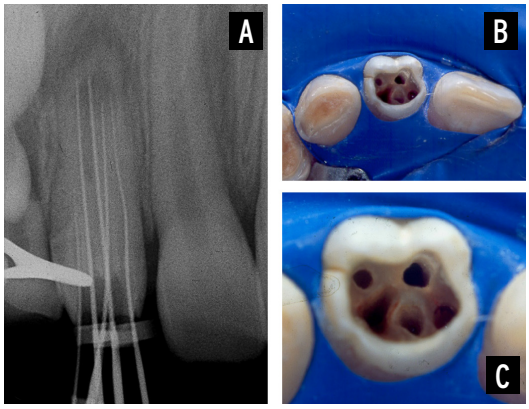

Figure 3
A) Radiographic image shows five root canals. **B, C)** Clinical images of the pulp chamber and the five canals, after root canal shaping.

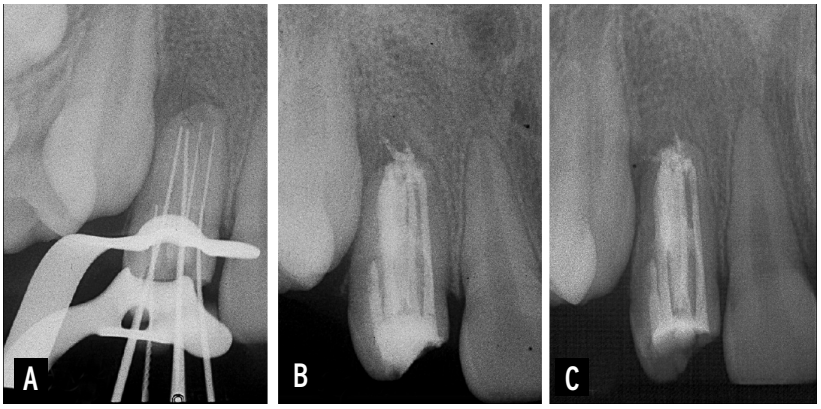

Figure 4
A) Eight months after the initial appointment. The apical radiolucent area had decreased in size. **B)** Postoperative radiograph with the obturated canal system and slight extrusion of material. **C)** One year after the beginning of treatment, a follow-up radiograph shows periapical healing of the previous lesion, and a part of the extended material has been resorbed.

Eight days after the initial appointment the patient returned with no swelling or symptoms. Local infiltration of Lidocaine 2% epi 1x100,000 was applied. Rubber dam isolation was obtained by placing the clamp on the first deciduous molar; cyanoacrylate was applied around the tooth to get a better seal of the dam to the tooth (Figure 2B). At this point, all of the clinical procedures were performed with the aid of a clinical microscope (OPMI Pico, Zeiss, Oberkochen, Germany); the access cavity was done with a #1 round high-speed carbide bur. With 0.10 stainless-steel K-files (Maillefer/Dentsply, Ballaigues, Switzerland), five root canals were located and negotiated, which were named mesiobuccal MB, distobuccal DB, distopalatine DP, centropalatine CP, and mesiopalatine MP. The DV, CP, and MP canals were necrotic, the other two were vital (Figure 2C). The working length was established with the radiographic method. The length of the DB canal was 13 mm and separated

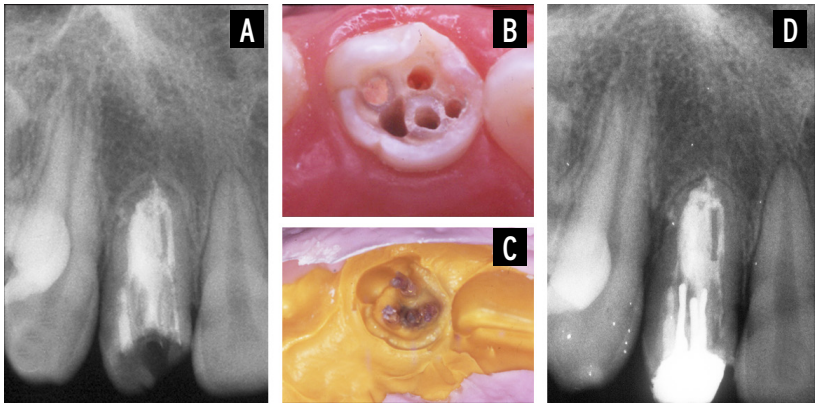

Figure 5
A) Radiography and **B)** clinical images showing the desobturation of four canals and silicon impression **(C)**. The metal post cast with three retentions cemented **(D)**.

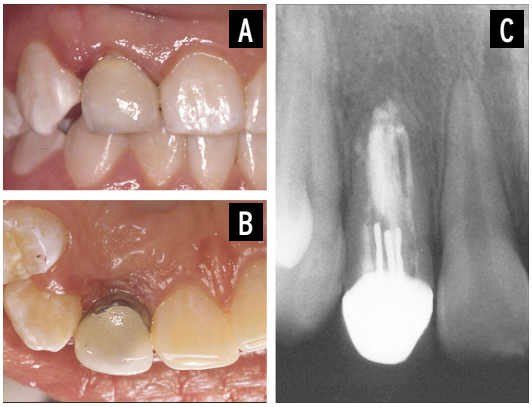

Figure 6
A, B) Clinical images of porcelain crown cemented. Follow up radiography, three years after the beginning of treatment **(C)**. The previous apical periodontitis is healed.

from the other canals. The rest measured 19 mm and converged to what seemed to be an apical pulp chamber (Figure 3A).
All the canals were hand instrumented to a #35 Flexofile (Maillefer/Dentsply), irrigated with 1% sodium hypochlorite (NaOCl) along with three, 20 seconds cycles of ultrasonic activated irrigation (UAI), with an Irrisafe tip #20 (Satelec-Acteon, Merignac, France) in a piezoelectric unit (Varios 370 NSK, Tochigi, Japan). Canals were dried with sterile medium paper points (Kerr, Glendora, USA) and filled with REDTA (Roth Int. Chicago, USA) for 5 minutes, flushed again with NaOCl and dried again with sterile medium paper points (Kerr) (Figures 3B and 3C). Pure calcium hydroxide (Sultan, York, USA) mixed with saline to a thick consistency was placed with a #30 Lentulo spiral (Maillefer/Dentsply) inside the canals, and the access cavity was carefully cleaned and sealed with glass ionomer cement (Fuji II LC, GC Corp, Tokyo, Japan). Ibuprofen (200 mg every 8 hours) was indicated if necessary.
The patient missed his second appointment and did not reschedule. Eight months later returned and presented an enamel fracture in the mesial-incisal angle. During the elapsed time the patient had no signs or symptoms. The working length was verified (Figure 4A) root canals were cleaned again with a #35 hand file, irrigated with 1% NaOCl and UAI. Calcium hydroxide mixed with saline was used as intracanal dressing. Three weeks later the patient remained asymptomatic, and calcium hydroxide was removed from the root canals with UAI for two minutes and EDTA final irrigation. Canals were obturated with thermo plasticized gutta-percha and AH Plus (Dentsply DeTrey, Konstanz, Germany) by continuous wave technique, with an Elements Obturation unit (SybronEndo, Glendora, USA). Four root canals showed intercommunication along the root and in the apical pulp chamber; the distobuccal canal looked separated (Figure 4B). The crown was sealed temporarily with glass ionomer and scheduled in one week for restoration. Cold and electric tests from neighbor teeth were standard.
Unfortunately, the patient missed his appointment for restoration. He returned only after seven months later, with a fracture of almost all of vestibular enamel. Radiographically, the periapical lesion showed healing (Figure 4C). Given the particular root canal anatomy, a cast post with four "fingers" as retainers was indicated. Gutta-percha was removed from four root canals (MB, DP, CP, MP, Figure 5A) with heated endodontic plugger #50 (Maillefer/Dentsply). Internal debris was retired from post spaces with saline irrigation and a K-file #45 and dried with

coarse absorbent paper points (Figure 5B). Then, light-body vinyl polysiloxane impression material (Regular set, Imprint 4 VPS; 3M-Espe, Saint Paul, MN, USA) was carried into post canal spaces with a #30 Lentulo spiral (Maillefer/Dentsply). A partial fine plastic toothpick was inserted in each root canal, to prevent rupture or dislocation of impression material. With heavy body material in a tray, the impression was completed (Figure 5C). Metal post cast with four "fingers" was elaborated with nickel-chrome alloy (Smartbond II non Beryllium, Dental Depot, Ft. Lauderdale, USA). When the metal post cast was tested on the patient, one of the "post fingers" was fractured. Due to the patient's lack of adherence, the decision to cement the post was taken (Figure 5D) with glass ionomer cement (Fuji I LC, GC Corp). In the same appointment, the core was prepared for a full crown, and a vinyl polysiloxane impression (Imprint 4 VPS; 3M-Espe) was made. An alginate impression (Max Print, MDC, Zapopan, México) of the mandibular teeth and a bite register (Imprint 4 Bite, M-Espe), as well as dental color and shades, were taken. A porcelain-crown was elaborated and cemented one week later (Figures 6A and 6B). The mother was informed that the porcelain crown should be evaluated and changed when the patient is an adult.

After three years from the beginning of treatment the patient was symptom-free. A radiograph showed periapical healing (Figure 6C) and the tooth was in normal function.

Discussion

The lateral incisor dens in dente presented unusual morphology, as a barrel-crown shape with deep grooves and pits. The invaginated grooves render more susceptible to accumulate biofilm, impossible to clean with brushing, leading to caries (7). Those morphological defects can lead to direct microorganism invasion, producing pulpitis, necrosis and periapical inflammation (1, 3, 6). On the other hand, direct trauma causes a concussion on pulp and periodontal tissues (19). Intensity, direction, type of trauma, apical development, the age of the patient and time, are factors that influence the response of the oral tissues to trauma. After the concussion, the dental pulp may not respond to cold or electrical tests due by injury, inflammation or pressure on the nerve fibers in the periapical region (20). This affectation in many cases is reversible since, after 2 to 6 months, many traumatized teeth without immediate pulpal response recover normal sensitivity (19, 20).

Given the proximity of the permanent central incisor and the temporal canine adjacent to the lateral incisor, it is very likely that they received part of the soccer ball trauma. However, both central incisor and canine showed a standard response to vitality tests. We assume that direct trauma six months prior leaded to the affectation of pulpal irrigation of lateral incisor, and with its critical anatomical conditions of possible micro-communication from the dental biofilm trough pits and grooves, invasion of microorganisms to the pulp produced necrosis and subsequent periapical abscess.

Freshly erupted teeth in which are observed deep palatal grooves or foramina coeca, and the presence of dens in dente are suspected, must be diagnosed as soon as possible (2, 3), and treated conservatively with fissure sealing or composite restoration before microbial invasion occurs (3, 7). A strict periodic clinical control is mandatory, in order to detect any pathological change (7, 8). If bacterial contamination to the pulp is prevented, and no signs of pulpal pathosis presented, no further treatment is indicated (3, 18).

The case presented had three necrotic and two vital canals, but we decided to treat them all as necrotic since four were joined in an apical chamber. Treatment of dens in dente is complicated because of its atypical shape and complex root canal system (1-3). Frequently, treating such cases requires a combination of various endodontic techniques. In complex root canal systems, with isthmus and communication among canals, hand or rotary instrumentation leave untouched areas, where necrotic tissues and bacteria can

remain (21). UAI with NaOCl has shown good results to improve canal and isthmus cleanliness (22), as well as remove calcium hydroxide used as intracanal medication (23).
Holland et al (24) used calcium hydroxide in the treatment of pulpless teeth and associated apical pathology, in order to stimulate healing of the periapical tissues and the formation of an apical barrier. $Ca(OH)_2$ mixed with saline solution as an intracanal medication allows the dissociation of OH^- ions and Ca^{++} ions. The OH^- ions are responsible for the pH rise, which creates its bactericidal effect (25-27). Calcium hydroxide antibacterial activity is due in part to its OH^- ions action on the bacterial cell membrane (26), damaging this important cellular structure that is essential for bacterial metabolic processes. Also, calcium hydroxide inactivates lipopolysaccharides of Gram-negative bacteria (25).
Although prolonged use of calcium hydroxide as intracanal medication has been pointed out as a factor that can decrease resistance to root fracture, a recent study (28) has shown that the intracanal dressing for nine months of calcium hydroxide does not produce these effect, compared to the control teeth. The factor that leads to the observed increase in radicular fractures in immature teeth is the decreased resistance due to its thin dentinal walls in immature teeth (28). In this particular case, a metal cast post with thin retentions was decided, in order to conserve as much as possible dentine structure from the root, to keep the root resistance in the long term.
Several recently used techniques and materials should be evaluated in the diagnosis (CBCT) and management of these complex cases, since they can provide more conservative therapies. In cases of pulpal necrosis and immature apex, it is possible to perform endodontic regeneration procedures by using hydrogel scaffolds derived from decellularized and demineralized bovine bone (29), or scaffolds from blood clot with the aim of inducing the formation of mineralized tissue within the root, leading to strengthening of the root walls. The filling of these very complex anatomies, which can present multiple inter-canal septa, can be carried out with calcium silicate cements in its entirety, without gutta-percha (30).
On the other hand, crown and root malformation in some dens in dente can lead to periodontal lesions, which can be managed with regenerative techniques and materials (29, 30), which allow more conservative treatment approaches for patients. The clinician should consider the possibility of periapical surgery in some cases (2, 3).
The combined use of disinfection strategies (hand filing and passive ultrasonic irrigation with NaOCl), the use of calcium hydroxide and thermoplasticized filling technique and a modified cast post, allowed the successful treatment of this case that presented particular anatomy. In such cases like the one presented here, the clinician should use biological and technical means to treat the patient conservatively and maintain the tooth successfully.

Conclusions

Dens in dente type 3 offers a unique challenge to clinicians, due to its complex and unpredictable anatomy presented in every case. From diagnosis and through each of the stages of endodontic therapy and restoration, the canal system of dens in dente presents difficulties in localizing, cleaning, shaping, disinfecting, filling and restoring this complex canal system. In this case, through conventional endodontic therapy with the aid of magnification, optimization of irrigation with ultrasonics, long term of calcium hydroxide intracanal medication and a warm filling technique, it was possible to solve a complex anatomical case.

Clinical Relevance

In the treatment of Dens in dente type 3, the clinician must be aware of the different techniques available, as magnification with the clinical microscope, ultrasonic activated irrigation and intracanal medication as well as thermo plasticized filling techniques, in order to achieve success in the treatment of this anatomical anomaly.

Restoration of these abnormal crowns and roots represents a challenge for the clinician, in order to obtain functionality and aesthetics.

Conflict of Interest

The authors deny any conflict of interest related to this study.

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References

1 *Hargreaves KM and Goodis HE. Seltzer and Bender's Dental Pulp. Chicago, Ill, USA: Quintessence Publications; 2002.*
2 *Kulild JC, Weller RN. Treatment considerations in dens invaginatus. J Endod. 1989;15:381-4.*
3 *Hülsmann M. Dens invaginatus: aetiology, classification, prevalence, diagnosis, and treatment considerations. Int Endod J. 1997; 30:79-90.*
4 *George R, Moule AJ, Walsh LJ. A rare case of dens invaginatus in a mandibular canine. Aust Endod J. 2010;36:83-6.*
5 *Vajrabhaya L. Nonsurgical endodontic treatment of a tooth with double dens in dente. J Endod. 1989;15:323-5.*
6 *Oehlers FA. Dens invaginatus (Dilated composite odontome) I. Variations of the invagination process and associated anterior crown forms. Oral Surg Oral Med Oral Pathol. 1957;10:1204-18.*
7 *Rotstein I, Stabholz A, Heling I, Friedman S. Clinical considerations in the treatment of dens invaginatus. Endod Dent Traumatol. 1987;3:249-54.*
8 *Alani A, Bishop K. Dens invaginatus. Part 1: classification, prevalence and aetiology. Int Endod J. 2008;41:1123-36.*
9 *Keleş A, Çakici F. Endodontic treatment of a maxillary lateral incisor with vital pulp, periradicular lesion and type III dens invaginatus: a case report. Int Endod J. 2010;43:608-14.*
10 *Patel S. The use of cone beam computed tomography in the conservative management of dens invaginatus: a case report. Int Endod J. 2010;43:707-13.*
11 *Kfir A, Telishevsky-Strauss Y, Leitner A, Metzger Z. The diagnosis and conservative treatment of a complex type 3 dens invaginatus using cone beam computed tomography (CBCT) and 3D plastic models. Int Endod J. 2013;46:275-88.*
12 *Tavano SM, de Sousa SM, Bramante CM. Dens invaginatus in first mandibular premolar. Endod Dent Traumatol. 1994;10:27-9.*
13 *Tsurumachi T, Hayashi M, Takeichi O. Non-surgical root canal treatment of dens invaginatus type 2 in a maxillary lateral incisor. Int Endod J. 2002;35:68-72.*
14 *Girsch WJ, McClammy TV. Microscopic removal of dens invaginatus. J Endod. 2002;28:336-9.*
15 *Skoner JR, Wallace JA. Dens invaginatus: Another use for the ultrasonic. J Endod. 1994;20:138-40.*
16 *Bolaños OR, Bayardo M, Morse DR. A unique approach to the treatment of a tooth with dens invaginatus. J Endod. 1988;14:315-7.*
17 *Benenati FW. Complex treatment of a maxillary lateral incisor with dens invaginatus and associated aberrant morphology. J Endod. 1994;20:180-2.*
18 *Wells DW, Meyer RD. Vital root canal treatment of a dens in dente. J Endod. 1993;19:616-7.*
19 *Andreasen JO, Andreasen FM, Andersson L, Andreasen JO. Textbook and color atlas of traumatic injuries to the tooth. 4th ed. Oxford, UK: Blackwell Munksgaard; 2007.*
20 *Ahn SY, Kim D, Park SH. Efficacy of ultrasound Doppler flowmetry assessing pulp vitality of traumatized teeth: a propensity score matching analysis. J Endod. 2018;44:379-83.*
21 *Nair PNR, Henry S, Cano V, Vera J. Microbial status of apical root canal system of human mandibular first molar with primary apical periodontitis after "one visit" endodontic treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;99:231-52.*
22 *Gutarts R, Nusstein J, Reader A, Beck M. In vivo debridement efficacy of ultrasonic irrigation following hand-rotary instrumentation in human mandibular molars. J Endod. 2005;31:166-70.*
23 *Eren SK, Aksel H, Parashos P. A novel model for testing the efficiency of removal of calcium hydroxide from complex root canal anatomies. Aust Endod J. 2017; 43:5-10.*
24 *Holland R, de Souza V, Nery MJ et al. A histological study of the effect of calcium hydroxide in the treatment of pulpless teeth of dogs. J Br Endod Soc. 1979;12:15-24.*
25 *Safavi KE, Nichols FC. Effect of calcium hydroxide on bacterial lipopolysaccharide. J Endod. 1993;19:76-8.*
26 *Estrela C, Sydney G, Bammann L, Fellipe Jr. O. Mechanism of action of calcium and hydroxyl ions of calcium hydroxide on tissue and bacteria. Braz Dent J. 1995;6:85-90.*
27 *Byström A. Evaluation of endodontic treatment of teeth with apical periodontitis (Ph.D. Thesis). Umeå University Odontological Dissertation No. 27, University of Umeå, Sweden, 1986.*
28 *Kahler SL, Shetty S, Andreasen FM, Kahler B. The effect of long-term dressing with calcium hydroxide on the fracture susceptibility of teeth. J Endod. 2018;44:464-9.*
29 *Tattullo M, Riccitiello F, Rengo S, Marelli B, Valletta R, Spagnuolo G. Management of endodontic and periodontal lesions: the role of regenerative dentistry and biomaterials Dent J. 2020;8:32-6.*
30 *Coraini C, Mascarello T, de Palma CM, Gobbato EA, Costa R, de Micheli L, Castro D, Giunta C, Rossi S, Casto Ch. Endodontic and periodontal treatment of dens invaginatus: report of 2 clinical cases. G It Endod 2013;27:86-94*