Use of synthetic hydroxiapatite and MTA in periapical surgery: A case report

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ABSTRACT

Objective: This article aimed to report a case of periradicular surgery in which biomaterials, such as MTA and synthetic hydroxiapatite were used. A periapical radiograph showed an extensive radiolucent area extending from the mesial aspect of the tooth 21 to distal aspect of tooth 22. Apicoectomy was performed and root-end cavities were prepared and restored with MTA as a retrofilling material. Synthetic hydroxiapatite was also used aiming to model the lost bone structure. The enucleated lesion was submitted for histopathological examination. A diagnostic of periapical granuloma was established based on the microscopic analysis. Two years after the periradicular surgery, there were no clinical or radiograph suggestive signs of treatment failbure. Instead, the patient's follow-up has shown that the case management has been successful as indicated by lesion regression and periodontal repair. Based on this case, we can conclude that the definitive diagnosis of the type of periapical lesion can only be made by a histological examination and apical surgery can be an excellent complementary procedure when endodontic treatment has not yielded healing outcome.

Keywords: Periapical diseases. Periapical periodontitis. Periapical tissue.

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Introduction

The progression of pulpal inflammation to the periapical region and microorganism colonization of the root canal system lead to innate and adaptive immune responses, and results to periapical alveolar bone destruction and periapical lesion formation.[1,2]

Classically, chemical and mechanical preparation of the root canal and local medication based on calcium hydroxide pastes, followed by the root canal system obturation results in elimination of the infection and healing of the periapical tissues. However, in some cases, the periapical lesion persists despite the conventional endodontic treatment. The lack of success is mostly attributed to the anatomical complexity of root canals, which makes impossible getting a satisfactory microbial stimulus elimination.[3] Other reasons for persistent periapical periodontitis are foreign body responses toward infected root dentin displaced by over instrumentation toward filling material or toward cholesterol crystals.

Periradicular surgery is indicated as a complementary procedure in cases in which endodontic treatment failed. Apicoectomy is the most common type of periradicular surgery, comprising the elimination of pathological tissues, resection of the apical third of the root and placement of a retrofilling material.[4]

This article reports a case of apicoectomy in which biomaterials such as MTA and synthetic hydroxiapatite (HAP-91)® were used. The periapical outcome after surgical enucleation of the lesion is also described.

Presentation of case

A 66-year-old male patient was referred to a particular clinic in Endodontics, Belo Horizonte, Brazil because of a chronic process involving the maxillary left central and lateral incisors.

The patient presented with parcial destruction of the buccal bone plate and edema at the apical third of the affected teeth (Fig 1A). In the review of the medical history, the patient did not mention any kind of health problems and denied a history of allergies or use of any medication. In the dental history review, he reported a car accident 5 years before which resulted in trauma to teeth 21 and 22. At this time, conventional endodontic treatment was performed and the patient had received a porcelain-fused-to-metal post in both teeth. Intraoral clinical examination did not reveal swelling of the labial mucosa adjacent to teeth 21-22. Periodontal pockets were absent. On vertical percussion, the teeth were painless. A diagnostic periapical radiograph showed an extensive radiolucent area extending from the mesial aspect of tooth 21 to distal aspect of tooth 22 (Fig 1B).

As root canal obturation with an acceptable quality was found from the periapical radiograph, the teeth were arranged by periapical surgery.

Under local anesthesia, a semilunar flap was lifted up and the roots of both teeth were exposed (Fig 2A ,B). The completion of the case was carried out in 3 phases. The first phase consisted of a carefully enucleation of the lesion. The enucleated material was submitted to

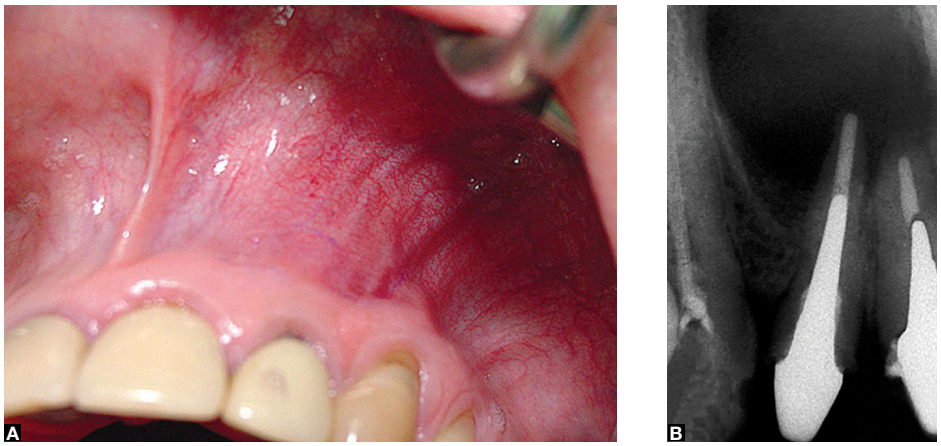

Figure 1. A) Edema at the buccal mucosa observed during clinical examination. **B**) Periapical radiograph showing a large radiolucent area surronding the tooth apex.

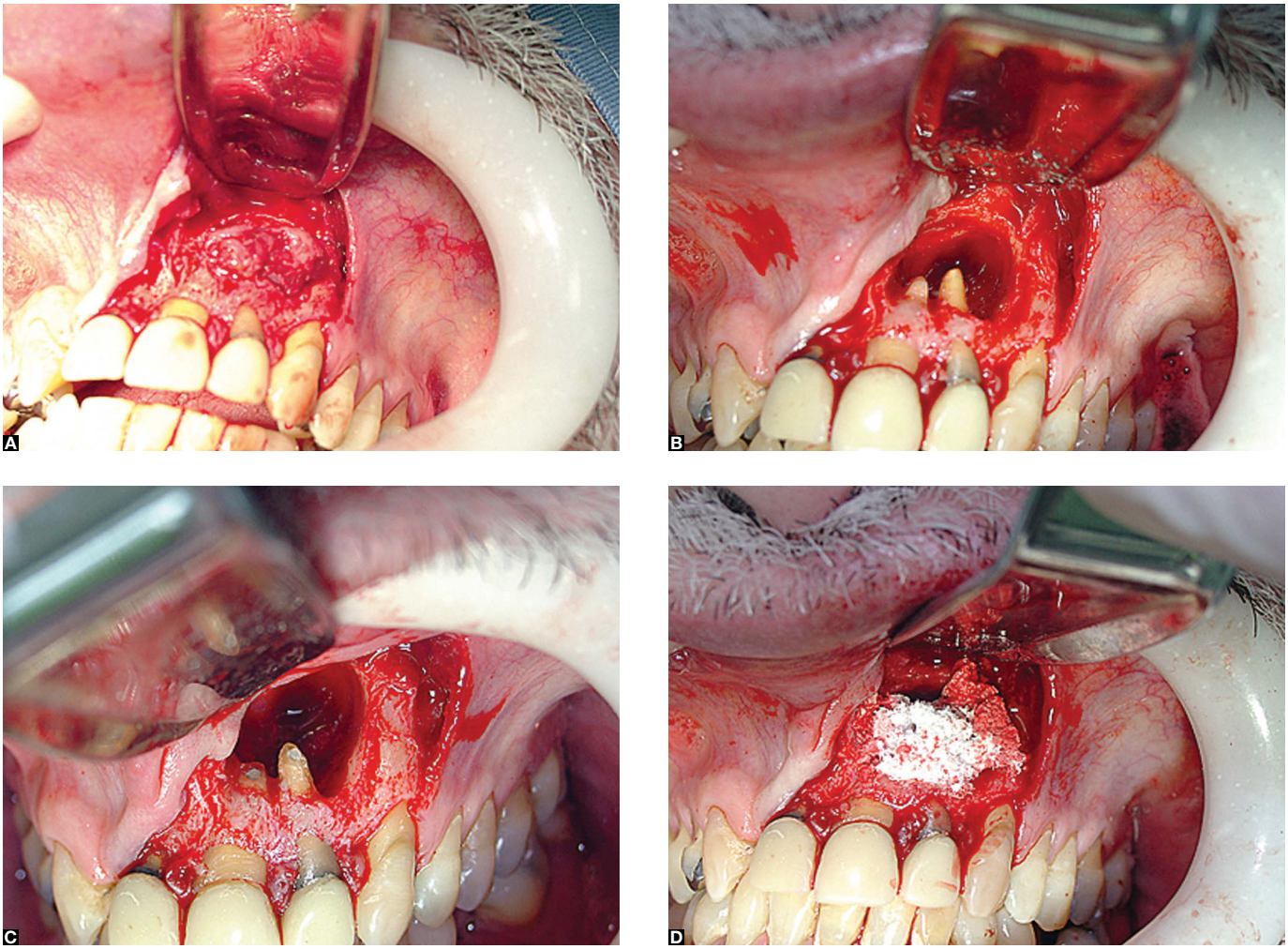

Figure 2. A) Exposed lesion **B**) Aspect after lesion enucleation **C**) Restoration of the root-end cavity with MTA after removal of the apical portion **D**) Use of synthetic hydroxiapatite to reconstruct the original bone architecture of the region.

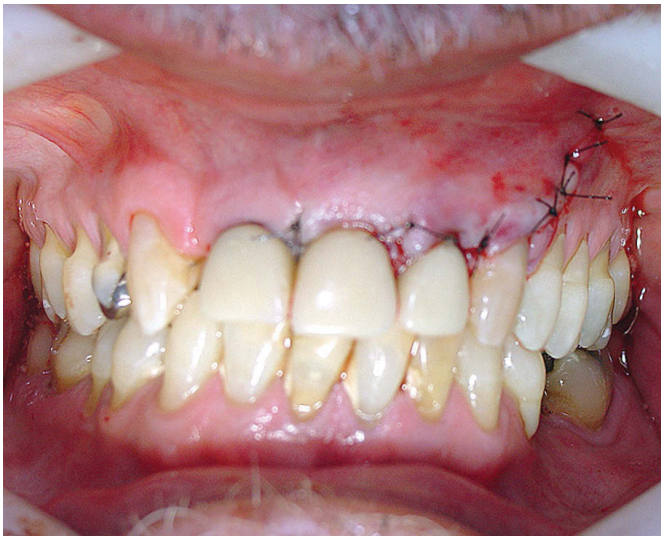

Figure 3. Aspect after surgery.

histopathological evaluation. Next, an apicoectomy was performed removing 2 mm of the apical roots. A specific diamond tip attached to the handpiece of an ultrasom device (Enac OE-3 Ultra-Endo Instrument System; Osada Electric Co., Tokyo, Japan) was used to prepare a root-end cavity. MTA was the material of choice because of its effective marginal sealing capacity (Fig 2C).

For internal filling and remodeling of the destroyed bone structure, synthetic hydroxiapatite (HAP-91) was used (Fig 2D).

After the mucoperiostal flap was repositioned, a conventional suture was placed. Sutures were removed 7 days postoperatively, and the patient was required to attend a follow up after 6 months (Fig 3).

The patient's follow-up showed that the case

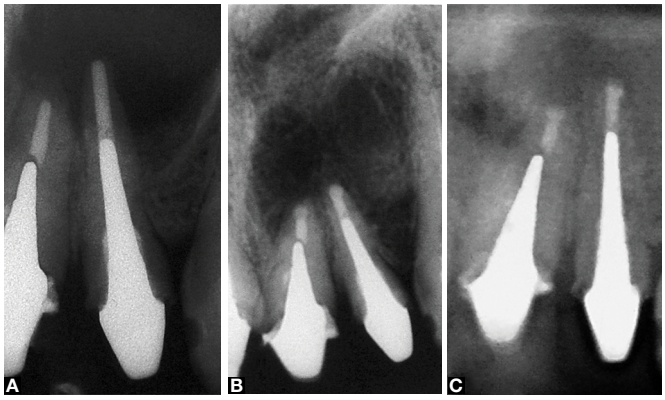

Figure 4. A) Preoperative radiograph **B**) Apicoectomy with MTA retrofilling on teeth 21 and 22 **C**) 1 year follow-up with periapical repair.

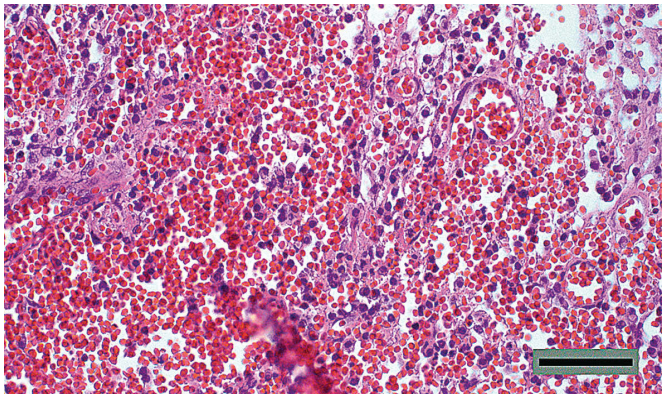

Figure 5. Histology of enucleated lesion.

management was successful and yielded lesion regression and periodontal repair (Fig 4).

Histopathological analysis

A conclusive diagnosis of periapical granuloma was established by histological examination: The fibrous conjunctive capsule enclosed granulomatous tissue contained chronic inflammatory cells, with varying dissemination (Fig 5). Blood vessels showing some vascularization were observed, but no epithelium.

Discussion

Lesions associated with apical periodontitis such as granulomas, abscesses, and cysts fail to heal after nonsurgical root canal therapy for the same reason, persistent intraradicular and/or extraradicular infection. However, the definitive diagnosis of the type of periapical lesion can only be made by a histological examination.

In the present case, the enucleated lesion was classified as periapical granuloma. The histological characteristics of the lesion were consistent with Nair et al,[5] that classified solid granulomas as symptomless pathologies with a granulomatous tissue infiltrated by lymphocytes, plasma cells and macrophages, and a well-developed fibrous capsule. This kind of lesion may be epithelialized. Their occurrence varies between 9,3%[6] and 87,1%.[7] In a recent study by Schulz et al,[8] using the same criteria defined by Nair et al,[5] the granuloma occurrence was 70%. Schulz et al[8] pointed out periapical granuloma as the most common pathology that could be expected in periapical lesions.

Periapical surgery was considered the choice due to prosthodontic risks associated with orthograde retreatment. It is generally believed that periapical surgery is the choice when nonsurgical endodontic retreatment is neither feasible nor indicated Schulz et al.[8] According to Nair et al,[9] in cases of apical granuloma or cysts, the surgical treatment is more likely to resolve these pathologies because they remain inaccessible to orthograde root canal debridement.

In this reported case, MTA was chosen as the retrofilling material. Several studies have shown that the cement is an osteoinductive and cementogenic agent that stimulates immune cells to release the lymphokines required for the repair and regeneration of cementum and stimulates bone coupling factors necessary for the bioremineralization and healing of osseous periapical defects.[10-15] Evidence also supports the ability of MTA to provide a reliable sealing capacity, being a bacteria-resistant barrier when used as a retrofilling material.[16,17]

Synthetic hydroxiapatite (HAP-91®) was used as bone filling material . It is relatively easy to handle during the surgery. The most notable characteristic of hydroxiapatite because of its high bone affinity and bone conductivity, is its ability to bind directly to the bone tissue. The binding form is called “bonding osteogenesis”[18]. The bonding mechanism has been well characterized in several studies.[19,20]

Conclusion

On the basis of the outcomes of this case, it might be concluded that:

» Endodontic surgery is often a promising

alternative when conventional endodontic treatment has not yielded the desired healing outcome or even the retreatment has risks.

» The prognosis for endodontic surgery depends on the quality of the root canal filling. Because of its characteristics of promoting excellent marginal sealing and stimulating osteoblastic adherence to the retrofilling surface, MTA was chosen as the retrofilling material.

» The use of certain osteoinductive or osteoconductive materials such as synthetic hydroxiapatite can be very helpful to large bone destruction.

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