Septodont

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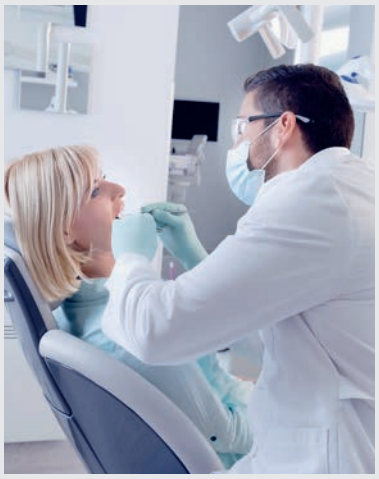
Editorial



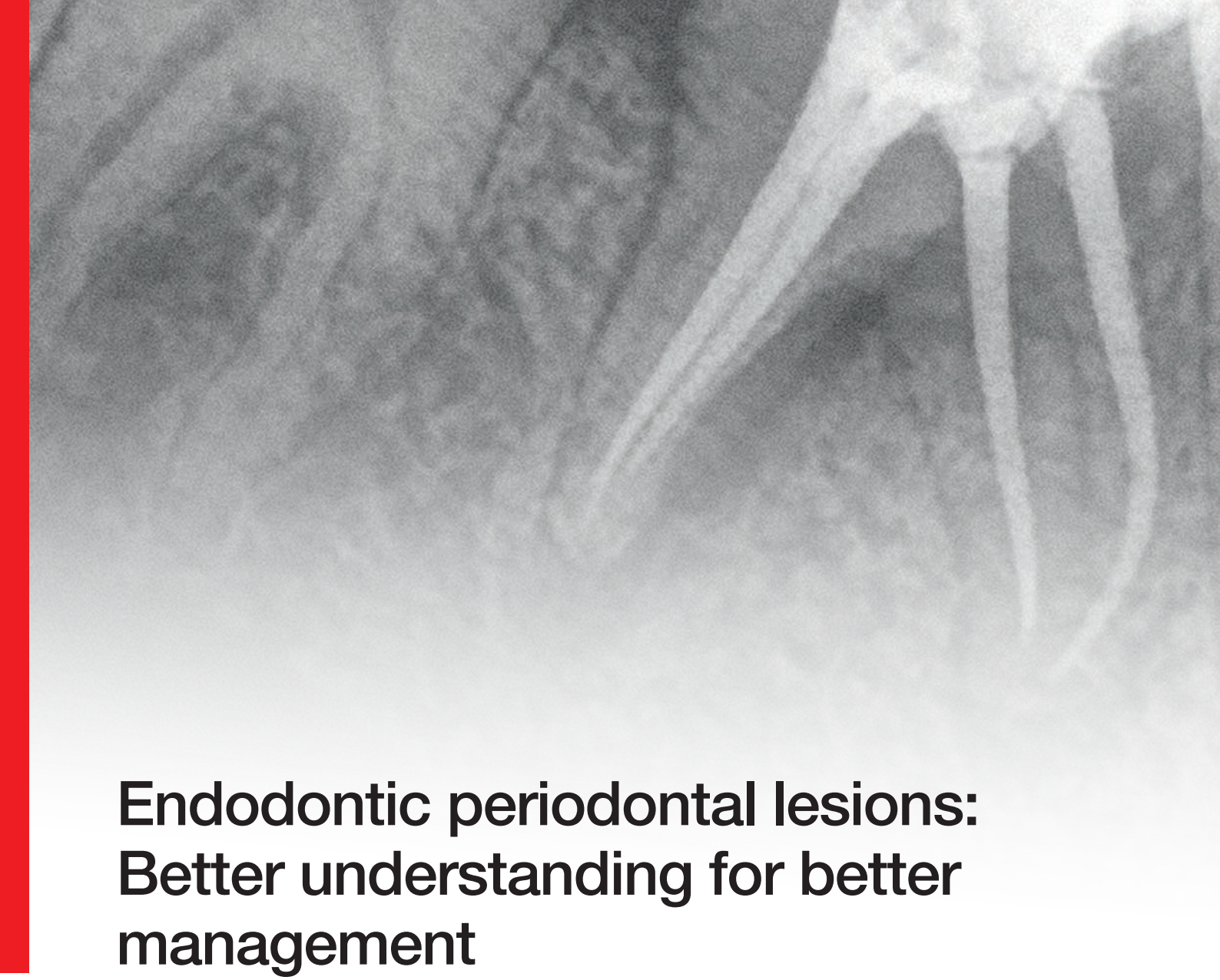
Septodont created the *"Septodont Case Studies Collection"* - a series of case reports - in 2012 to share with you their experience and the benefits of using these innovations in daily practice.
Over the past years, authors from more than 15 countries have generously contributed to the success of our magazine that is now distributed on the 5 continents.

Each new issue of the Case Studies Collection is the opportunity to discover new clinical challenges and their treatment solutions.
The 23rd issue features 2 cases for BioRoot™ RCS, 2 cases for Biodentine™ and 1 case involving both BioRoot™ RCS and Biodentine™:

- BioRoot™ RCS is the paradigm for endodontic obturations. Its outstanding sealing properties combined with anti-microbial and bioactive properties allow to get a high seal of the endodontium without having to use complex warm gutta techniques.
- Biodentine™, the first biocompatible and bioactive dentin replacement material. Biodentine™ uniqueness not only lies in its innovative bioactive and "pulp-protective" chemistry, but also in its universal application, both in the crown and in the root.

The cases are written by the practitioners, the products' application in every case is under the responsibility of the author. Septodont reminds that every product has an official indication, available in the product's information notice.

Content



Endodontic periodontal lesions: Better understanding for better management

Prof. Nabiha Douki Zbidi
Dr. Mohammed Rafik Cherif
Dr. Asma Saad

Introduction

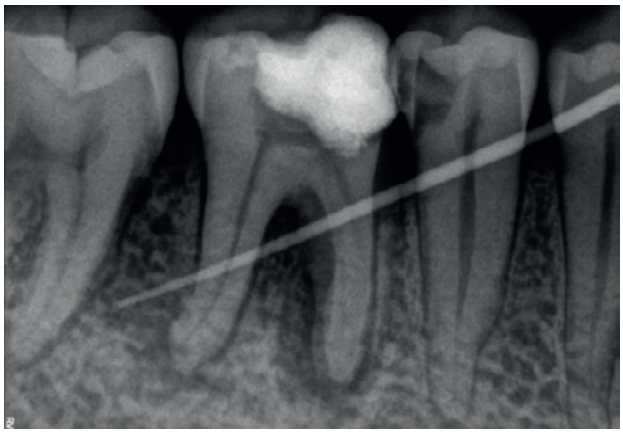
Endodontic periodontal lesions are still controversial as far as diagnosis and classification are concerned. And from this follows another problem in the treatment plan which was based for a long time on the chronology of the lesion. Nevertheless, the prognosis of this type of lesions is very variable and sometimes unpredictable. (1, 2, 9)

Which classification should be adopted for better management?
How to establish an appropriate treatment plan according to the type of lesion to ensure the most favorable prognosis?
From this work, we will try to answer these different questions by illustrating clinical cases.

Case 1

A 38-years-old patient consults for a pus taste in his mouth with antecedent of occasional spontaneous and chewing pain related to the tooth 36. the clinical examination shows a sinus tract with purulent exudate, a negative vitality test and a narrow periodontal probing almost reaching the apex. Pre-operative radiograph shows the communication of the Gutta-Percha point with the distal root. The selected diagnosis is a Gulabivala class I endodontic periodontal lesion. (6) The canals were shaped to a size of 25/100, 06 taper, disinfected with a 3% sodium hypochlorite solution activated with ultrasonic agitation. A final rinse with17% EDTA followed by a final flush with saline was completed before fitting the gutta percha cones.

- Canals were dried with paper points.
- BioRoot™ RCS was used as a bioceramic sealer according to the hydraulic condensation technique. (9)



A: Locating cone: the Sinus tract is related to the distal root with periapical lesion and bone loss in the inter radicular space.

Fig. 1: pre-operative RX.

Case 2

A 10 years patient consults for chewing pains. The patient said to have had a fistula highly located next to tooth #46 which was the source of pus. Diagnostic tests were conclusive there is a endo-periodontal lesion (Gulabivala Class I). (6) After removal of carious tissues, pre-endodontic restoration was build up in order to isolate the tooth with rubber dam.

Access cavity refinement then shaping of the root canals to a size of 25/100, 06 taper with 2 shape files (microméga, France) were performed irrigating protocol: NaOCl 5,5% EDTA 17%, three cycles of 30 seconds by ultrasonic insert activation, then final irrigation with saline. BioRoot™ RCS was considered as the material of choice for filling the root canals to obturate the channels of the furcation. (10, 11)

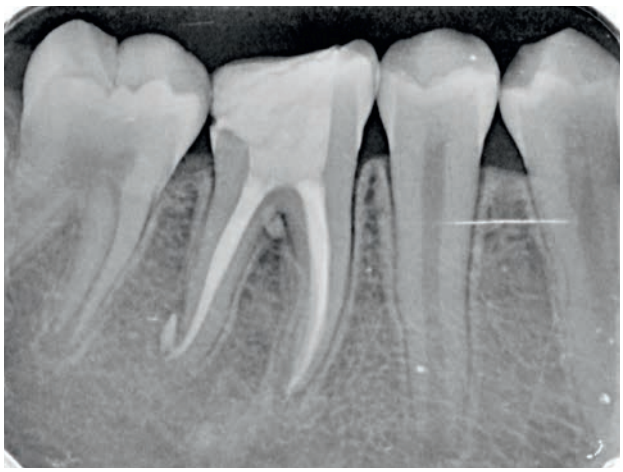


Fig. 2: 6 months radiological control.

Case 3

A 45-year-old female patient, whose medical history was non contributory, came to our department for evaluation and treatment of tooth #46. She complained of discomfort on chewing, related to tooth #46. Clinical and radiographic examination revealed a sinus tract and radiolucent lesion in the furcal and distal side of tooth #46. the selected diagnosis is a Gulabivala class II endo-periodontal lesion. RCT was performed and the root canals were obturated with hydraulic condensation technique using BioRoot™ RCS as sealer.

Fig. A: Pre-operative radiograph.

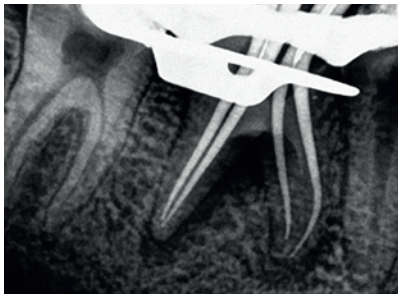


Fig. B: Pre-operative radiograph.

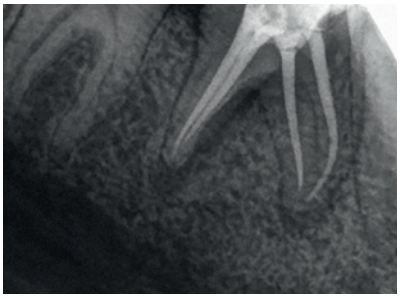
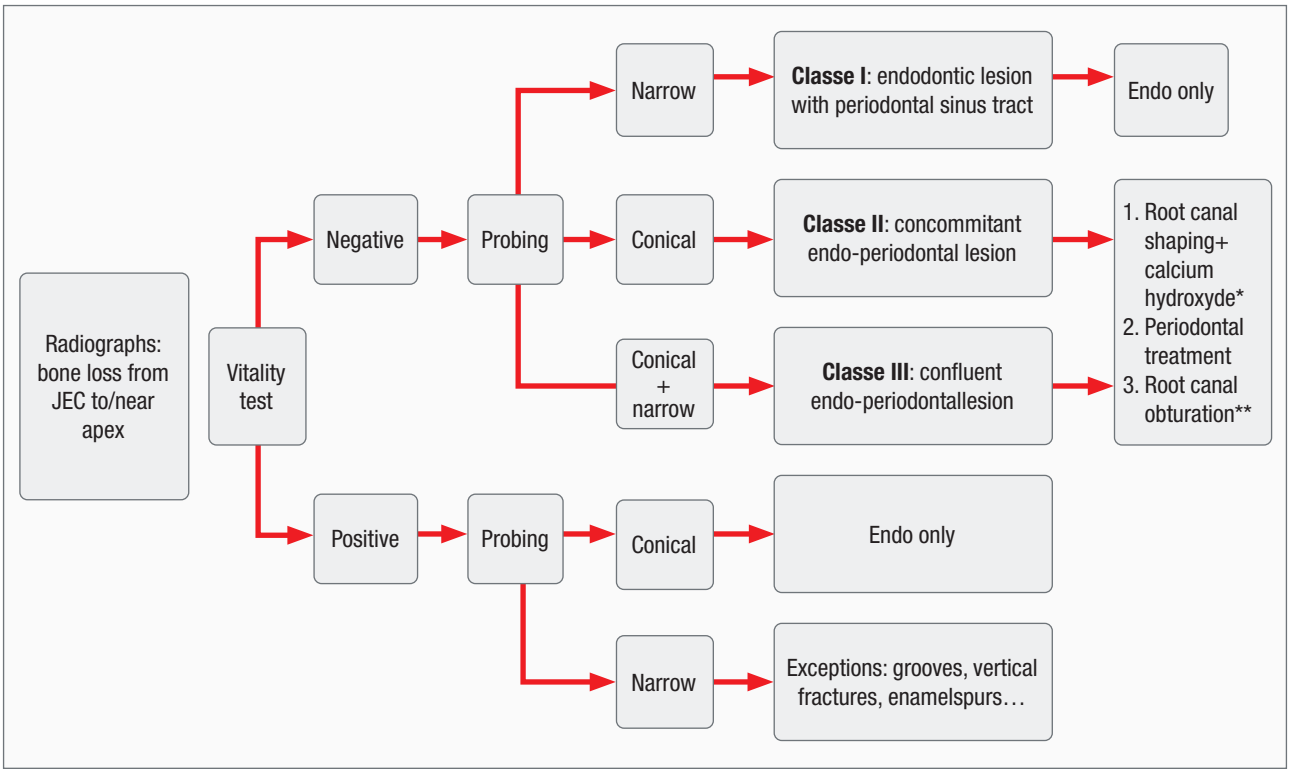


Fig. C: 3 months control radiograph.

Discussion

Decision tree explaining the diagnosis and treatment of each lesion type:



The classification of Gulabivala and Darbor was chosen in 2004 because of its simplicity and clinical interest.

The prognosis of class III is based mainly on the extent of the periodontal lesion.

* Inter-sessional sessions with calcium hydroxide are necessary while waiting for epithelial attachment gain of at least 1mm in order to ensure apical sealing of the canal filling.

**It is preferable to perform a hydraulic condensation technique with bioceramic sealer as root canal filling. (12) An active NaoCl irrigation and final rinse followed by a light drying, can attract the hydrophilic sealer inside the accessory channels which is mainly desired in cases of periodontal endo lesion.

Bioceramics are promising materials in terms of the filling's quality as well as in healing; they have a better capacity to seal the lateral channels via the hydraulic pressure exerted, their surface tension and their hydrophilic character. They stimulate, in addition, tissue regeneration. (10)

The BioRoot™ RCS finds its indication in the teeth with endo-periodontal lesions especially those where there is bone involvement. (13) Indeed the release of calcium hydroxide is more important and more prolonged than other cements. By coming into contact with fluids and dentinal tissues it stimulates bone and periodontal regeneration in a short time. (9)

The presence of sealer beyond the apex is not a sign of failure and will not be followed by symptoms since this cement is less cytotoxic than other cements. It is well tolerated by the body. (11)

Final irrigation should be performed with saline. Any other irrigant such as sodium hypochlorite, EDTA and alcohol can affect the properties of the cement.

Coronal restoration at the end of the treatment is of paramount importance in the prognosis; sealing will prevent bacterial recontamination and will decrease the risk of recurrence. (3)

Prognosis: Depends on extent of periodontal injury

Conclusion

The dual etiopathogenesis of these lesions involves a combination of endodontic and periodontal therapy. (8) It should be noted that the evolution depends essentially on the degree of involvement of the periodontal tissues. (2) But this is not always true: as shown by these different clinical cases, the treatment of the class I is essentially based on the root canal treatment as well as the prognosis and the periodontal treatment is not systematic. (4, 5)

In the management of Class III, the endodontic component is undertaken first and root canal filling will be performed before or after periodontal treatment; this is according to the degree of the periodontal lesion. (6, 7)

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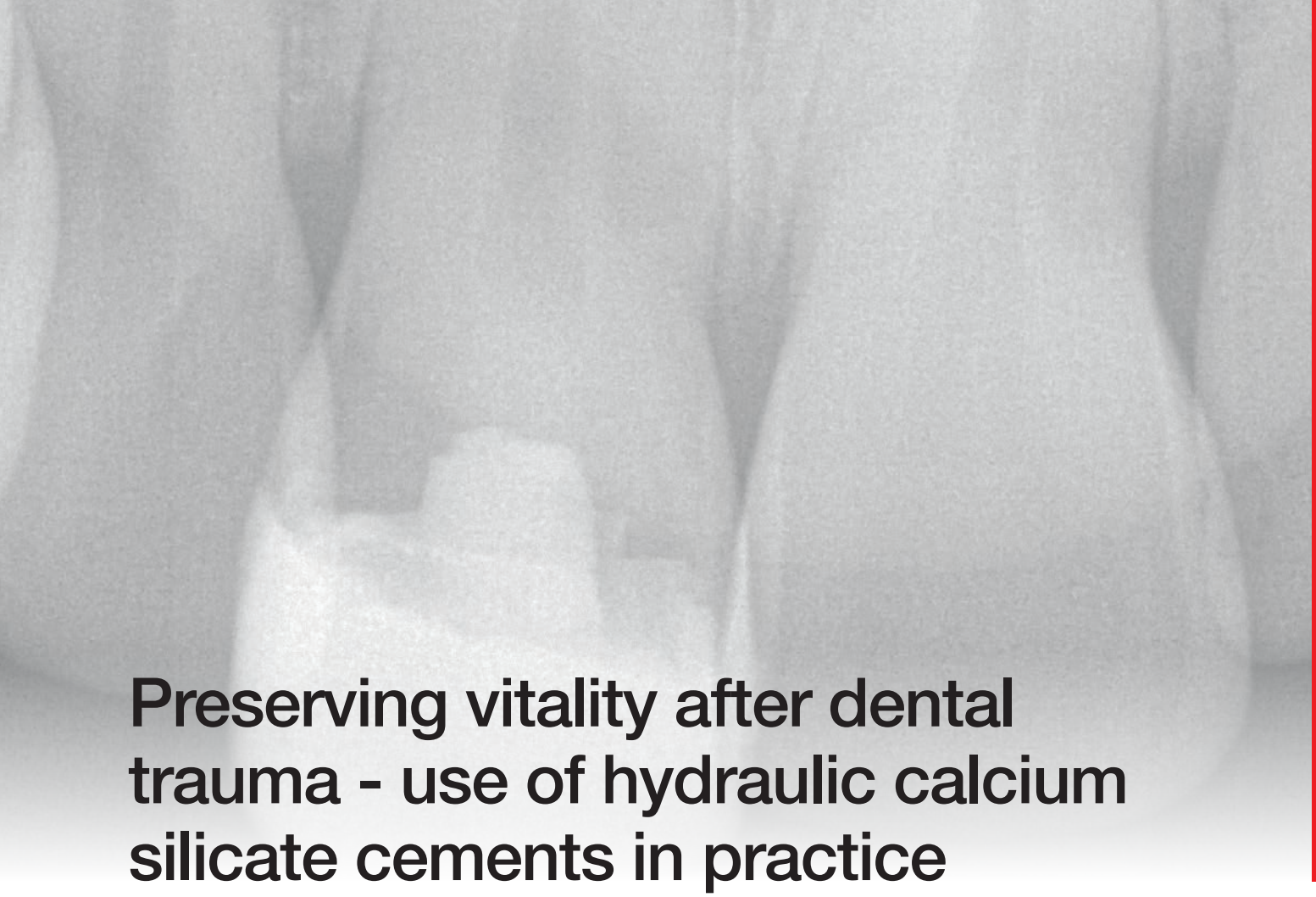

Preserving vitality after dental trauma - use of hydraulic calcium silicate cements in practice

Dr. Sascha Herbst, Prof. Falk Schwendicke, MDPH

From a statistical viewpoint, one in three adults experiences dental trauma during the course of their life, very often during their childhood. Appropriate primary dental care is a priority to ensure the teeth concerned can be preserved for the long term. Pulpotomy plays a key role in such care. Removing a part of the dental pulp can preserve the remaining vital pulp tissue and avoid root canal treatment. The clinical case study below demonstrates the use of pulpotomy with a hydraulic calcium silicate cement.

A dental trauma poses a challenge in everyday practice due to the heterogeneity of cases and treatment options. From a statistical viewpoint, 33% of adults experience dental trauma during the course of their life [1]; there is pulp involvement for 6.4-18.3% [2]. Deciduous teeth are affected by dental trauma more often (22.7%) than permanent teeth (15.2%) [3]. Various therapies are indicated, depending on the extent of the trauma. This article aims to discuss primary care for crown fractures with pulp involvement.

In the first step, comprehensive anamnestic and clinical diagnostics are essential for adequate emergency care after a dental trauma. Correct diagnosis and assessment of the pulp condition are the cornerstones of long-term success in therapy with regard to measures aimed to preserve vitality. The therapy decision is based on the relationship between the duration of unsterile pulp exposure and the extent of pulp inflammation [4]. The latter is characterized by histological damage to the odontoblast layer, vasodilation and granulocyte infiltration into the exposed tissue. The longer the exposure

lasts, the more pronounced the inflammatory reactions will be; if left untreated, complete pulp necrosis can occur [4].

Treatment options include direct capping, partial and full pulpotomy or root canal treatment. In case of direct pulp capping, a capping material is applied directly to the pulp wound while, in the case of pulpotomy, part of the pulp tissue is removed before the capping is applied (partial pulpotomy: about 1-3 mm; full pulpotomy: coronal pulp is removed). In contrast, the entire pulp tissue is removed during root canal treatment.

The success rate after direct capping over the pulp exposed to the oral cavity is around 80 % [5, 6]; direct capping is inferior to partial pulpotomy with the same indication (94-96 % success rate) [7, 8]. The reason for this is that potentially infected tissue is retained during capping and may cause the inflammatory process to progress. In contrast, a partial pulpotomy eliminates this tissue before the pulp stump is capped and is indicated for after up to 48 h of unsterile exposure [4]. A full pulpotomy can be recommended for a period of 48-96 h, depending on the clinical status of the pulp [4]. Root canal treatment should be performed in the case of longer pulp exposure [9].

Fig. 1: Initial clinical situation.

Both calcium hydroxide preparations (Ca(OH)2) and hydraulic calcium silicate cement can be used to dress the pulp wound after a pulpotomy. The use of calcium hydroxide has a long history in dentistry; the material was specified in relation to dental trauma and resorption back in 1930 [10]. Although calcium hydroxide offers good biocompatibility and induces the formation of a hard tissue barrier [11], the material's mechanical stability is inadequate and it is also not permanently impervious to bacteria due to an irregularly shaped hard tissue barrier [12]. Hydraulic calcium silicate cements offer an alternative and are superior to conventional calcium hydroxide compounds due to their biocompatibility, stability and impermeability to bacteria [12].

In the following case study, a 31-year-old male patient came to the Interdisciplinary Walk-In Centre at the CharitéCenter for Oral Health Sciences CC 3 in Berlin in April 2020 around 28 hours after a dental accident. The patient had suffered a syncope incident of unknown origin and received initial medical treatment in a hospital first. He was unable to remember the cause of the accident. On reflection, it was suspected that he had fallen on a stair edge. Once the medical history was obtained, comprehensive intra and extraoral radiographic diagnosis was performed. External skull injuries were ruled out, there were no pathological findings at the trigeminal pressure points and the patient had no problems with temporal and spatial orientation. There were no definite or possible signs of fracture to the maxilla or mandible. The sensitivity tests on teeth 13-23 were positive; Tooth 11 was sensitive to percussion. Moreover, Tooth 11 presented a crown fracture with pulp involvement and a mobility grade of I ***(Fig. 1a, 1b)***. A root fracture was considered unlikely due to the radiographic and clinical presentation.

Fig. 2: Initial X-ray image of condition after front tooth trauma .

Fig. 5: State after pulpotomy and haemostasis.

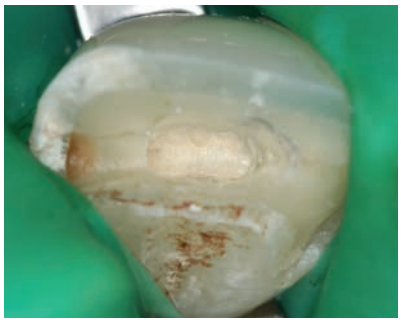

Fig. 6: Prepared pulp capping with Biodentine™.

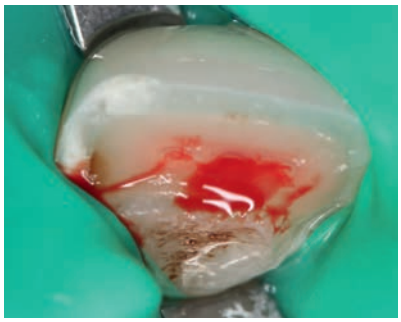

Fig. 3: Bleeding from the pulp after the fibrin layer is removed.

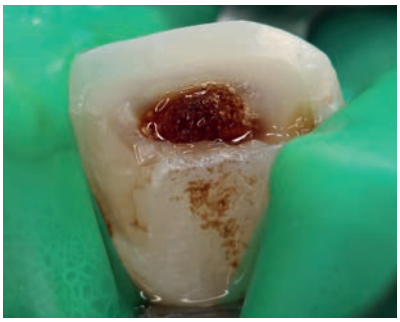

Fig. 4: Haemostasis with 1% NaOCl and sterile foam pellet.

The preoperative X-ray showed a defect in the coronal hard tissue which extended into the pulp chamber ***(Fig. 2)***. Due to an exposure time of less than 48 hours and the specific dental findings, partial pulpotomy was discussed as treatment option with the patient. From a clinical viewpoint, a fibrin coating appeared on the exposed pulp and light red bleeding was induced after initial probing ***(Fig. 3)***.

Using a dental dam to ensure completely dry conditions, infected tissue was gradually removed with a sharp, sterile diamond while irrigating with 1% sodium hypochlorite (NaOCl). Once 3 mm pulp tissue was removed, haemostasis could be obtained with a sterile foam pellet and 1% NaOCl ***(Fig. 3)*** within 3 minutes ***(Fig. 4)***. The pulp stump was then covered with Biodentine™ calcium silicate cement (Septodont, Saint-Maur-des-Fossés, France). After a curing time of 12 minutes, the cavity was cleaned using a sandblaster (Microetcher CD, Danville Materials, San Ramon, US). A temporary adhesive restoration was applied using an etch-and-rinse technique with OptiBond FL (Kerr, Rastatt, Germany), CeramX Duo A1 and Ceram X Flow A2 (Dentsply, York, US) since the patient was unable to tolerate prolonged procedures due to his physical state ***(Fig. 7)***. A radiographic examination was then performed to check the pulpotomy ***(Fig. 8)***. The tooth was subsequently permanently restored alio loco using a customised wax-up and a direct composite core.

Fig. 7: Temporary cover with composite

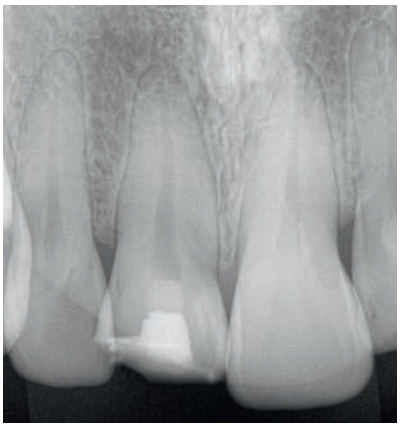

Fig. 8: Periapical radiograph after pulpotomy.

Fig. 9: Periapical radiograph 6 months postoperatively.

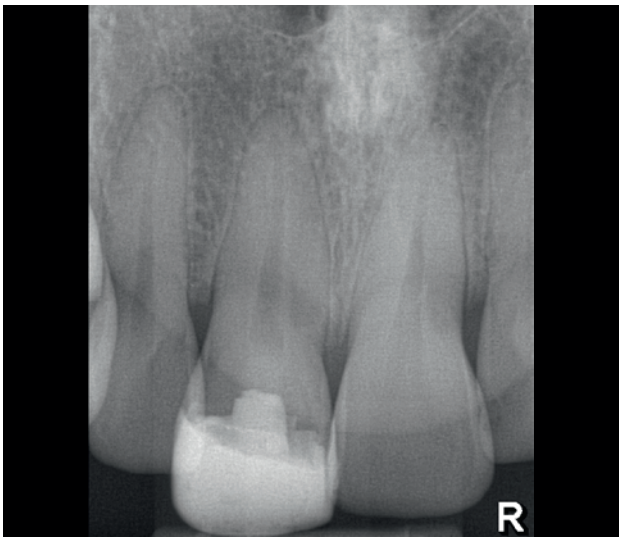

Fig. 10: Periapical radiograph 18 months postoperatively.

After six months, teeth 13-23 presented themselves as vital and insensitive to percussion. No anomalies were detected on radiographic images ***(Fig. 9)***. After 18 months, Teeth 13-23 also responded in the same way to cold and presented no pathological findings clinically and radiographically ***(Fig. 10, 11)***.

In this case study, the treatment decision to use pulpotomy was straightforward since all criteria had been met for predictable treatment: the duration of pulp exposure was less than 48 hours, there was a positive reaction to cold and haemostasis was achieved within a few minutes. Conventional root canal treatment offers an alternative to pulpotomy but is significantly more invasive. Based on the clinical findings, the decision was made in favour of a minimally invasive attempt to preserve vitality. This offers advantages such as a shorter duration of treatment, preservation of the pulp proprioception and avoidance of further loss of hard tooth tissue due to root canal preparation. The reason for choosing Biodentine™ among the wide range of calcium silicate cements was largely due to the tooth region affected since very high aesthetic standards are applied to the anterior teeth. Studies show that, compared to cements with zirconia, the risk of tooth discolouration is significantly increased when hydraulic calcium silicate cements are used with bismuth oxide as an X-ray contrast agent and if there is contact with blood or sodium hypochlorite [13, 14]. As a result, a tricalcium silicate cement was used with zirconia as an X-ray contrast agent with Biodentine™ in this case. However, the disadvantage is the comparatively reduced X-ray opacity, making the distinction between cement and physiological tooth structures somewhat more difficult in the X-ray image ***(Fig. 8-10)*** [15].

Pulpotomy after dental trauma is a reliable, minimally invasive treatment for preserving pulp vitality. Hydraulic calcium silicate cements deserve particular interest as a first choice material since they excel due to their excellent biocompatibility, mechanical stability and associated high success rate.

Fig. 11: Clinical situation after 18 months.

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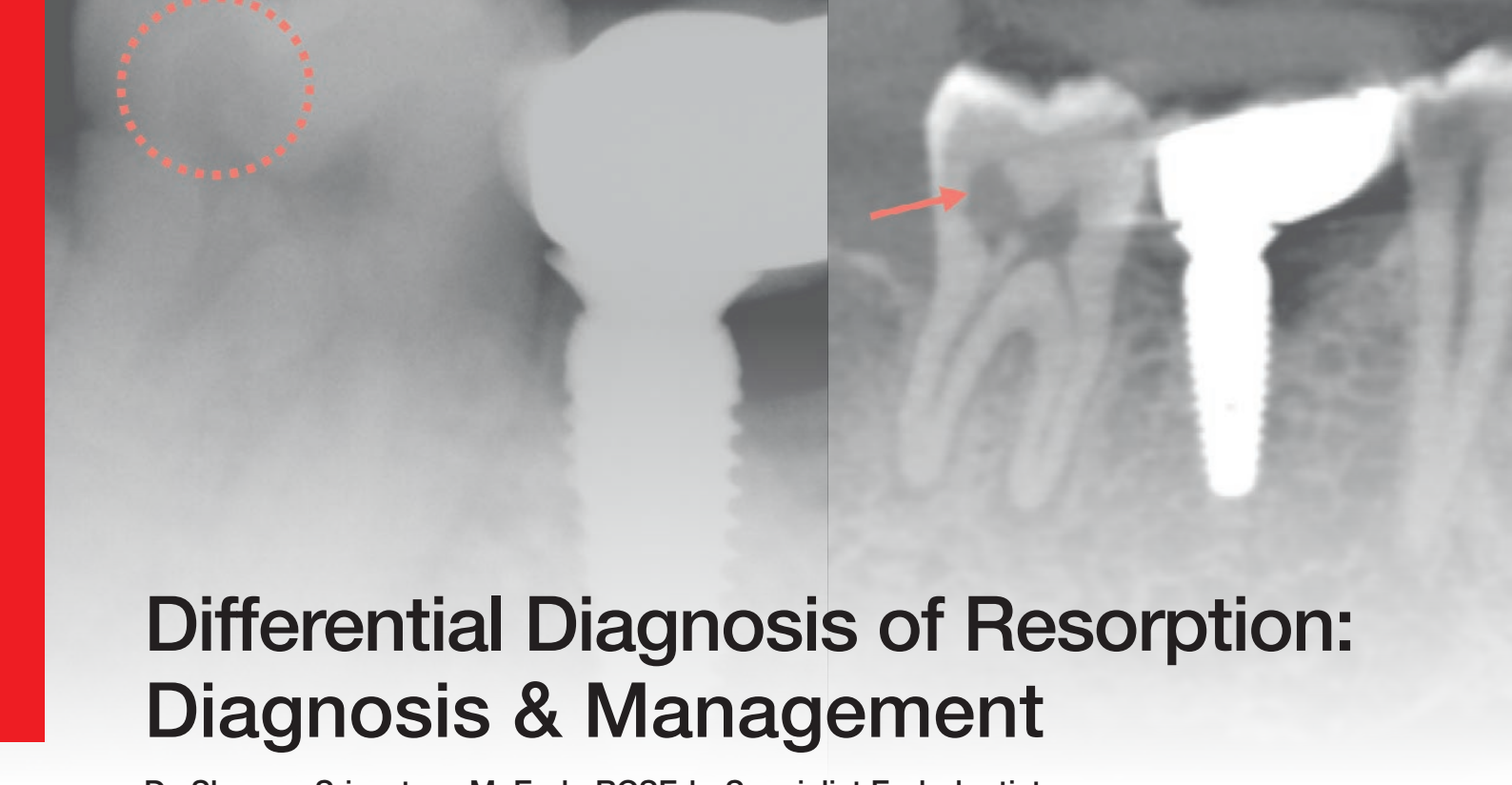

Differential Diagnosis of Resorption: Diagnosis & Management

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Introduction

This case focuses on the diagnosis and management of internal inflammatory resorption (IIR), using Biodentine™ as a bulk fill due to its enhanced physical and chemical properties, as well as its ability to cease clastic activity.

Resorption in permanent teeth is undesirable, since it is of a pathologic origin, driven by clastic cells leading to the destruction of mineralized cementum or dentine. (1) It can be classified based on histology, aetiology or its origin in literature. (2-6)

In adults, root resorption is caused by osteoclast like multi and/or mononucleated cells called odontoclast. This process is usually initiated when there is damage to the unmineralized organic cementoid and predentin, which protects the root from external and internal root resorption respectively. This is due to the inability of clastic cells to adhere to unmineralized surfaces. (6, 7)

Resorption can be classified as internal and external, and further classified as; internal inflammatory resorption; internal replacement resorption; external inflammatory resorption; external cervical resorption; external replacement resorption; surface resorption, and transient apical breakdown, which are categorized under external resorption.

The process of resorption occurs over three stages: initiation, resorption, and repair (8). It is understood to be a self-limiting process and can go undetected clinically. After its initiation, if the resorptive surface is sustained by infection/or pressure, the destruction of hard dental tissue will continue leading to the tooth becoming unsalvageable over time.

Resorption is poorly understood and often misdiagnosed. The use of CBCTs in Endodontics has significantly improved the detection of internal and external resorption, and provides a 3-D representation of the lesion size, location, extent and proximity to the pulp. (9-17)

Internal inflammatory resorption (IIR) usually occurs when there is damage to the predentin, either by trauma due to physical/chemical irritation and/or by bacterial infection in pulpal

inflammation. Typically, in IIR lesions, the pulp tissue, coronal to the resorptive site will be necrotic, while the apical portion remains vital, providing nutrients to the odontoclasts for the progression of the resorption. The resorption ceases when the pulp in the entire canal is necrotic/loses vitality. (1, 4, 5)

IIR lesions are granulomatous in nature, and profuse bleeding on probing can be observed, which will cease after the removal of the pulp and the granulomatous tissue.

In vital teeth, IIR is usually diagnosed when a patient exhibits signs or symptoms of reversible or irreversible pulpitis, whereas in cases where the tissue is completely necrotic, IIR is diagnosed radiographically when the patient presents with signs and/or symptoms of apical periodontitis.

The literature has described these lesions as a radiolucent symmetrical round or oval ballooning of the root canal wall, but in reality, the radiographic appearance of these lesions might not adhere to its rigid presentations. (18)

Although parallax radiographs might help determine the position of the lesion, periapical radiographs have their limitations in differentiating external cervical resorption from internal resorption. The full extent of the lesion cannot be determined, and often can lead to misdiagnosis, especially in multi-rooted teeth, due to the superimposition of the unaffected tooth over the affected root.

During the management of IIR, a small field of view (FOV), high-resolution CBCT is recommended to determine the exact nature, location, and extent of the IIR, and whether it has perforated the root (4, 17). All these factors affect the outcome of the treatment.

Due to the irregularities within these defects, energized irrigation (19), inter-appointment medication (17, 20), followed by obturation using thermoplasticised gutta-percha is recommended.

In very rare cases external cervical resorption, can occur internally, initiating itself within the tooth prior to perforating the PRRS (Protective Resorptive Root Sheath). Keeping this in mind as a differential diagnosis, Biodentine™ is an ideal material to use to cease any potential clastic activity.

Clinical Case

A 39-year-old male was referred to a specialist private practice for the endodontic assessment of pain associated with the lower right quadrant (LRQ). The patient complained of an intermittent dull ache during mastication, and occasional radiating pain along the LRQ region without any stimuli. The LR6 was extracted 3 years ago and was replaced with an implant. The patient has history of parafunction but does not wear a nightguard.

The patient was medically fit and well.

Clinical examination revealed good oral hygiene, a minimally restored dentition and BPE (Basic Periodontal Examination) scores of 112/121.

The LR5 was unrestored and responded within normal limits to Endofrost (Coltène/Whaledent, Langenau, Germany).

The LR7 did not respond to Endofrost. The tooth was tender to percussion, and tender to palpation. The LR7 was unrestored, with no obvious signs of caries, although there was a crack along the buccal aspect of the tooth. The probing depths were within normal limits, even along the buccal crack.

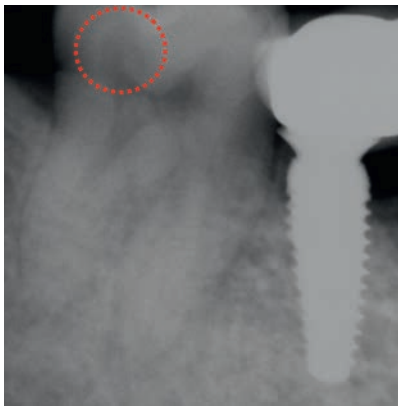


Fig. 1: Pre-Operative Periapical Radiograph of the LR7. The Red Circle encapsulates the Diffuse Radiolucency, which is suggestive of resorption.

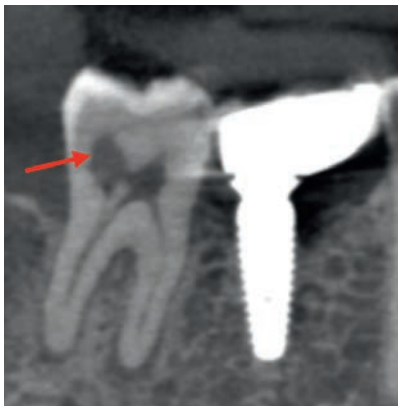


Fig. 2: Sagittal Slice; Red Arrow shows the extent of the resorption in a bucco-lingual plane.

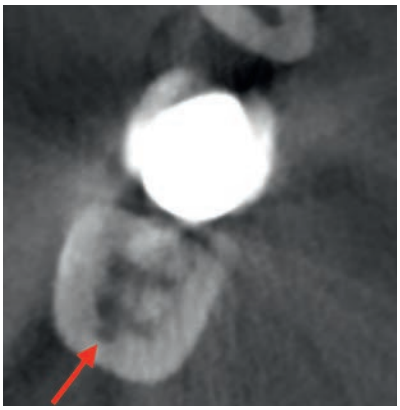


Fig. 3: Axial Slice; The red arrow shows the resorption perforating the PRRS, and extending into the distal aspect of the coronal pulp.

Fig. 4: Obturation.

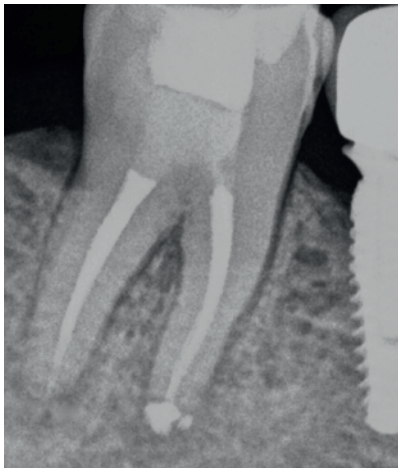
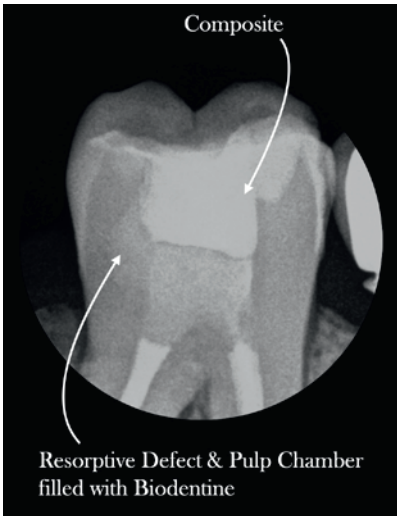


Fig. 5: Post-Operative Radiograph.



The periapical radiograph of the LR7 revealed a diffuse radiolucency ***(Fig. 1)*** adjacent to the distal pulp horn, a pulp stone in the coronal third of the distal canal and a periapical pathology associated with the mesial and distal roots. A small FOV (5x5cm) CBCT was taken to further assess the diffuse radiolucency.

The CBCT scan confirmed the presence of internal resorption in the coronal third of the pulp chamber, encapsulating the distal pulp horn ***(Fig. 2 and 3)***.

A diagnosis of Chronic Apical Periodontitis associated with a necrotic pulp, and Internal Inflammatory Resorption was reached for the LR7.

After discussing the various treatment options, the decision to perform a root canal treatment and internal repair of the resorptive defect was made, subject to restorability.

The LR7 was isolated with a rubber dam. The operating field was disinfected using 5.25 % Sodium Hypochlorite (21) and accessed in a conservative fashion. The pulp chamber was cleaned and refined with ultrasonics. The pulp stone in the distal canal was detached and removed with the help of ET25 ultrasonic tips (Acteon, France).

The canals were coronally flared using ProTaper Gold SX files (Dentsply Sirona, USA) and a glide path was achieved using a #10 flex-o K file, and patency was confirmed using an apex locator (Eighteeth, E Connect S).

Chemo-mechanical preparation was completed using ProTaper Next (Dentsply Sirona, USA) up to X2 (25/06), 0.5mm short of the ‘0’ reading. 5.25% sodium hypochlorite was used as an irrigant after every file sequence.

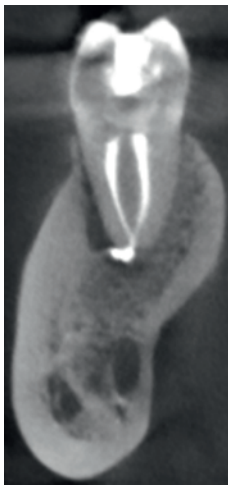


Fig. 6: Post-Operative view of the mesial canals in the coronal slice.

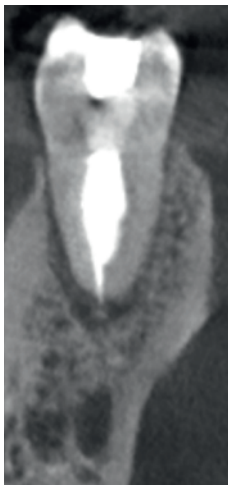


Fig. 7: Post-Operative view of the distal canal in the coronal slice.

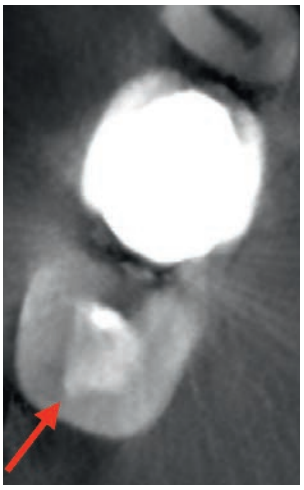


Fig. 8: Post-Operative view of the resorptive defect condensed with Biodentine™ (Red Arrow).

Following the chemo-mechanical preparation, the canals were irrigated with 17% EDTA, and the liquid was activated using an Endo-activator (Dentsply Sirona, USA). The canals were then rinsed with 5.25% Sodium Hypochlorite and then dried with paper points. Since BioRoot™ RCS (Septodont, France) was being used a sealer in the mesial canals, they were washed gently with saline, and aspirated to provide moisture for the setting reaction of the calcium silicate sealers.

The canals were obturated with a single cone technique (X2 gutta percha) using BioRoot™ RCS with hydraulic condensation.

After completion of the root canal treatment, the resorptive defect was debrided using rose head burs, and disinfected with cotton pellets soaked with 5.25% Sodium Hypochlorite. Biodentine™ (Septodont, France) was mixed as per manufacturers recommended instructions, and the entire pulp chamber was restored with the calcium silicate cement up till the coronal most extension of the resorptive defect.

Following the initial setting time of 12 minutes, a composite core (Herculite XRV Unidose; Kerr Italia, Scafati, Italy) was placed in the LR7. The tooth surfaces and Biodentine™ was etched with 37% phosphoric acid, followed by the application of a bonding agent (OptiBond Solo Plus; KerrHawe, Bioggio, Switzerland).

A post-operative CBCT was taken in this case ***(Fig. 6, 7 & 8)***, to ensure the resorptive defect was well filled, and the lesion could be monitored in 3-Dimensions over time.

The patient was reviewed at 6 months to assess healing of the lesions, as well the ceasing of the progression of the resorption, prior to cuspal coverage.

The review shows healing of the lesions associated with the mesial and distal roots, and no further progression of the resorption ***(Fig. 9, 10 & 11)***.

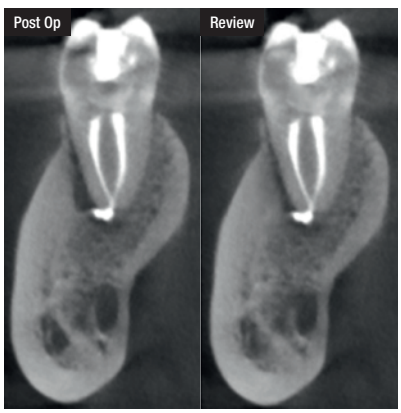


Fig. 9: Coronal Plane; Healing of the periapical lesion associated with the mesial root.

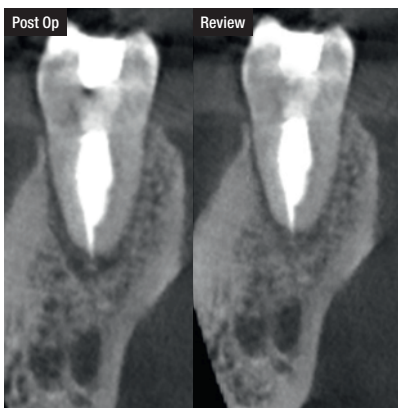


Fig. 10: Coronal Plane; Healing of the periapical lesion associated with the distal root.

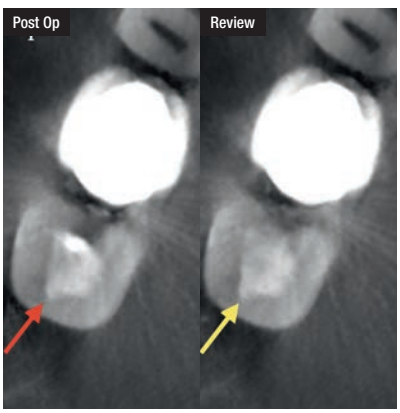


Fig. 11: Axial Plane: Resorptive defect condensed with Biodentine™ (Red Arrow), has remained unchanged (Yellow Arrow) at 6 months.

Discussion

The objective of treatment with regards to resorption is, to cease clastic activity to prevent further loss of mineralized tooth structure.

Internal inflammatory resorption ceases once the tooth has lost its vitality. The position of the IIR in this case could also mimic a very rare External Cervical Resorption (ECR), which can initiate within the tooth, without an external portal of entry, and spread around the protective resorptive root sheath (PRRS) prior to perforating it, which could lead to inflammation of the pulp, and cause pulp necrosis.

The diagnosis of IIR was made based on the presenting spread of the resorption. After the tooth was accessed, the entire coronal pulp, as well as the radicular pulp in the mesial canals were completely necrotic. The distal canal was partially necrotic, and there were areas of irreversibly inflamed hyperemic tissue, either granulomatous or fibro-vascular in nature, in the resorptive defect above the distal pulp horn, which could be the contributing factor for the clastic activity and eliciting symptoms of pulpitis.

Non-Surgical Root Canal Treatment was completed with a single cone technique using BioRoot™ RCS with hydraulic condensation, which has demonstrated high success rates in endodontic treatments. (22, 23)

Biodentine™ sets upon hydration, a process which leads to ion/molecule release. These so-called by-products inhibit bacterial growth and interact with surrounding tissues, leading to the dampening of inflammatory reactions and inducing healing in the form of repair and regeneration.

The sustained release of calcium hydroxide aids in ceasing any clastic activity by alkalinization of these lesions, making it an ideal material to be used to restore the resorptive defect in this case.

Biodentine's interaction with dentine is a combination of micromechanical as well as chemical interaction between the two substrates. Tag-like structures can form within the dentinal tubules which may reflect a micromechanical retentive mechanism to hold the cement in place (23, 24). This explains the improved shear bond strength with dentine over time and has a similar bond strength to glass ionomer cement to dentine (25, 26).

Biodentine™ is the only resin-free tricalcium Silicate-based material which has high mechanical properties, after a short setting time, which are similar to dentine. The compressive strength of Biodentine™ (300MPa) is comparable to that of natural dentine (297 MPa) (27), which is an important property to withstand masticatory forces. This property allows the material to be used as a bulk fill and as a dentine substitute.

It also acts a liner to seal the pulpal floor preventing any leakage via inter-radicular or sub-pulpal floor canals.

Additionally, the 12-minute initial set of the material allows it to be bonded with different types of adhesives, finishing of the final restoration with composite in a single visit.

The cuspal coverage restoration was delayed until the 6-month review, to ensure healing of the peri-apical lesion, and no further progression of the resorption, as the latter could not have been monitored with a definitive restoration using a CBCT.

Conclusion

Biodentine™ is bio-interactive with surrounding environment and tissues through ion-rich pore solution enriched with calcium hydroxyl ions. This solution is responsible for the alkaline etching of dentine as well as the production of apatite minerals and calcium carbonate in the presence of body fluids. Such interactivity may grant an improved seal for the cement dentine interface combined with the biological and antimicrobial effects of released ions.

While Biodentine™ shares comparable physical and chemical properties with calcium silicate cements, this material has significantly higher mechanical properties, and has the advantage of shorter setting time allowing its use as a therapeutic coronal restorative material besides its uses in Endodontics.

Biodentine™ is an invaluable component and should be a stalwart material in a practioner's armamentarium, bridging restorative and endodontic applications.

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He specialises in: Failures of Endodontic Treatments; Complex Diagnosis & Multidisciplinary Treatment Planning using CBCTs; Apical Microsurgery; Intentional Replantations; Vital Pulp Therapies; Dental Trauma and Restorations of Endodontically treated teeth.

Shaurya currently works in referral practice in Mumbai, and speaks nationally as well as internationally on topics that have an impact on Endodontic Outcomes, such as Diagnosis & Use of CBCTs in Endodontics; & Evidence Based Treatments & Outcomes using Calcium Silicate Materials.

All treatments provided are using the latest peer-reviewed evidence and in accordance with the European Society of Endodontology.

Instagram: Shaurya.endo

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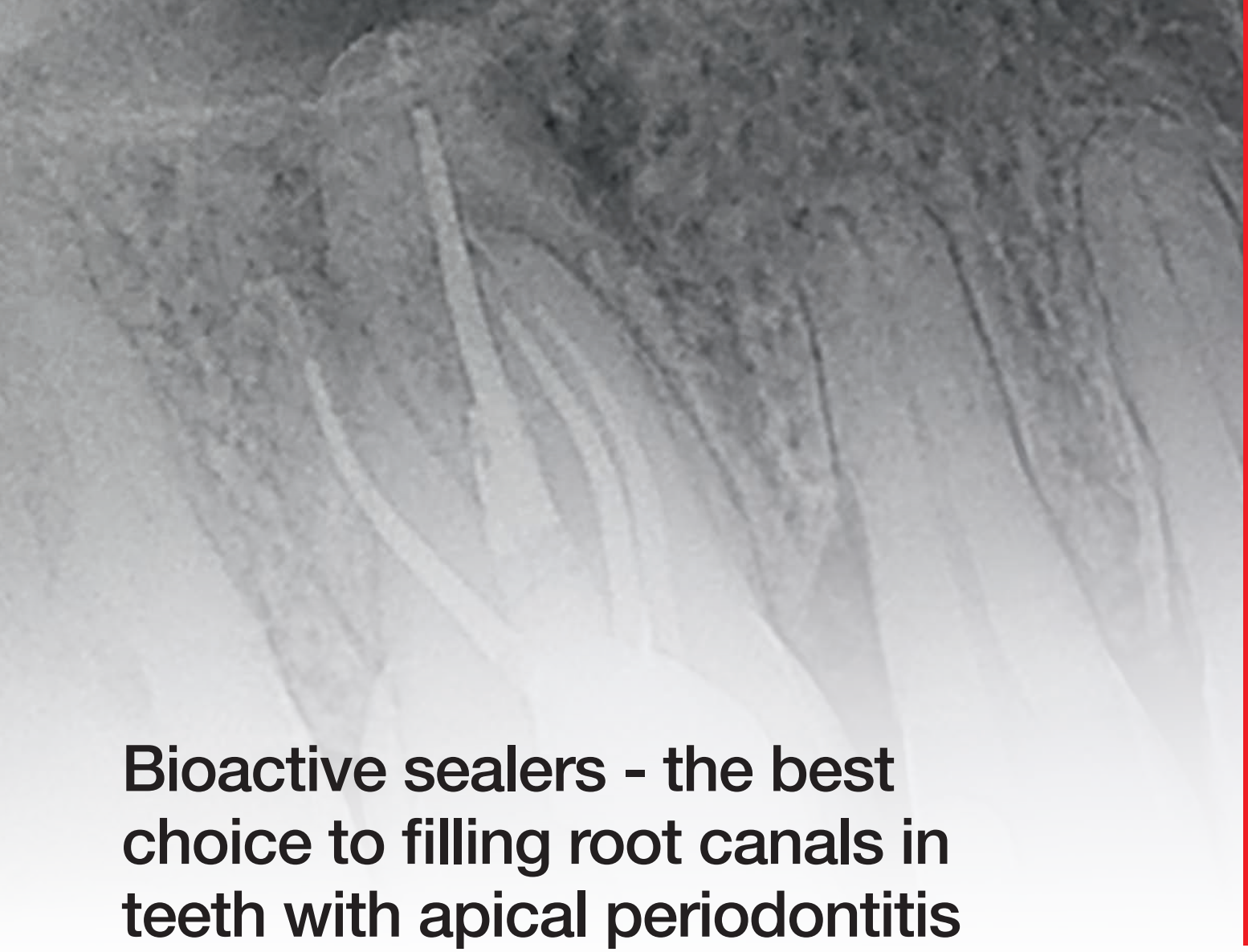

Bioactive sealers - the best choice to filling root canals in teeth with apical periodontitis

Dr. Fabiano Souza Pereira

Summary

Introduction: The goal of this paper was to present a case report of symptomatic apical periodontitis of permanent maxillary molar in which was applied a single cone technique root filling with Calcium silicate–based endodontic sealer.

Methods: After adequate disinfection of the root canal system, the root canals were filled using the single cone technique with BioRoot™ RCS (Septodont, Saint-Maur-des Fosses, France)

Discussion: Sealers with the ability to enhance osteogenesis have the potential to promote faster and more predictable healing of apical periodontitis. Thus, the knowledge of sealer with these potentials can improve our ability to choose a better endodontic sealer to be used in cases of extensive apical lesions.

Conclusion: The single cone technique with a calcium silicate bioactive sealer BioRoot™ RCS has the potential to be adjuvant in a fast and complete healing of extensive periapical lesion after adequate disinfection of the root canal system.

Introduction

Apical periodontitis (AP) is an inflammatory disease affecting the tissues surrounding the root end of a tooth and is caused by root canal infection (1). Due to various pathological flora, teeth with AP can have significant influence on the endodontic treatment prognosis (1,2). The root canal treatment aims to enable the healing AP occurs by the decontamination of the root canal system (RCS) provided by strategies from the mechanical preparation, root canal irrigants such as sodium hypochlorite, intracanal dressing, obturation and coronary sealing.

Root canal sealing is an essential phase of endodontics to ensure the success of the treatment. This phase is characterized by the sealing of the entire root canal that can be mechanical with materials providing a hermetic seal and/or also from a biological origin. In this case, the filling material induces a hard tissue formation by the periodontal ligament cells, isolating the root canal from the surrounding tissues and stimulating the healing processes of the damaged apical tissues (3).

The introduction of tricalcium silicate cements in endodontic therapy has contributed to elevate the success rates in all kinds of endodontic treatment. The first calcium silicate-based cement has been developed for use in endodontic indications was the mineral trioxide aggregate (MTA) (4). Since then, endodontists and general practitioners have appreciated the high success rate in its applications. The positive results of MTA encouraged the development of a variety of calcium silicate materials also known as bioceramic products (5). They are produced in putty and sealer consistencies, powder and liquid-gel system or ready-to-use. The sealer consistency allowed to use the bioceramics as a conventional root canal filling material.

BioRoot™ RCS (Septodont, Saint-Maur-des-Fosses, France) is a powder/liquid hydraulic tricalcium silicate-based cement recommended for single cone technique or cold lateral condensation root filling. The powder contains tricalcium silicate, povidone and zirconium oxide; the liquid is an aqueous solution of calcium chloride and polycarboxylate. (6) BioRoot™ RCS has antimicrobial activity (7), moreover, it presents bioactivity with calcium release, strong alkalizing activity and apatite forming ability. (6)

Based on further endodontic treatments that have been benefited greatly from tricalcium silicate endodontic cements, it is important to report and discuss the results of treatments in which the newer generation of calcium silicate sealers have currently been used. The main goal of this paper was to present a case report of symptomatic apical periodontitis of permanent maxillary molar in which was applied a single cone technique root filling with BioRoot™ RCS sealer with 3 and 15-months follow-up.

Case report

A 31-year-old female ASA 1 (American Society of Anesthesiologists) was referred to a private dental clinic with complaints of a severe throbbing pain, sensitivity to chewing and biting, positive to apical palpation and a small swelling in the palatal region of tooth 16. There was no response on the pulp vitality test and a grade II tooth mobility was present. The preoperative radiograph ***(Fig. 1a)*** showed a mesio-occlusal composite in touch with the pulp cavity of tooth 16. A large area of radiolucency in the apical area was observed along the palatal root apex. A cone beam computed tomography (CBCT) revealed a great bone destruction in the palatal root heading into furcation region and it was also breaking the palatal cortical bone in the middle third of the root. Besides that, the CBCT showed some small lesions in the buccal apex's roots. ***(Fig. 2,3)***. The diagnosis was a symptomatic apical periodontitis (acute apical abscess).

During the first session the pulp chamber was accessed and a drainage of purulent exudate could be obtained through the root canals. ***(Fig. 1b)***. In the sequence, the mechanical preparation was performed with rotary files Logic (Easy, Dentistry products, Brazil). The last file used in the apical foramen limit of buccal root canals was tip 35 and taper .03 The palatal root canal was enlarged up to tip 40 and taper .03. Some sodium hypochlorite 2,5% was used during all the mechanical preparation. After the canal preparation, a volume of 40 ml of sodium hypochlorite was delivered inside each root canal and the final irrigation was applied with 10ml of saline solution. Next, the root canals were dried with paper points and it was found out that no purulent exudate was present in the pulp cavity. Ultimately, the calcium hydroxide (Ultracal XS, Ultradent, South Jordan, UT, USA) was put inside the 4 root canals and an antibiotic medication of amoxicillin-clavulanic acid was prescribed per seven days period and the patient was also oriented to take an analgesic Ibuprofen for three days.

After 14 days in the second session, the patient reported no symptoms and the root canals were filled using the single cone technique with a bioactive sealer BioRoot™ RCS (Septodont, Saint-Maur-des-Fossés, France). The cavity access was restored with a composite resin and the patient was also informed about the need for the follow-up. New CBCT scans were taken at 3 and 15 months post treatment and they showed a complete healing of periapical lesions. The treatment sequence and follow-up can clearly be seen in Figures 1-9.

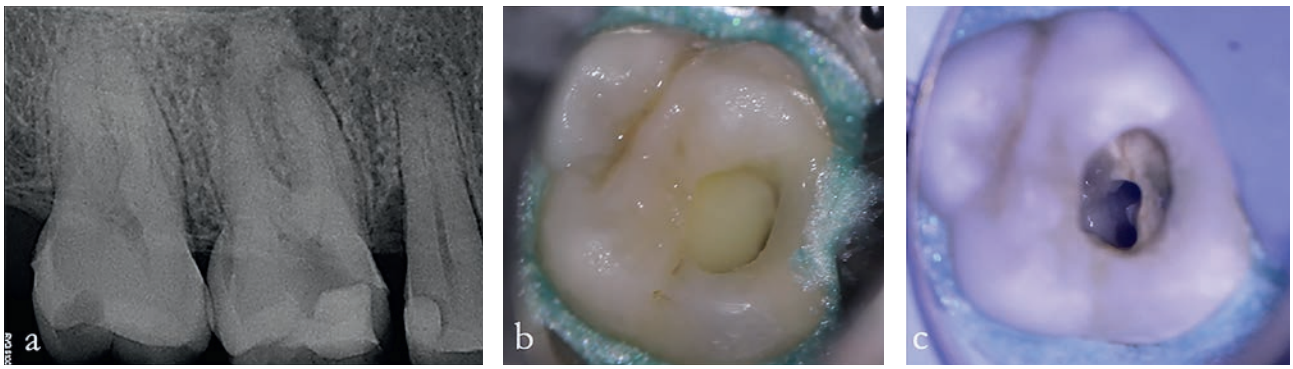

Fig. 1: Preoperative radiograph (a) and clinical aspects (b-c): drainage of purulent exudate and mechanical preparation.

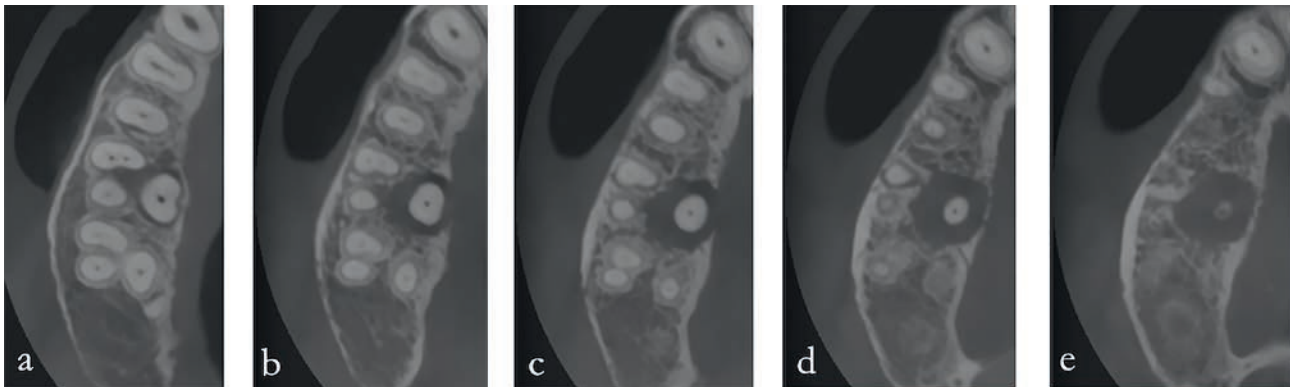

Fig. 2: Preoperative CBCT axial imagens (a-e): cervical third (a); midle third (b,c); apical third(d,e).

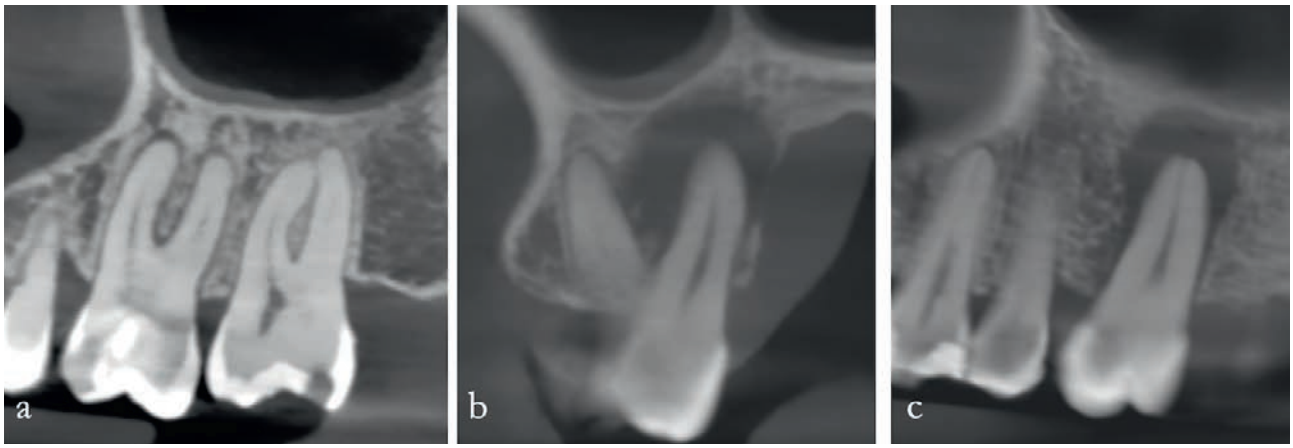

Fig. 3: Preoperative CBCT sagital image (a); coronal images (b,c). Note extensive bone destruction on palatal root and furcation region.

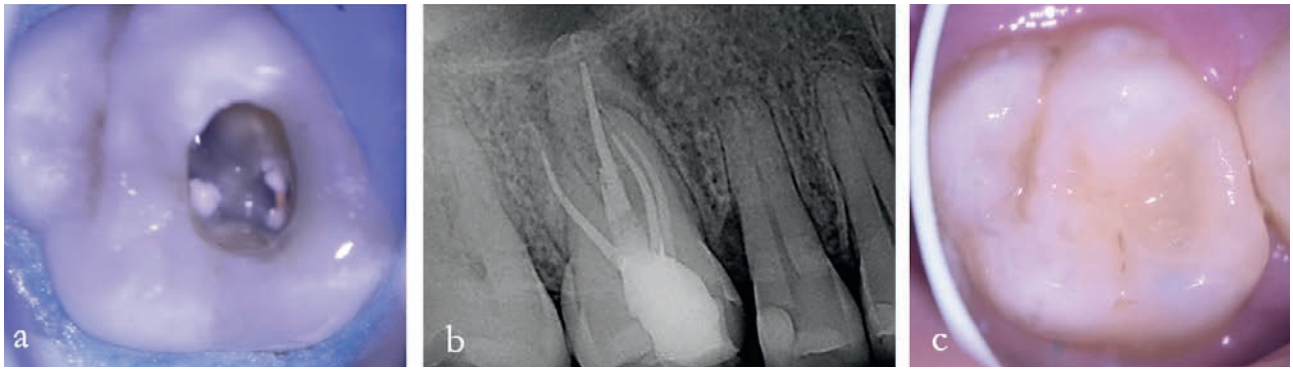

Fig. 4: Filling root canals with BioRoot™ RCS with single cone technique (a,b); cavity access was sealed (c).

Fig. 5: Follow up at 3 months (b) and 15 months (c). CBCT sagittal images of buccal root canals.

Fig. 6: Follow up at 3 months (b) and 15 months (c). CBCT coronal images. The blue arrows indicate the sealer at apical foramen of palatal root canal (b) and a probably hard tissue into 2 final millimeters of the root end (c).

Fig. 7: Follow up at 3 months (b) and 15 months (c). CBCT sagittal images. The blue arrows indicate the partial new bone formation (b) and a complete healing (c) of apical lesion on palatal root canal.

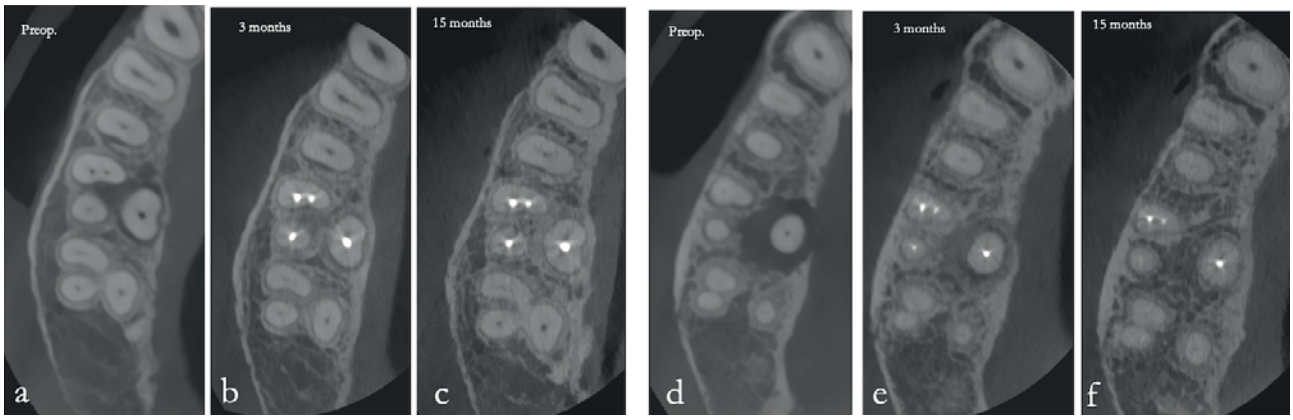

Fig. 8: Follow up at 3 months (b,e) and 15 months (c,f). CBCT axial images. Note the new bone in the furcation region (b,c). Observe the complete healing of cortical palatal bone at midle third (d,e).

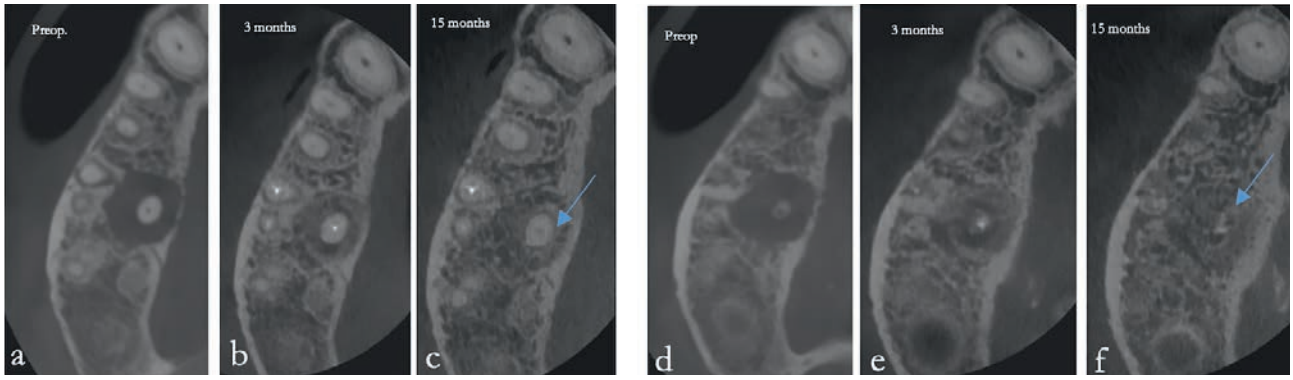

Fig. 9: Follow up at 3 months (b,e) and 15 months(c,f). CBCT axial images of 2 final millimeters of the root canals. Note the complete formation of a new bone (c,f).

Discussion

The scientific community have tested a diversity of materials and techniques for root canal sealing aiming achieve an adequate seal for the root canal system to prevent tooth reinfection (2,3,8,9,10). Currently there is a great tendency to use bioactive sealers because of their outstanding biological properties (3).

BioRoot™ RCS has fewer toxic effects on periodontal ligament cells than zinc oxide eugenol sealer and induced a higher secretion of angiogenic and osteogenic growth factors than zinc oxide-eugenol (3). These characteristics support the fast bone repair at 3 months showed in this case report. The destruction of periapical cortical bone in the palatal root was totally recovered ***(Fig. 6b,8e)*** and at the end of 15 months the periapical lesion was completely healed ***(Fig. 5c,6c,7c,8f,9f)***. Sealers with the ability to enhance osteogenesis have the potential to promote faster and more predictable healing of apical periodontitis (3,11,12,13). Thus, the knowledge of sealer with these potentials can improve our ability to choose a better endodontic sealer to be used in cases of extensive periapical lesions.

Calcium silicate–based sealers have shown high solubility after immersion in water compared with the standard resin-based sealers (14,15). The solubility of calcium silicate–based sealers can be explained by the release of OH- and Ca+2 ions that provide an alkaline environment contributing to the formation of mineralized tissues (14). In our report, we can speculate that it happened. In CBCT recall of 15 months, observe into the 2 final millimeters of palatal root canal the loss of sealer material ***(Fig. 6b)*** with a probably hard tissue formation at the apical foramen. ***(Fig.6c)***

Root canal filling plays an important role in the long-term success of endodontic treatment, but it is important highlighting that a root-filling material with the obturation technique used there, is no less important than any step of the root canal treatment. Although calcium silicate materials have already had a great impact on endodontic treatment, further studies as clinical investigations should be conducted to confirm the results obtained so far in a simple case report.

Conclusion

The single cone technique with the bioactive sealer BioRoot™ RCS has the potential to be adjuvant in a fast and complete healing of extensive periapical lesion after adequate disinfection of the root canal system.

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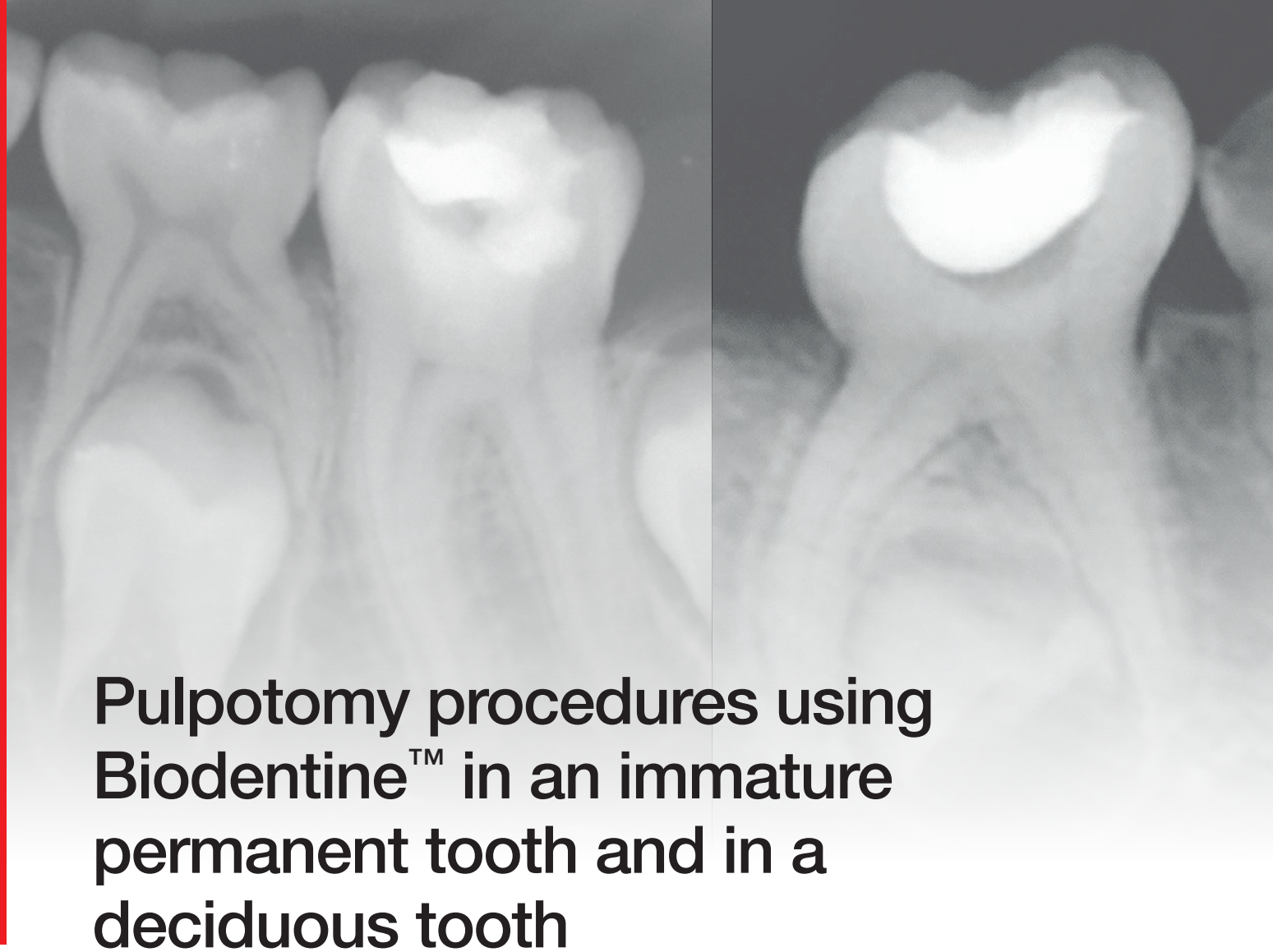

Pulpotomy procedures using Biodentine™ in an immature permanent tooth and in a deciduous tooth

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Summary

Introduction: Calcium silicate-based cements have demonstrated remarkable clinical outcomes, and, among others, Biodentine may be considered a valid option in the treatment of primary and permanent teeth and a promising material to be applied in different area of endodontics.

Methods: Two cases of vital pulp therapy in a deciduous and an immature permanent tooth have been reported. Pulpotomy procedures were performed using Biodentine as pulp dressing material in both cases. Clinical and radiographical follow-up were performed until 1-year post-treatment.

Discussion: Biodentine demonstrated a 100% success rate in both reported cases showing to be more than suitable as pulpotomy material. Specifically, in case of immature permanent tooth, apexogenesis was appreciated.

Conclusion: Biodentine demonstrated a great induction of new hard tissue formation and may be considered a valid choice in vital pulp therapy.

Introduction

Calcium silicate-based cements have demonstrated remarkable outcomes mainly in endodontics and have resulted in predictable, safe, and successful therapies [1-3]. These cements are considered as unique ceramic compounds capable to react with water forming a solid mass [4]. Among others, Biodentine™ demonstrates a greater resistance to compression and flexion than other tricalcium silicate-based cements as well as sealing properties, bonding strength, and a great release of calcium ions [5-7]. In addition, Biodentine™ shows better results when compared to MTA in terms of handling, reduced setting time, and color stability, caused by the absence of bismuth oxide [8].

Due to these reasons, Biodentine™ can be considered a valid option in the treatment of primary and permanent teeth and a promising material that can be applied in different area of endodontics [9]. Among others, vital pulp therapy provides favorable clinical survival results over time, allowing maintenance of vitality of primary teeth until their natural exfoliation as well as apexogenesis in immature permanent ones [10].

Case report

Case 1: cariously exposed immature permanent tooth

A deep carious lesions involving the mandibular first molar (3.6) was observed in a female patient aged 6 years, as previously reported by Bossù et al [1]. The dental element presented immature root formation and reversible pulpitis. Vital pulp therapy was carried out to allow apexogenesis. Briefly, after local anesthesia and rubber dam isolation, the caries was removed and the pulp tissue was exposed. Coronal pulp was amputated by high-speed diamond bur under abundant irrigation. Hemostasis was achieved using sterile cotton pellets moisturized with saline solution within 5 minutes. Then, Biodentine™ was prepared according to the manufacturer's instructions and placed on radicular pulp stumps with a thickness of 2-4 mm. Definitive restoration with resin composite was performed after 3 days, once the cement hardening was clinically appreciated by a dental probe. Periapical radiographs were obtained immediately after pulpotomy procedures (baseline) ***(Figure 1a)***, then the element was clinically and radiographically evaluated after 1 ***(Figure 1b)***, 3 ***(Figure 1c)***, and 12 months ***(Figure 1d)***.

Clinical evaluation revealed an absence of pain, discomfort, swelling or inflammation at every time point, reporting a success rate of 100%. The absence of pulp reaction was further confirmed by the radiographic assessment, as demonstrated by the progressive formation of the dental roots, closure of the apical foramina as well as the increase of root walls thickness.

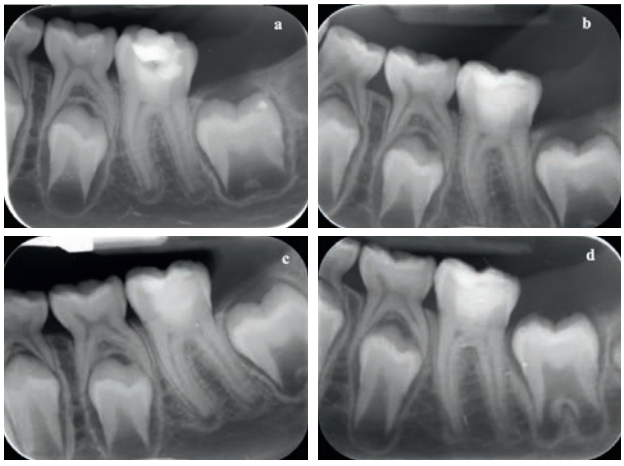

Fig. 1: Periapical radiographs of the dental element (3.6) treated with Biodentine™. a. immediately after vital pulp therapy (Baseline); b. at 1 month; c. at 3 months; d. at 1 year of follow-up. Progressive formation of the dental roots could be observed over time with an absence of periapical reaction.

Case 2: cariously exposed deciduous tooth

A deep carious lesions involving the mandibular second deciduous molar (8.5) was observed in a male patient aged 5 years. The dental element presented reversible pulpitis, therefore vital pulp therapy was carried out. Briefly, after local anesthesia and rubber dam isolation, the caries was removed and the pulp tissue was exposed. Coronal pulp was amputated by high-speed diamond bur under abundant irrigation. Hemostasis was achieved using sterile cotton pellets moisturized with saline solution within 5 minutes. Then, Biodentine™ was prepared according to the manufacturer's instructions and placed on radicular pulp stumps with a thickness of 2-4 mm. Definitive restoration with resin composite was performed after 3 days, once the cement hardening was clinically appreciated by a dental probe. Periapical radiographs were obtained immediately after pulpotomy procedures (baseline) ***(Figure 2a)***, then the element was clinically and radiographically evaluated after 1 ***(Figure 2b)***, 6 ***(Figure 2c)***, and 12 months ***(Figure 2d)***.

Clinical evaluation revealed absence of pain, discomfort, swelling or inflammation at every time points. Radiographically, absence of periapical reactions was appreciated.

The overall success rate at 12-month follow-up was 100%.

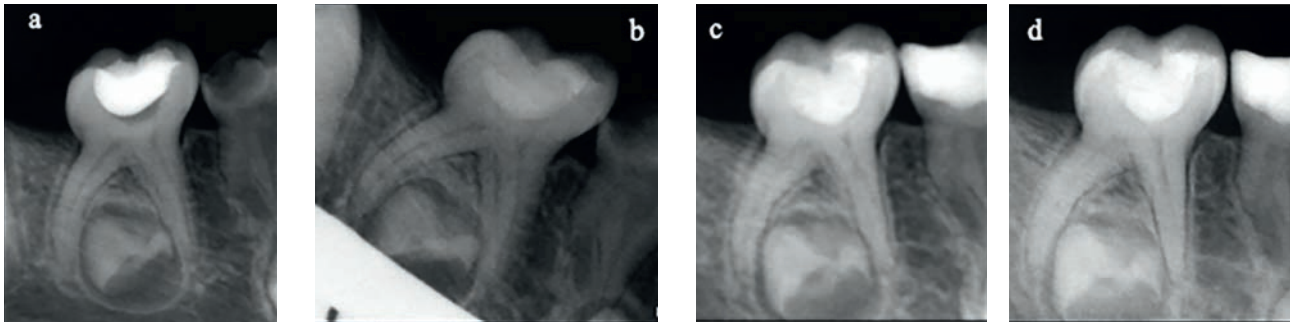

Fig. 2: Periapical radiographs of the dental element (8.5) treated with Biodentine. a. immediately after vital pulp therapy (Baseline); b. at 1 month; c. at 6 months; d. at 1 year of follow-up. Absence of periapical reactions can be observed at all evaluated time points.

Discussion

The reported clinical cases showed that Biodentine™ yielded successful clinical and radiographical outcomes when applied in vital pulp therapy of immature permanent tooth and primary tooth, respectively. After 1 year of follow-up, it might be speculated that apexogenesis, as the continued physiologic development and formation of the root's apex [11], was obtained.

The present report clinically confirmed the excellent features of Biodentine™ as good biocompatibility and promotion of mineralized dentinal tissue deposition [1].

Conclusion

Biodentine™ demonstrated a great induction of new hard tissue formation and may be considered a valid choice in vital pulp therapy of primary as well as immature permanent teeth.

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Prof. Bossù has coauthored more than 50 papers published in national and international peer-reviewed Journals in the field of Preventive Dentistry, Pediatric Dentistry, Endodontics and Dental Materials. He attended more than 100 National and International Congresses as Invited Lecturer.

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