CASE REPORT

A new calcium silicate-based material (Biodentine) for filling radicular perforation in an endodontic-periodontal lesion: A case report


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Abstract

This case report presents an apical radicular perforation management using new calcium silicate-based cement (Biodentine) in a combined endodontic-periodontal lesion. The presence of apical radicular perforation may interfere in the endodontic treatment prognosis. Radicular perforation filling with bioactive cement through endodontic surgery is a possible treatment. This study presents an apical radicular perforation with periodontal involvement, due to alveolar bone loss on the buccal radicular surface from an incorrect intracanal preparation for the fiber post placing. The chosen alternative was a periapical surgery, the perforation was filled with a silicate and calcium chloride bioactive cement (Biodentine; Septodont, Saint-Maur-des-Fossés Cedex, France), and the radicular surface was etched with citric acid, because the access from root canal was impossible. The follow-up was for 8 months, through clinical and radiographic analysis. At the end of the follow-up, radiographic analyses showed the bone healing, and no clinical changes in periodontal probing depth, gingival recession, and the height of the interproximal mesial and distal papillae were observed. The root perforation treatment has a difficult management, especially when the dental root has a simultaneous periodontal commitment. The Biodentine proves to be a promising material for use in these situations.

Keywords

Dentin, endodontics, mineral trioxide aggregate, perforation, dental root

Introduction

The root perforation from inflammatory or iatrogenic cause is a complication in the endodontic treatment and has uncertain prognosis. Some situations have the management possibility through the root canal, using special technical features during the endodontic root filling or associating with the root traction and the cervical exposure. The root canal access is impossible, another alternative is periradicular surgery and perforation filling with compatible biologic materials, especially the bioactive cements. The calcium-based cements, associated or not with calcium chloride, are the best alternative for these clinical situations.

The Biodentine (Septodont, Saint-Maur-des-fossés Cedex, France) is a new calcium silicate-based material that presents compatibility and mineralized tissue bridge formation after pulpotomy, with similar integrity and morphology compared to mineral trioxide aggregate (MTA). Furthermore, the Biodentine has excellent physicochemical properties similar to other materials from MTA.

However, there are no studies that demonstrate the Biodentine clinical behavior in the radicular perforation filling from an iatrogenic case, especially when both endodontic and periodontal procedures are simultaneous involved.

Therefore, the aim of this study is to present one successful clinical case and the methodology for an apical radicular
perforation with alveolar bone loss at the buccal surface management, using the bioactive cement containing silicate and calcium chloride (Biodentine) as a filling material.

Case Report

A 40-year-old female patient was referred for endodontic evaluation of the upper left canine. The patient reported pain during mastigation and sensitivity to palpation at apical region from the alveolar mucosa. The patient reported that the symptoms started after the intracanal fiber post preparation and cementation.

The clinical evaluation showed a slight edema placed next to the radicular apical third, sensitivity to percussion in both horizontal and vertical directions and no dental mobility. The radiographic analysis revealed the root canal was partially obturated, the intraradicular preparation had bypassed from the long axis, going toward to the external surface from the mesial root. Furthermore, lateral radiolucent image from the external root surface was located next to the cervical limit of the remaining canal filling [Figure 1a].

After the clinical and radiographic evaluation, the case was defined as a radicular perforation due to improper intraradicular preparation. The treatment strategy was an endodontic surgery with perforation exposure and radicular filling with a calcium-silicate based cement similar to the retrograde filling technical procedures.

The surgical area access was performed by intrasulcular flap involving the papilla and gingival mucosa. A vertical incision was made between the mesial side and upper central incisor, approximately 3 mm from the distal face of the involved root [Figure 1b]. The divulsion started from mesial from the meeting of the horizontal and vertical marginal incision, 2 mm of periosteum over the alveolar crest was preserved, using the Freer instrument (Golgran, São Caetano do Sul, SP, Brazil) in oscillatory motion and 15 scalpel blade.

After the divulsion, the absence of alveolar bone was observed next to the mesial face from the middle third and on the radicular buccal surface. The local granulation tissue was initially removed with a Lucas 85 curette (Golgran, São Caetano do Sul, SP, Brazil) and McCall 17-18 curette (Golgran, São Caetano do Sul, SP, Brazil), and the root perforation in the apical radicular third was located [Figure 1c]. The perforation was regularized with the P1 ultrasonic insert (Helse, Ribeirão Preto, SP, Brazil), triggered at ultrasound unit (Various II; NSK, Kanuma Tochigi, Japan), at potential 2, under saline irrigation.

Immediately after, the radicular perforation was dried from sterile absorbent paper points (Dentsply, Petrópolis, RJ, Brazil). Active biosilicate cement (Biodentine; Septodont, Saint-Maur-des-fossés Cedex, France), made of a powder mixture (tri-calcium silicate, calcium silicate-c, calcium carbonate filler and oxide, iron oxide, zirconium Xide) and liquid (calcium chloride, water hydrosoluble polymer) was used for the perforation filling. The components mixture was at a ratio of 1 powder part to 6 drops of the liquid; the compound was mixed at amalgamator for 30 s. Then, the mixture was placed at root perforation with a metal spatula, filling part of the root canal. The external surface was adapted to the external radicular shape using an SF spatula (Golgran, São Caetano do Sul, SP, Brazil). A radiograph was taken to verify the perforation completion, after the cement insertion and adaptation to the radicular shape [Figure 2a and b]. Clinical and a radiographic evidenced the radicular perforation filling, then 50% citric acid (pH) was applied on the external radicular surface for 3 minutes, washed with 10 mL of saline and the intrasulcular flap was repositioned and sutured with vicryl 4-wire 0 (Ethicon, São José dos Campos, SP, Brazil) [Figure 2c].

The suture was removed 7 days after the surgery. The first post-operative inspection was performed in 45 days [Figure 3a]. The final inspection was 8 months after the surgery, no clinical changes were observed at alveolar and/or gingival mucosa and functional tooth, nor the presence of periodontal pockets. Another radiographic was performed and revealed an increase of local radiopacity that means the clinical success was obtained [Figure 3b].

Figure 1: (a) Initial radiographic image, black arrow shows the next area to root perforation (b) Intrasulcular flap with partial divulsion, demonstrating the alveolar bone loss on the left upper canine root. (c) Root perforation exploration

Figure 2: (a) Black arrow shows the area next to the root perforation filled with silicate-based bioactive cement (Biodentine). (b) Black arrow shows root perforation filled with Biodentine (c) Suture
Solving radicular perforation with Biodentine

Magro, et al.

Discussion

This case report describes an alternative treatment to solve iatrogenic or inflammatory cases of radicular perforation, when the root canal access is impossible, and using a biactive biosilicate cement (Biodentine) as a filling material with proper prognosis at the post-operative.

The inability to access the root canal hindered the conservative techniques, and the endodontic surgery was the chosen alternative. Surgical technical principles were followed by currently concepts from endodontic surgery. The root perforation access was performed by intrasulcular flap with partial divulsion, keeping 2-3 mm from connective tissue over alveolar crest cervical, to reduce the dehydration and the local bone resorption.

Due to the size and irregular shape of root perforation, it was impossible to perform the preparation with specific tips energized by ultras-som. However, an ultrasonic diamond tip was used to regularize the root perforation, to favor the cement retention over the preparation.

The Biodentine cement was selected as perforation filing material due to its satisfactory bond strength to dentin compared with the MTA, as in repair furcation perforations situations. Alsubait et al. demonstrated that the bond strength of ProRoot MTA (white MTA) in root dentin are similar. The Biodentine cement manipulation was without any humidity, once the blood and irrigation solutions in root canal negatively interfere on the bond strength of calcium silicate based materials.

The satisfactory tissue response and cytotoxicity compared with other cements based on calcium silicate were decisive factors for the choice of Biodentine cement as filling material for root perforation. Mori et al. microscopically observed that the Biodentine inflammatory reaction at rats subcutaneous tissue had a moderate intensity at 7 analysis days, but at 30 days, the reaction was discrete or insignificant, and similar to MTA. These results agree with Khedmat et al. that observed similar cytotoxicity from both material on human monocytes, by the MTT assay.

The cytotoxicity on periodontal ligament cells and the osteogenic differentiation potential were considered for the filling material choice for the root perforation. Corral Nuñez et al. observed that Biodentine and MTA did not affect the cell viability of fibroblasts, with similar messenger ribonucleic acid expression of interleukin (IL)-1α and IL-6 by cells, but Biodentine favored the cell adhesion after 24 h.

The materials cytotoxicity evaluation method may interfere at the results. Despite, Samyuktha et al. have observed that the MTA was less toxic to the fibroblasts from the periodontal ligament when determined by trypan blue dye assay after 24 h and 48 h team period, Lee et al. demonstrated that these materials have positive effects on osteoblast differentiation in mesenchymal stem cells when evaluated expressions of alkaline phosphatase, osteocalcin, and bone sialoprotein by reverse-transcription polymerase chain and real-time polymerase chain reaction. Therefore, the Biodentine was the chosen material once studies have shown cellular good tolerance and osteogenic potential.

The case outcome after 8 months did not presented changes in periodontal probing depth, gingival recession, height of the interproximal mesial and distal papilla, and revealed radiolucent periradicular image reduction, according to Lui et al. parameters of clinical and radiographic success. Although the papilla base incision provides better soft tissue preservation in the early post-operative period, the intrasulcular flap option was due to the impossible mensuration of alveolar bone loss at the site next to the root perforation.

Therefore, the use of Biodentine as root perforation filling material is an alternative for the tooth function preservation, even in situations with simultaneous periodontal involvement, presenting satisfactory radiographic and clinical prognosis.

Conclusion

The Biodentine material demonstrated clinical and radiologic satisfactory results, as filling root perforation material in teeth with simultaneous periodontal involvement caused by iatrogenic cause.

Clinical significance

Root perforations have difficult resolutions, especially in dental root with simultaneous periodontal commitment. The Biodentine proves to be a promising material for use in these situations.

References


