

New perspectives in periapical surgery: Ostectomy and osteotomy

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How to cite this article: Cervera Ballester J, Menéndez Nieto I, Soto Peñaloza D, Peñarrocha Diago M, Peñarrocha Oltra D. New perspectives in periapical surgery: ostectomy and osteotomy. J Oral Science Rehabilitation. 2019 Mar;5(1): 8-17.



Fig. 1a

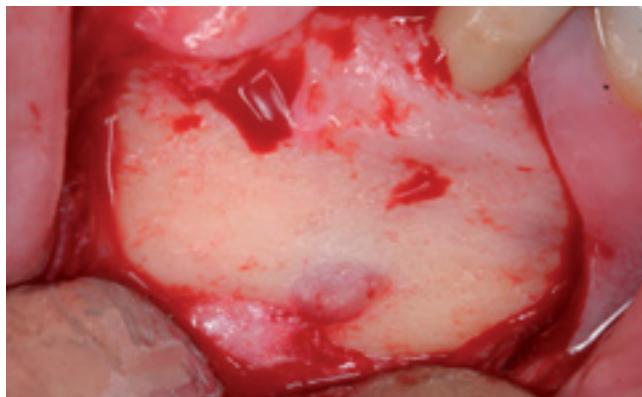


Fig. 1b

Abstract

Objective

The aim of this investigation was to review the surgical factors related to ostectomy in periapical surgery and their relationship to prognosis.

Method

An update was made of different techniques to achieve adequate access to the periapical lesion. Visual control of the affected roots is important for a successful result in periapical surgery; for this reason, the bone tissue from the vestibular cortical bone must be removed through an ostectomy or osteotomy.

Results

The technique used and the amount of bone removed must be analyzed preoperatively, since it will have a direct relationship to the surrounding anatomical structures, the healing time and the need to perform bone regeneration techniques.

Conclusion

With the use of microsurgical techniques, the size of the ostectomy should not exceed 5 mm in order to reduce the healing time and thus improve the prognosis of periapical surgery. Osteotomy is an alternative technique that allows preservation of the external cortical bone, but has been little studied.



Fig. 1c



Fig. 1d



Fig. 1e

Keywords

Ostectomy; osteotomy; periapical surgery; endodontic surgery; prognosis.

Introduction

Periapical surgery entails 3 procedures: root end resection, root end cavity preparation and bacteria-tight sealing of the root canal system at the cut root end with a retrograde filling. For this, it is necessary to remove the periapical inflammatory pathological tissue to reach the dental apex.¹ Many years ago, in 1845, Hullinhen proposed surgical trephination through the soft tissue and bone and into the pulp to alleviate a pathological pulp process.² At present, to access the periapical lesion and obtain visual control of the affected roots, the soft tissue has to be raised and bone tissue from the vestibular cortical bone must be removed through an ostectomy or osteotomy.³ In some cases, the pathological periapical lesion has already perforated the cortical bone, providing direct access to the apex and allowing the removal of the pathological tissue with only a remodeling of the peripheral bone.

Before surgery, it is important to calculate on a parallel radiograph the length and number of roots, the curvature of these, and the position of the apices and the important anatomical structures, such as the foramen, inferior dental nerve and maxillary sinus.⁴ At present, the incorporation of cone beam computed tomography (CBCT) as a complementary radiographic technique has greatly simplified the diagnosis and detection of all these characteristics. Ahn et al. proposed introducing a CAD/CAM-guided surgical template in periapical surgery to minimize the extent of ostectomy for locating the root apex in cases with a thick and intact buccal bone plate and to facilitate surgery on teeth close to problematic anatomical structures.⁵

The aim of this investigation was to review the surgical factors related to ostectomy in periapical surgery and their relationship to prognosis.

Surgical technique

Ostectomy entails the removal of bone tissue from the cortical bone to reach the dental apex. How large an ostectomy should be is predicated on the native size of the lesion, adequate armamentarium access, and proximity to vital structures, such as the mental nerve, mandibular canal and maxillary sinus.⁶ In conclusion,

Ostectomy in periapical surgery



Fig. 2a



Fig. 2d

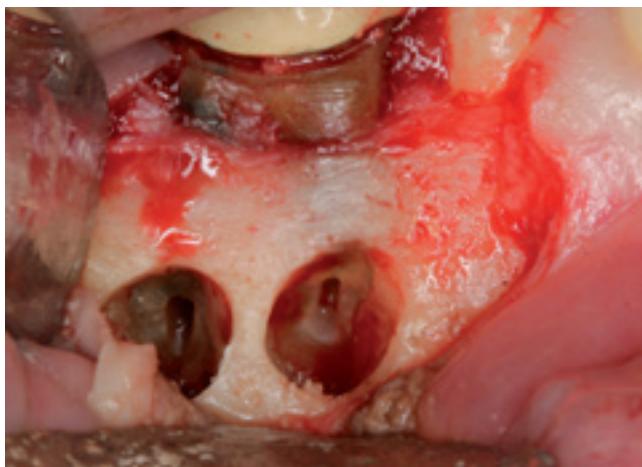


Fig. 2b



Fig. 2e



Fig. 2c

the size of the ostectomy should be as small as possible, but sufficiently large to enable curettage of the entire periapical lesion and access to the instruments needed to perform apical surgery.

The ostectomy is done with a round tungsten carbide bur (size 6–10) mounted on a handpiece and abundant irrigation with physiological saline (**Fig. 1**). Recently, a contra-angle handpiece with a 45° angular head was

launched on the market to facilitate injection of only water, not air, to avoid possible emphysema.

A point between 2 and 4 mm of the apex is selected and a hole is made perpendicular to the longitudinal axis of the tooth until dental tissue is reached. The osteotomy is then continued with small movements of the bur in order to distinguish with touch the difference between bone and root cementum.

In mandibular molars, the external cortical bone has a higher density and a complicated entry angle, so the osteotomy should be broader to have good access to the roots and be able to identify them clearly, leaving also larger bone defects after periapical surgery, which can be filled with a bone grafting material, optionally combined with the use of membranes.

In 1961, Boyne et al. measured labial bone plate destruction after osteotomy and periapical curettage.⁹ They found that the smaller defects (5–8 mm) exhibited complete bone regeneration, while the 9–12 mm defects showed herniation with fibrous tissue. Ten years later, Hjorting-Hansen and Andreasen made cavities of 5, 6 and 8 mm through buccal and lingual plates or through only the buccal plate of mandibles in 6 adult dogs.¹⁰ The authors concluded that bone healing was related to the size of the cavity, as well as whether both cortical plates were removed.

According to Rubinstein and Kim, there is a direct relationship between wound healing and the size of the osteotomy: a small lesion (0–5 mm) took 6.40 months to heal, a medium lesion (between 6 and 10 mm) 7.25 months and a large lesion (than 10 mm) 11.00 months.¹¹ For this reason, in mandibular molars, when the radiographic diagnosis confirms the presence of apical

lesions in both roots separated by an intact osseous septum and without inflammatory tissue infiltrate 2 independent osteotomies can be performed to access each root, creating smaller bone defects and decreasing the bone healing time (**Fig. 2**). With microsurgical techniques, the size of the osteotomy is significantly



Fig. 3b



Fig. 3a



Fig. 3c

Osteotomy in periapical surgery

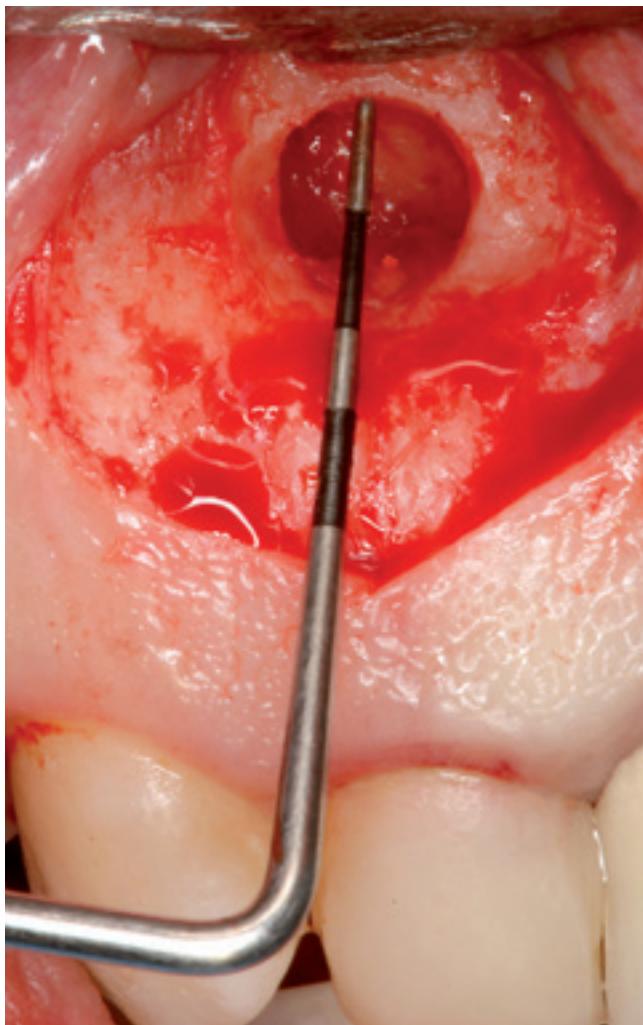


Fig. 3d

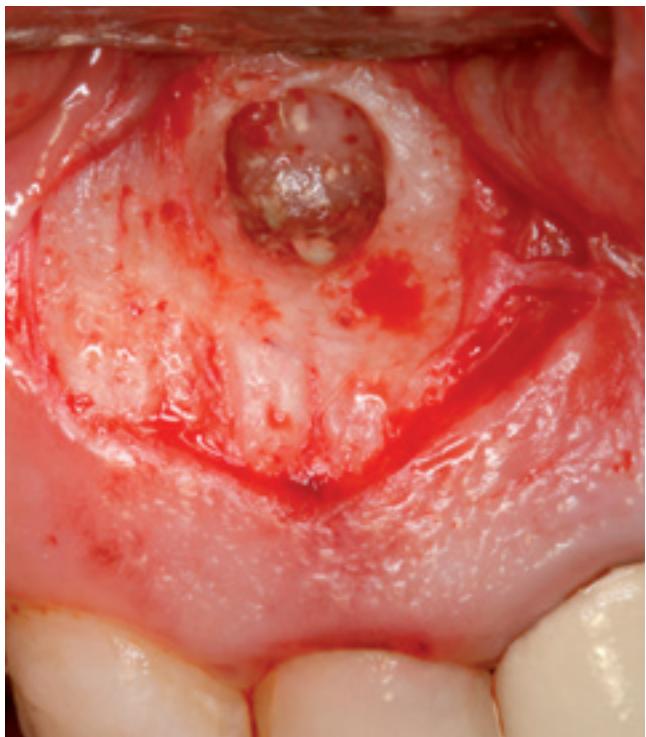


Fig. 3f

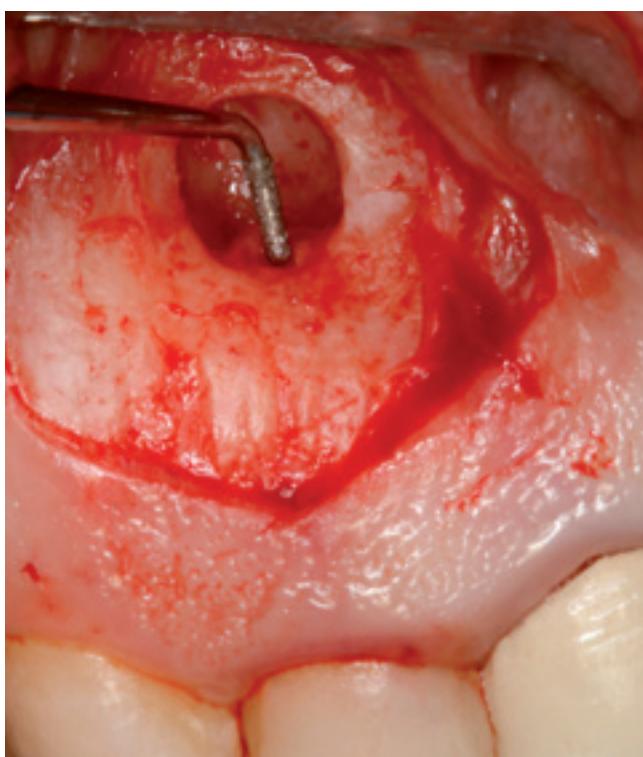


Fig. 3e

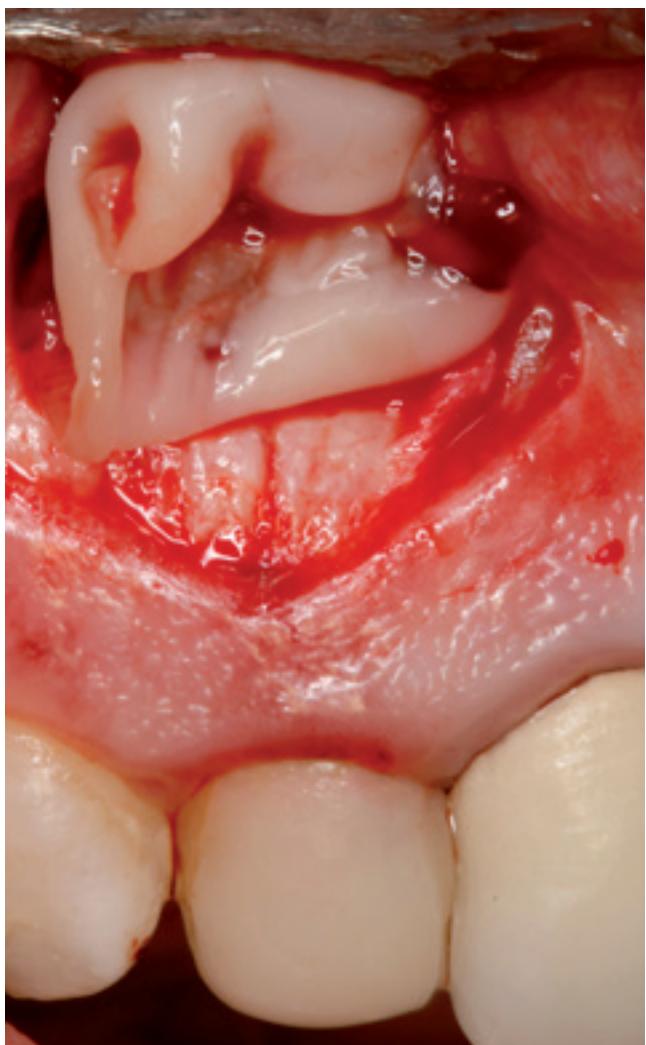


Fig. 3g

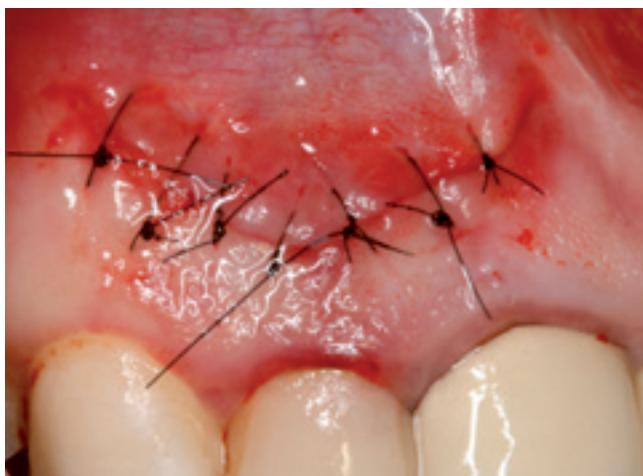


Fig. 3h



Fig. 4b



Fig. 3i

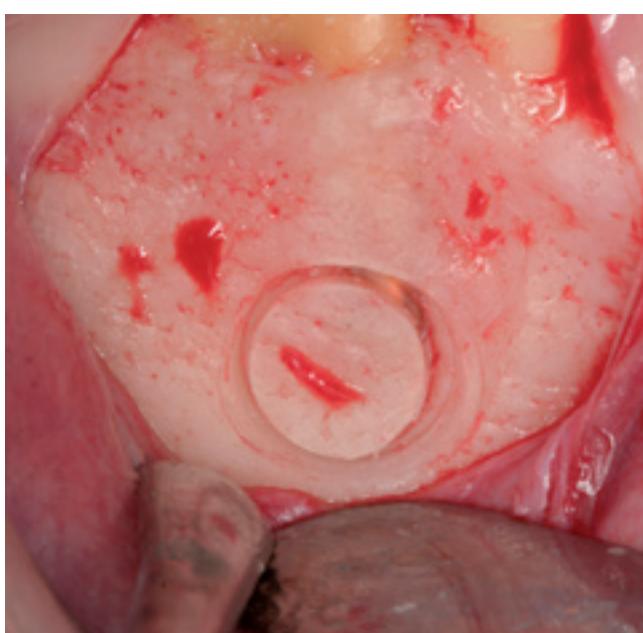


Fig. 4a



Fig. 4c



Fig. 5a



Fig. 5b

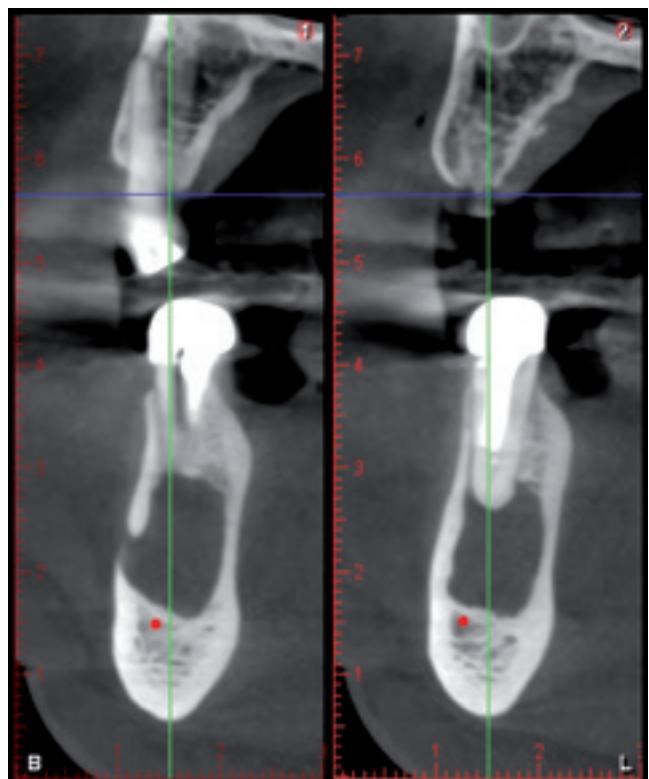


Fig. 5c

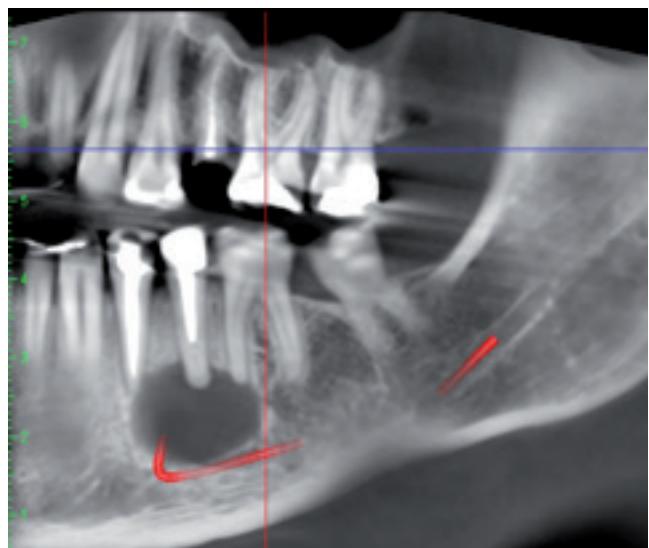


Fig. 5d

smaller than with a conventional osteotomy,^{12, 13} just 4 mm in diameter. This is just larger than an ultrasonic tip of 3 mm in length, yet allows the tip to vibrate freely within the bone cavity (**Fig. 3**).¹²

Osteotomy is an alternative surgical technique that allows the preservation of the external cortical bone. Peñarrocha and Sanchis used the so-called window osteotomy, made with hollow cylindrical trephines of different diameters.¹⁴ The osteotomy of the cortical bone begins with a trephine of adequate diameter and abundant irrigation with physiological saline, until the cancellous bone is reached, which is perceived as a decrease in resistance during drilling. Once the access window has been created, a small and fine chisel is

introduced to lift the bone block. During periapical surgery, the bone lid remains in physiological saline, and it is replaced over the cavity at the end of the surgery (**Fig. 4**). Currently, the osteotomy can also be performed with piezoelectric instruments. For Abella et al., the advantages of piezoelectric surgery include protection of soft tissue, optimal visualization of the surgical field, decreased blood loss, reduced vibration and noise, increased comfort for the patient, and protection of tooth structures (**Fig. 5**).¹⁵

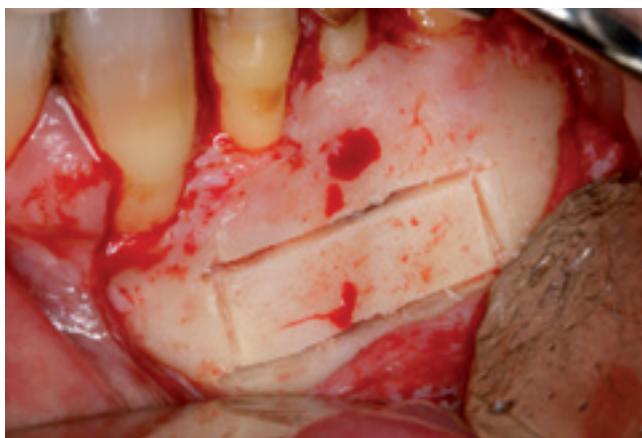


Fig. 5e

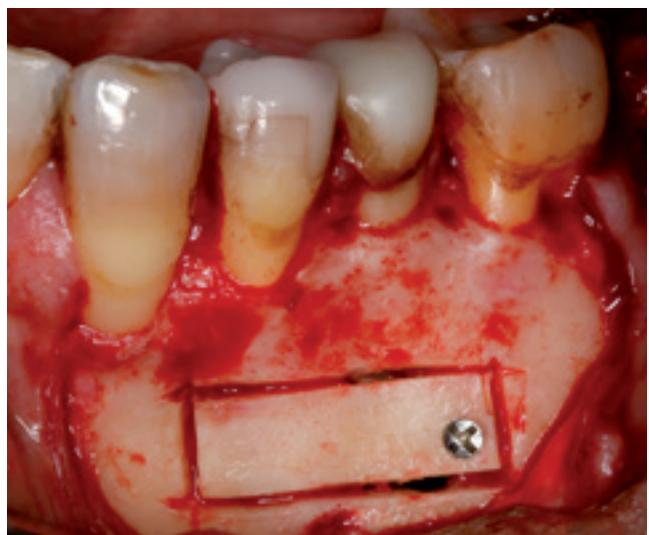


Fig. 5g

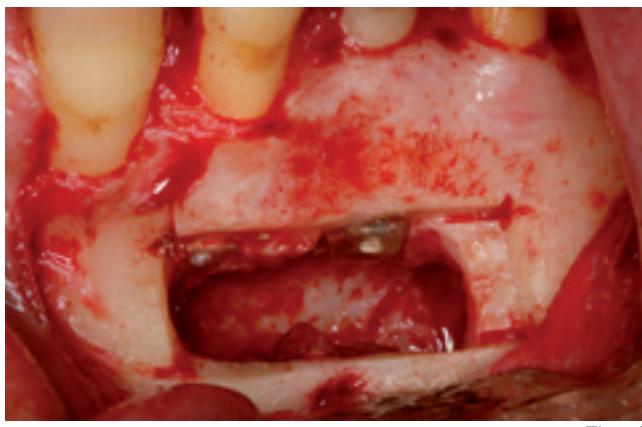


Fig. 5f



Fig. 5h

García-Mira et al. showed that there are no statistically significant differences between ostectomy and osteotomy with respect to postoperative pain and prognosis.¹⁶ Instead, patients in the ostectomy group had increased inflammation. Peñarrocha and Sanchis showed some advantages of the osteotomy window with respect to the ostectomy: (a) simpler and faster in a complicated area such as the posterior mandibular area; and (b) conservation of the patient's own bone to promote the healing of the lesion.¹⁴ The surgical bone defect can be filled with different materials (such as collagen sponge and lyophilized bovine bone) before replacing the bone lid. Osteotomy has been little studied in the literature. The main complication of this technique, especially if using trephine drills, is the possibility of damaging roots if the position or direction of the cut is inadequate.

Conclusion

Ostectomy in periapical surgery is a key step in periapical surgery and necessary to access the apex of a

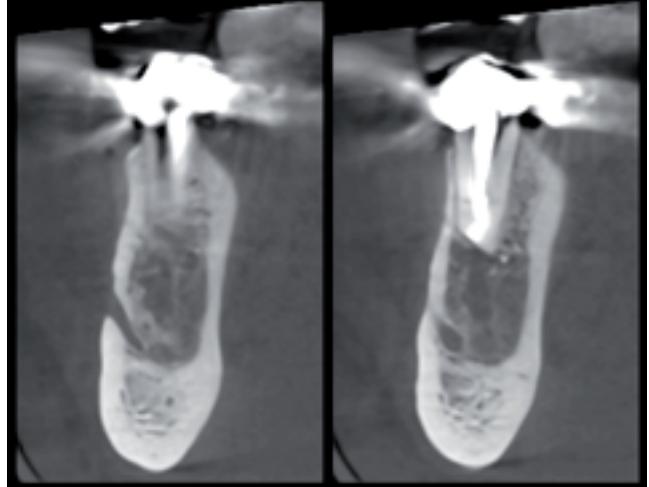


Fig. 5i

tooth with periapical pathology. Currently, with micro-surgical techniques, the size of the ostectomy should not exceed 5 mm if the apical lesion allows it, in order to reduce the healing time. Osteotomy is an alternative technique that allows the preservation of the external cortical bone, but has been little studied.

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Legends

Fig. 1a – Panoramic image of patient referred for dental implant assessment. An apical lesion affecting a mandibular left premolar was found.

Fig. 1b – Intraoperative image after flap elevation. Adequate retraction of flap to avoid damage of the mental nerve is very important.

Fig. 1c – Osteotomy is done with a round tungsten carbide bur mounted on a handpiece and abundant irrigation with physiological saline.

Fig. 1d – The osteotomy should measure about 4 mm. This diameter allows the free movement of the ultra-sonic tips.

Fig. 1e – Five-year follow-up panoramic radiograph showing complete healing of bone around the apex.

Fig. 2a – A trapezoidal flap design with a sulcular incision was made to access the mandibular molar with an apical lesion.

Fig. 2b – Two independent osteotomies were performed to access the mesial and distal roots, creating a small bone defect.

Fig. 2c – Clinical image of sealing with mineral trioxide aggregate of 2 retrograde cavities.

Fig. 2d – One-year follow-up periapical radiograph showing complete healing.

Fig. 2e – Seal of the retrograde cavity and complete healing of bone can be appreciated in this tomographic view.

Fig. 3a – Clinical image of the maxillary right anterior teeth, with healthy soft tissue, in a male patient referred for spontaneous pain in this area.

Fig. 3b – The radiograph showed an apical lesion affecting an endodontically treated lateral incisor.

Fig. 3c – CBCT study clearly showed an apical lesion affecting the cortical bone plate of the lateral incisor.

Fig. 3d – A periodontal probe was used to check the size of the osteotomy.

Fig. 3e – Retrograde cavity preparation using an ultra-sonic tip.

Fig. 3f – Mineral trioxide aggregate sealing of retrograde cavity.

Fig. 3g – A platelet-rich plasma preparation was used to fill the bone defect.

Fig. 3h – Soft-tissue aspect after suturing.

Fig. 3i – A postoperative radiograph showing the retrograde cavity and mineral trioxide aggregate filling.

Fig. 4a – A cylindrical trephine was used to perforate the bone and expose the periapical area.

Fig. 4b – Aspect of the root after sealing with mineral trioxide aggregate.

Fig. 4c – The bone lid was replaced over the cavity at the end of the surgery.

Fig. 5a – Clinical image of the mandibular area in a male patient with severe pain.

Fig. 5b – An intraoral radiograph showed a large periapical area associated with the first premolar, which had undergone endodontic treatment, and the second premolar, which had been treated with an intra-radicular post, but had not undergone endodontic treatment.

Figs. 5c & d – CBCT study showed a very close relationship between the apical area, mandibular canal and mental nerve emergence.

Fig. 5e – Osteotomy was performed with an ultrasonic device.

Fig. 5f – Intraoperative view after lesion removal and retrograde cavity filled with mineral trioxide aggregate.

Fig. 5g – The bone block was fixed with an osteosynthesis screw.

Fig. 5h – Clinical view of the soft tissue 1 year after the surgery.

Fig. 5i – The 1-year follow-up radiograph showed bone regeneration.