Intentional replantation: What kind of approach is this that can save teeth? Two long term case reports

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ABSTRACT

Introduction: The maintenance of natural dentition is preferable in most of cases. However, nowadays it is possible to use dental implants in cases where prognosis is very limited. Endodontics and all of its therapeutic modalities play an important role, which has, in principle, to prevent or eliminate apical periodontitis providing better conditions for wound healing of periapical and bone tissues. In the past few years, with technological advances, root canal treatment became more predictable and this can be seen reflected in the increase of success rates of primary treatment as well as non-surgical retreatment. Nevertheless, some cases can failure but, it is not the end for the tooth, once some therapeutic approaches are possible, like apical microsurgery or intentional replantation. **Method:** Intentional replantation is an approach in which some surgical steps are done, since the dental extraction until its repositioning back to the socket. In this article two bordering cases were described. **Results:** 2 and 11 years follow-up confirm the favorable results of this technique. Both cases with no apical lesion, bone healing and dental elements developing their natural functions. **Conclusions:** The high successful rates described in the literature give to this treatment approach an important face, and that should be more explored and disclosed in Brazil, specially between specialists and post-graduation students, once can avoid unnecessary dental implants.

Keywords: Endodontics, Bioceramics, Intentional replantation. Apical surgery.

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Introduction

The goal of any root canal treatment (RCT), independent of clinical situation, is to reach success with patients with no signal or symptoms, and principally no loss of tooth in a long run. Technical advance and implementation of modern technologies in every step of endodontic treatment – since diagnosis until final restoration – allow predictability and success in most of cases. However, sometimes, technical or anatomical issues during RCT can lead to failure and, to overcome this, are suggested: a) non-surgical retreatment; b) surgical retreatment (apical microsurgery or intentional replantation); or c) combination of both modalities.

Intentional replantation is a procedure that is part of Endodontics and, as well as apical microsurgery, has technical scientific basis and it is indicated to try to save teeth. Even though it is an old procedure, reports that come from 1877, according Grossman,[1] this surgical procedure is still a little teach and done in Brazil.

The best definition of intentional replantation is described as the act of remove intentionally the tooth from its socket, manipulate endodontically the apical third and, finally, repositioning the tooth on its socket again.[1] Some articles about this can be found in the literature, however, most of them are case reports and only few articles venture to describe the technique.[2-5]

In the past 20-25 years, the development of new materials, like bioceramics, among them MTA (mineral trioxide aggregated), was a big advantage histologically, because these materials filled a very important requirement: biocompatibility with periapical tissues. Other new technologies, that are part of modern Endodontics, such as: cone-beam computed tomography (CBCT), microscope and ultrasonic device, changed drastically the way of make surgery.

It is important to note that the new terminology microendodontic surgery, replacing the older called parendodontic surgery (traditional) it is not only a terminological question. The differences between traditional endodontic surgery and microendodontic surgery are vast and profound. The surgical concept, instruments, and materials are all different and there is a little similarity between the old and the new techniques, its purpose: to save teeth.

According to Becker,[6] intentional replantation includes multiple surgical steps, which must be performed in the most accurate way possible in order to obtain the best results. In a systematic review[7] was evaluated articles from 1966 until 2014, and the success rate ranged around 88%. But, the principles of apical microsurgery are also applied in cases of intentional replantation, thus it is possible to obtain highest and more predictable success rates in this cases, once the success rates in apical microsurgery ranged around 96,8%.[8]

Backed by literature and with high successful rate it is absolutely necessary understand that all available therapeutic possibilities to save a tooth should be evaluated and used before its indication for extraction and a future implant. In conclusion, the present article aim to describe the technique used in two long term case reports, showing how much the choice of maintaining teeth has been impacted in patient lives.

Indications

First of all, to perform an intentional replantation is necessary an accurate technical skill to extract the tooth in an atraumatic way and second, is required properly instruments and devices for Endodontic procedure. In other words, is mandatory that the surgeon has microscope – for an appropriate magnification and illumination of the reduced area where the procedure is done –, ultrasonic tips and micro instruments.[9]

The carefully choose of the case is another important observation. According to Kim & Kratchman[8], the teeth are classified as: A) good candidate; B) bad candidate; or C) good and bad candidate (Fig 1). Type A is a tooth that has straight roots and an intraosseous septum, and there is a less chance of root fracture in the apical third during extraction and the septum gives the necessary stability to the tooth after replantation. Type B presents radicular dilacerations or a sharp curvature in the apical third, which leads to difficulties during extraction and also replantation into the socket. The last one, type C, is considered a good candidate because the roots are convergent and this facilitate and reduce the chance of radicular fracture during extraction, but this type is considered a bad candidate too, because the absence of a septum affect the stability of the tooth after its replantation.

Difficult access – surgical access to lower second molars is extremely difficult because of the bone thickens that raise greatly, as a result of the external oblique ridge and by the position of the roots, which incline more lingually than the first molars[9,10] (Fig 2). Another case where there is a difficult access performing apical surgery is on palatal roots – for example, palatal roots of second molars can be more convergent. The approach on the palatal side is possible, but, technically it is a huge challenging, because to access surgically with burs is necessary a large osteotomy and, sometimes, to cut the buccal roots too.

Anatomic limitations – proximity of the teeth to anatomic landmarks such as the mental foramen or mandibular canal renders surgery risk due to possible postoperative paresthesia.

Perforations in areas not accessible surgically – when is not possible to solve the case through conventional treatment and the surgical approach would necessitate unnecessary removal of bone and root structure to reach the perforation site.

Only few times this procedure should be avoid, below are presented two situations to pay attention:

Bisphosphonate usage – Prolonged oral as well as bisphosphonates have been documented to potentially cause osteonecrosis when oral surgery is performed. Since replantation involver extraction, this should be considered during treatment planning and may preclude replantation from being an option for these patients.

Traumatized teeth (dental avulsion) – teeth that suffered already any kind of dental trauma, especially dental avulsion, are teeth that per si has a high chance of root resorption processes. Thus, the intentional extraction included in the procedure could be harmful to periodontal ligament cells – previously injured by the trauma – enhancing the chances of the procedure not working.

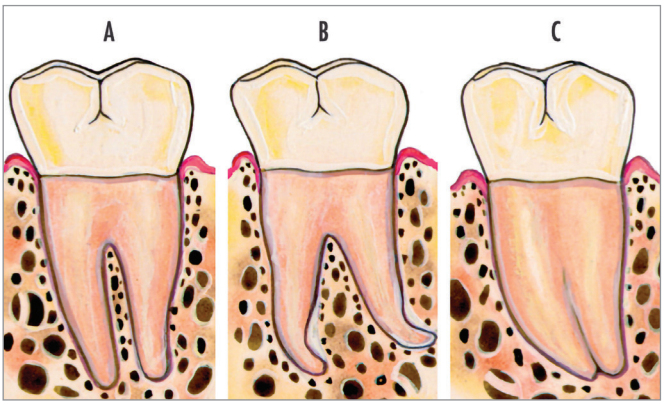

Figure 1. Classification of teeth according to the shape of their roots.

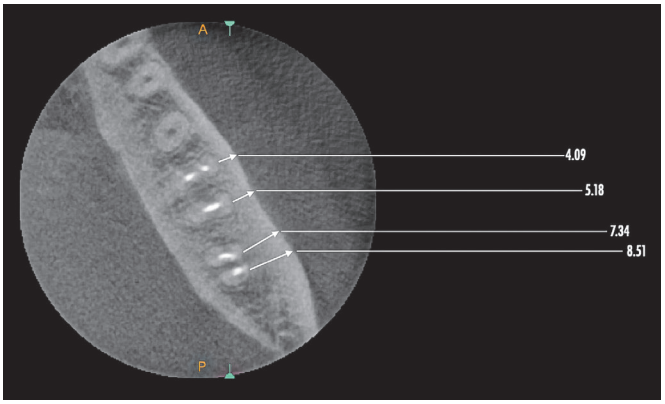

Figure 2. Bone thickness, with the distance of the lower molar roots from the buccal bone plate.

Important informations and surgical approach

There are some slight advantages of intentional replantation over apical microsurgery: a flap is not required for replantation, osteotomy is not needed, the field of view is not limited by osteotomy and adjacent structures, and manipulation of microsurgical instruments and ultrasonics are easier with tooth outside the mouth. These advantages improving the healing experience, once there is no loss of bone tissue and trauma in soft tissues. However, as documented by Li and Kratchman[9], resorption could be an undesirable consequence and care should be taken throughout the procedure to avoid extensively damaging the periodontal ligament (PDL), during both extraction and degranulation of the socket. In addition, curettage of the socket walls should be avoided, since the presence of PDL cells on the socket is sufficient for PDL re-establishment and prevention of resorption.

1. Extraction

Tooth extraction should be atraumatic and the tooth has to be removed intact. It is important to keep the forceps off the cementum and rest mainly on the crown. A gentle buccal/lingual luxation and slight rotational forces should be used to extract the tooth (Fig 3).

Figure 3. Tooth extracted atraumatically, held by forceps.

2. Extraoral phase

After extraction, the tooth can be kept seized by the forceps or can be held bi-digitally, being important remind that it is not allowed to touch in the cementum area. The working time on the extracted tooth should be short, where the maximum time is between 7 to 10 minutes, and always under frequent irrigation with Hanks balanced salt solution (HBSS) or Pedialyte, trying to keep the PDL cells viability.

In this phase, the lesion, if present, is removed and apicoectomy is done with a surgical bur called Zekrya. Radicular root surface should be inspected to exclude microcracks in the apical third, and immediately, with surgical appropriated ultrasonic tips the retro-prepare is done. After that, the retrograde prepare should be dried with paper points and then, MTA or bioceramic RRM is placed to fill the preps.

3. Dental replantation

Care should be taken to ensure the right orientation of the tooth before its replantation in the socket. In the time of replantation, as the apical portion was resected, the tooth will be easily re-inserted in the socket and this allows the clinician to depress the tooth and have it in infraocclusion. This is desirable for better reattachment of PDL during healing, since occlusal forces are minimized.

4. Splinting

Retain the tooth on its socket does not mean that it should be static. It is necessary a minimal mobility of the replanted tooth to maintain its physiological functions. When the amount of buccal or palatal/lingual bone loss is not extensive, splinting is only a precautionary measure. In these cases, sutures can be used to crisscross the occlusal surface of the tooth in a buccal-lingual orientation.

5. Postop instructions

As any surgery, the patients must receive orientation about what is allowed and forbidden during the recuperation process. Patients should be instructed to avoid using the side where the replantation was performed. Normally, postop discomfort after replantation is usually less than with conventional apicoectomy, and this is a result of a decreased amount of trauma on soft and bone tissues. Thus, routine pain

medications are usually sufficient. Brushing and flossing should be avoided for a day or two on the replanted tooth and its adjacent teeth. Mouthwashes are recommended to facilitate bacterial control of the region.

6. Suture removal and postop control

In most of replantation cases, the suture is removed between 7 – 10 days whereas, histologically, the wound healing of the PDL and junctional epithelium repositioning occur in two to four weeks after replantation.[11,12] If, for some reason, after this period the tooth mobility remains excessive, it is recommended to wait a few more days until it is effectively stable, in order to remove the suture. Case controls should occur one month after procedure; after 3 and 6 months; after one year; and should continue as long as possible. The incorporation of CBCT in Endodontics and its clear advantage related to accuracy and trustworthiness, this exam is the gold standard for evaluations and postop controls. Certifying, effectively, the long-term success of the procedure.[13-17]

Case reports

Case 1

30 years old, Caucasian, male patient, came to the dental office referred by another dentist. The patient was doing some other dental procedures (aesthetic and oral rehabilitation) and endodontic evaluation of tooth #37, which had a previously root canal treatment, was recommended.

No signs or symptoms were observed and none complain was reported about that tooth. However, the patient had a high aesthetic demand and he did not want to lose his tooth. During the clinical evaluation, was observed that the gingiva was health, with a normal gingival probe (2-3mm) and no mobility.

Radiographic exam showed straight roots separated by a septum and the root canal treatment, previously employed, reached the apical third limits and, in addition, there was an endodontic sealer material extruded apically. It was observed also a radiolucent image around the radicular apex and in proximity to mandibular alveolar nerve, for that reason, patient was diagnosed with asymptomatic apical periodontitis (Fig 4).

After that, was realized a cone-beam computed tomography (CBCT) using the CareStream CS-9000 (CareStream Dental, USA) device and the images were carefully evaluated. With the data was possible to observe the real situation of the tooth and measure the lesion size and its distance to alveolar nerve (Figs 5 and 6).

Took all characteristics of the tooth in consideration and patient's desire in maintain his tooth, it was proposed, as a possible approach, the intentional replantation.

In the day of the surgery, the patient has taken one hour before the procedure 1g of amoxicillin and 4mg of dexamethasone. It was realized the asepsis of the inferior third of the face with chlorhexidine 2% (lips, tip and nose wings, and mental area). The patient was submitted to an intraoral local anesthesia and after some minutes the atraumatic extraction begun. The procedure was realized with forceps number 23, which is indicated to mandibular molars. Figures 7 to 12 shows that after extraction, the tooth was put in a stainless steel surgical tub containing Pedialyte and the tooth was held by thumb and index fingers and the endodontic surgical procedure started.

The lesion came out attached to the root of the tooth during the extraction and it was removed at the same time of the apical third during the apicoectomy with a surgical bur (Zekrya FG Invicta – American Burrs, USA). After the root-end inspection, was realized the retro-prepare with surgical ultrasonic tips and then, bioceramics (EndoSequence BC RRM, Brasseler, USA) was placed and compressed with micro-instruments to full-fill the entire space. In the end of this process, the apical third apicoectomized was cleaned with Pedialyte and the tooth was replanted on its socket and sutured.

Seven days later, the patient came back to the dental office and during the clinical evaluation, was observed that the tooth was completely stable and the suture was removed. Figure 18 shows the roots seven days after the procedure. The patient returned in the previously mentioned periods of time and CBCT controls were realized one and two years after intentional replantation as can be seen in Figures 19 and 20. The positive evolution of this case guarantee the success of the procedure and the patient's expectation regarding the maintenance of the tooth was achieved. In conclusion, it was unnecessary to extract the tooth and replace it with an implant (Fig 21).

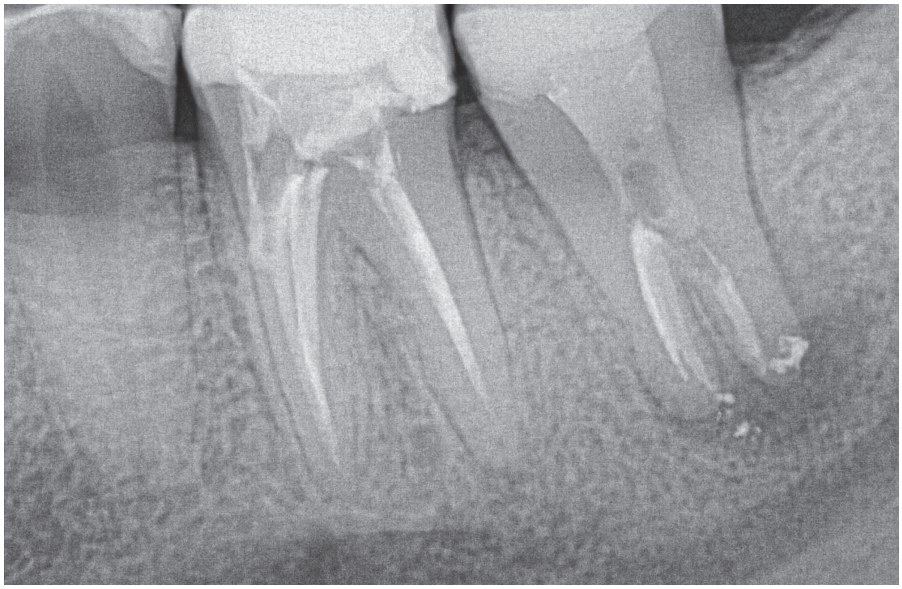

Figure 4. Initial radiograph showing a radiolucent image around the root apexes and their proximity to the mandibular canal.

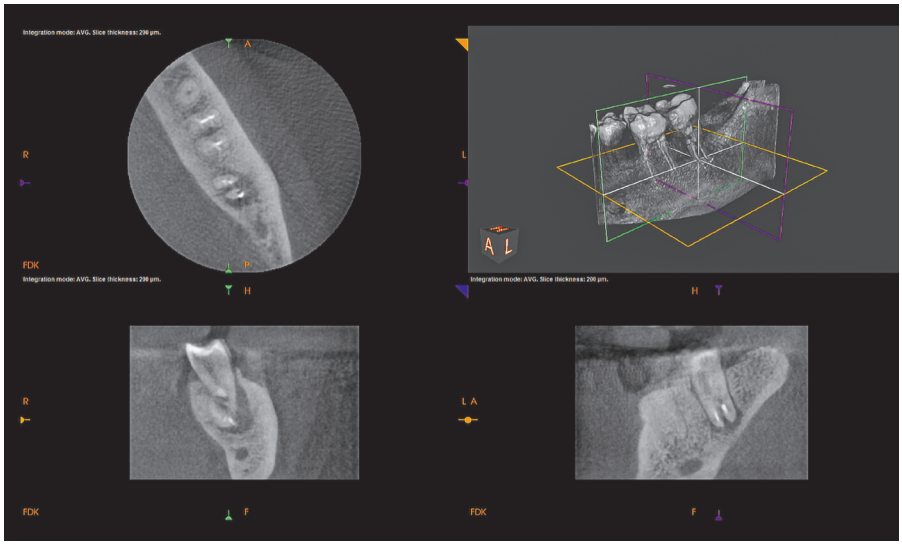

Figure 5. Tomographic cuts on the three axes, showing the real size of the lesion and its distance to alveolar nerve.

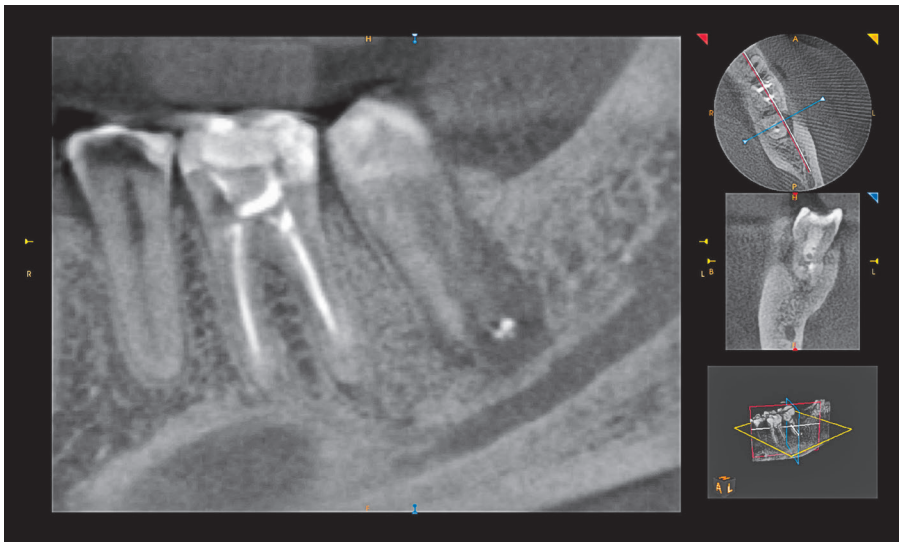

Figure 6. Tomographic cuts (sagittal, on the larger image) showing the actual size of the apical lesion.

Figure 7. Safe extracted tooth in the forceps, with the lesion sticking to the root apex.

Figure 8. Apical third cut with Zekrya FG Invicta drill (American Burrs, USA).

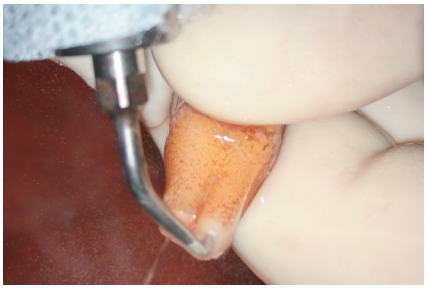

Figure 9. Retro-preparation with ultrasonic insert.

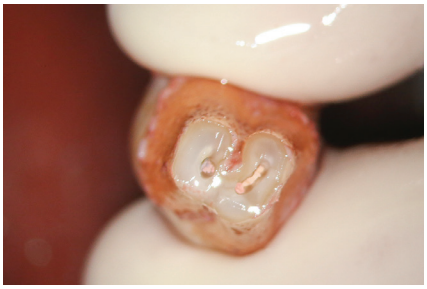

Figure 10. Inspection of the apical third of the root and the retro-preparation, always performed with magnification.

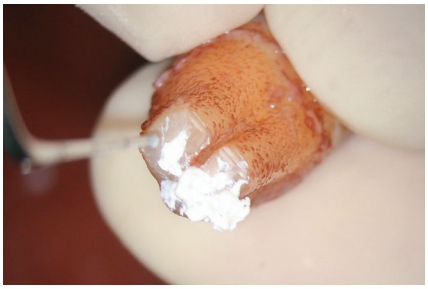

Figure 11. Retrofilling of the preparation with bioceramic repair cement EndoSequence BC RRM (Brasseler, USA).

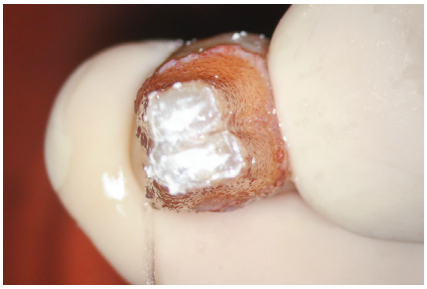

Figure 12. Washing of the apical third, for removal of the excess bioceramic EndoSequence BC RRM (Brasseler, USA).

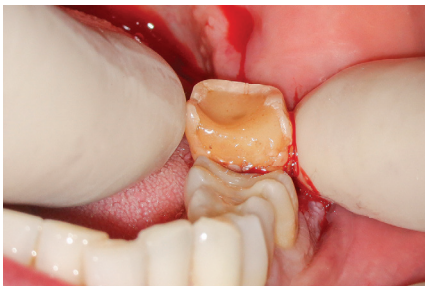

Figure 13 to 16. Repositioning the tooth in the alveolus.

Figure 17. Repositioned tooth in its alveolus and crisscross sutured.

Figure 18. Radiography after 7 days of surgical procedure.

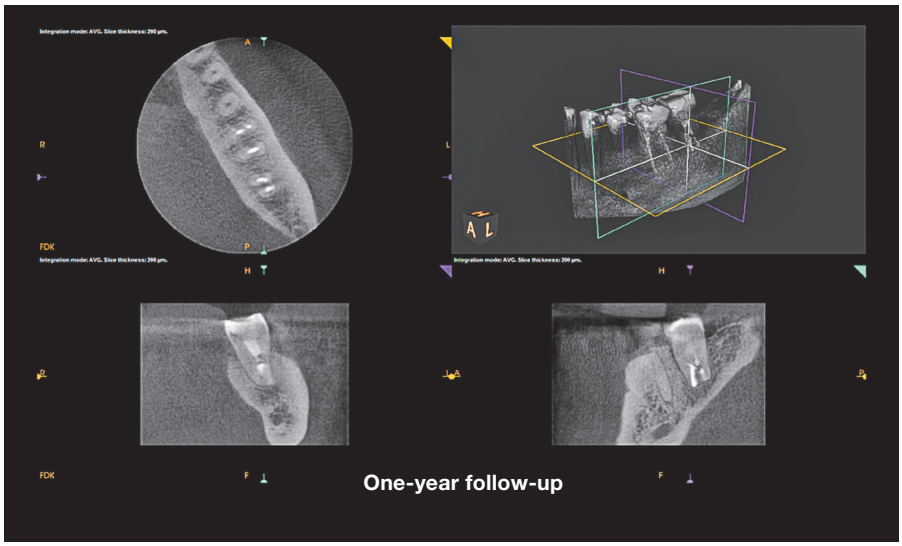

Figure 19. One-year tomographic cuts case follow-up.

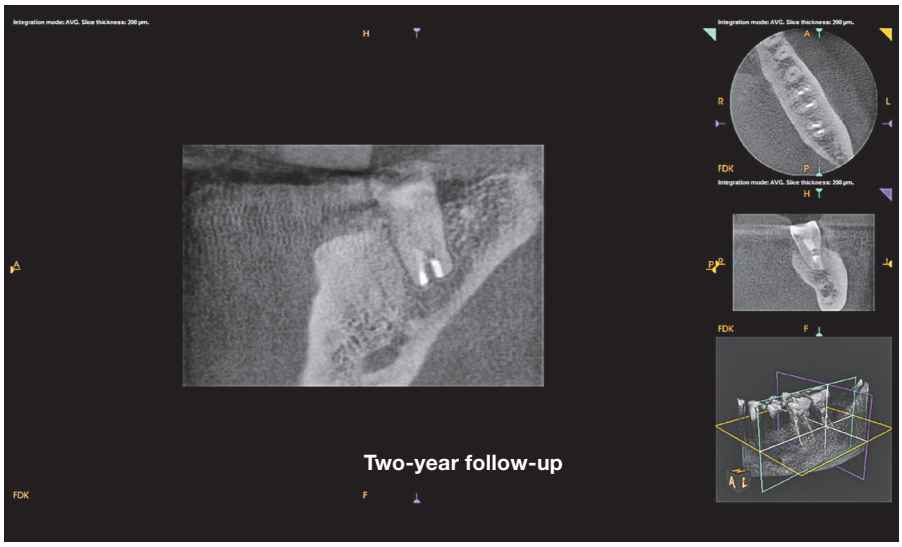

Figure 20. Tomographic (sagittal, on the larger image) two-year follow-up cuts, showing the repair of the apical lesion.

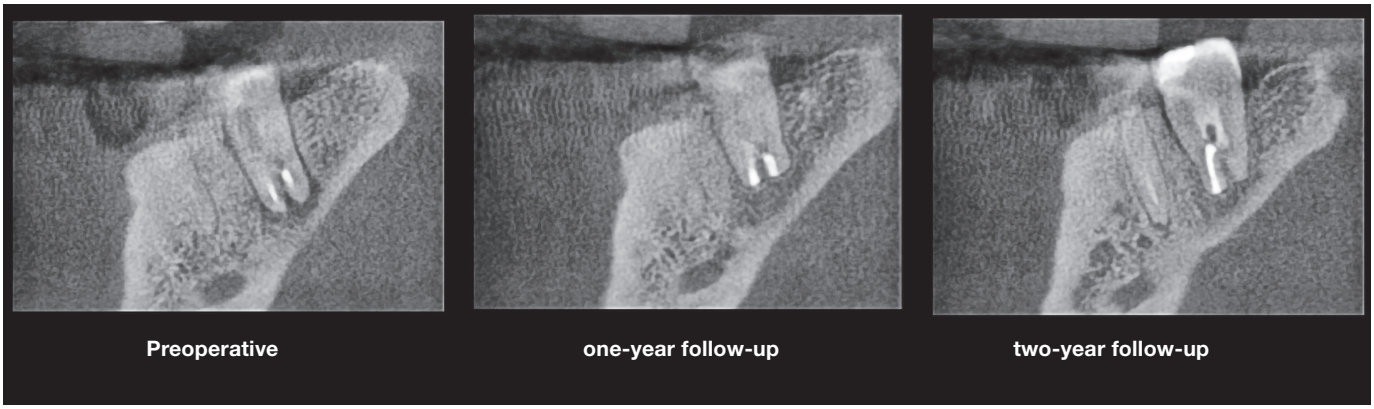

Figure 21. Tomographic cuts (sagittal plane): preoperative, one-year and two-year follow-ups, evidencing the repair of the apical lesion.

Case 2

Patient female, Caucasian, 44 years old, went to the dental office because she was experiencing pain in mandibular left region. In x-ray exam was observed a periapical lesion with substantial bone loss in the mesial side of tooth #36. It was also observed that the tooth already had an endodontic root canal treatment, but was noted the presence of some endodontic material like gutta-percha beyond the root apex. Additionally, in the apical third of the roots was noted a process similar to root resorption.

Patient was referred to a particular radiographic center to do a CBCT exam, which confirmed the apical root resorption as well as the presence of a radiopaque material compatible with an endodontic filling material (gutta-percha). Moreover, was not observed vertical root fracture in this tooth but, a huge proximity between the lesion borders and mandibular canal. These observations were important in the decision making and that is why intentional replantation was choose.

The procedure and every surgical step adopted in this case were similar as described in case one. Radiographic controls were realized after three months and one year (Figs 23 and 24), with no sign and symptoms. Eleven years later, the patient came to the dental office and was done another x-ray and CBCT in tooth #36. Figures 25, 26 and 27 have shown the complete healing in the apical area.

Undoubtedly, this long-term follow-up is a success not only from an Endodontic point of view, but also from a Dental perspective. It is clear that scientific knowledge and technical resources capable of saving natural teeth, when well understood and executed, are predictable and, at the end, they are capable of guaranteeing the first principle of the Dental profession: saving teeth!

Figure 22. Periapical radiography where note the presence of the gutta-percha cone outside of the channel limits, in the mesial root.

Figure 23. Periapical radiography of three-month follow-up, where you notice the decrease of the radiolucent image.

Figure 24. Periapical radiography of one-year follow-up, where you notice the decrease of the radiolucent image.

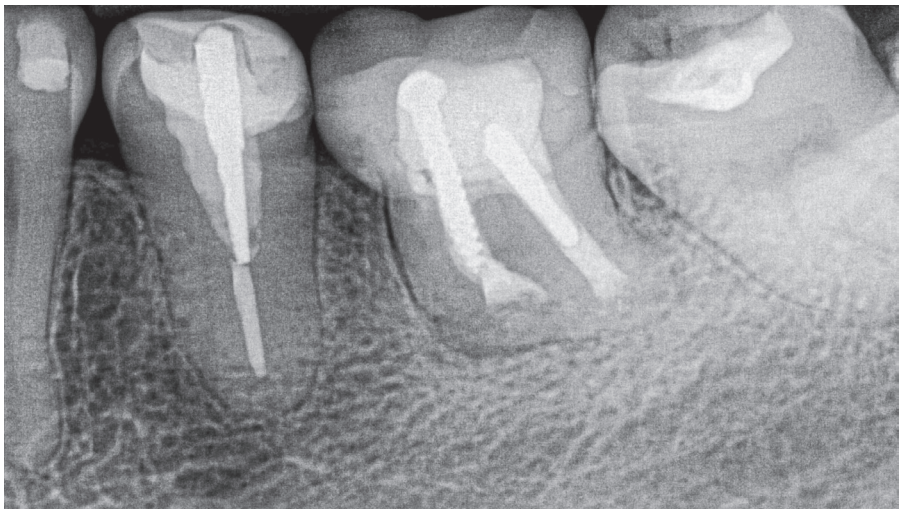

Figure 25. Periapical radiography of eleven-years follow-up, where one can notice the radiolucent image reduction.

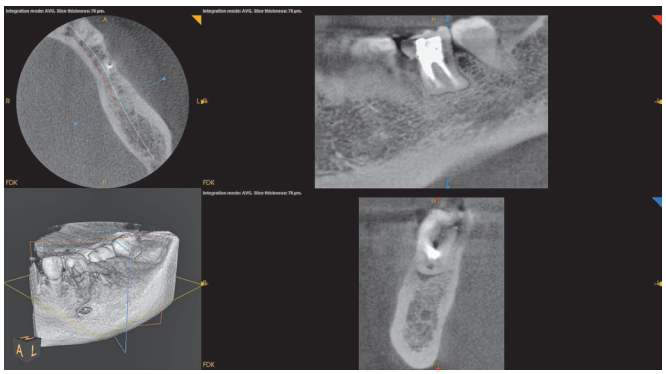

Figure 26. Tomographic cut of eleven-year control, where the radiolucent image decreases.

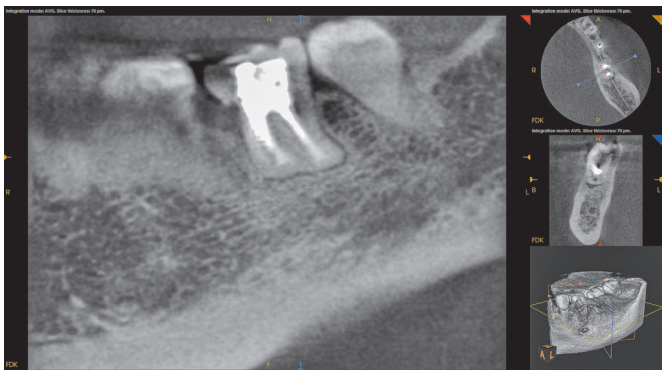

Figure 27. Tomographic (sagittal plane) cut of eleven-year control, where the radiolucent image decreases.

Discussion

Endodontics is the field of Dentistry that takes care of the internal portion of the tooth and, ultimately, is the field that acts to maintain the natural tooth while preserving the apical area free from infection processes. It is well established that the objectives of root canal treatment are: prevention and/or elimination of apical periodontitis, creating a microenvironment favorable to wound healing.[18-20]

The introduction of different and new technologies and techniques during endodontic therapy, increased the predictability and, consequently, the success rates too. Numerically, primary endodontic treatment has 97% of success whereas, non-surgical retreatment has 80% and surgical treatment 94%.[8,21-24] Based on these data, it is possible to argue that endodontic treatment is an important therapeutic modality that has high success rates. Additionally, endodontic treatment has principles that are based on technical and philosophical questions, which are essential for the preservation of natural dentition.

Among possible surgical procedures in Endodontics, either apical microsurgery or intentional replantation, both have similarity in relation to surgical steps and also related to their purpose in saving teeth. According to Torabinejad et al,[7] in a systematic review between 1966 and 2014, the successful rates of intentional replantation was 88%. Nevertheless, as pointed out by Becker[6] and confirmed in the works carried out by Setzer et.al[25] and Kohli et al,[26] due to the similarity between these two procedures – in relation to the use of magnification, lighting, microinstruments, ultrasonic tips and retro-filling materials (MTA and Bioceramics) – it is possible to infer that the success rates are similar and close to 94%.

Some years ago, dental implants have generated in some dental surgeons a huge transformation in their spirit and desire to save teeth. In the past few year, many article about implants and its long-term follow-up were conducted by some researchers and it was possible to touch in a neuralgic topic with a central important questioning: "*Would be the act of dental extraction and implant replacement a truly panacea that dominate Dentistry in the last two decades against a more complex approach (and sometimes more difficult) as it is the endodontic non-surgical and surgical retreatment?* As a result, Giannobile and Lang,[27] concluded the same as others authors have said about dental implants.[28-31] "*The mistaken belief in that dental implants have a better prognosis than the natural tooth in a long run, is now, clearly, rejected in many comparative studies.*" Besides, they affirm that is important to observe the success in relation to maintenance of teeth and preservation of natural dentition.

All other treatment options to salve compromised teeth, such as endodontic treatment, periodontal treatment, apical surgery, intentional replantation and dental auto-transplantation, should be taking in consideration and individually.[32] Thus, is necessary a very craterous evaluation of the case before considering intentional replantation, once it may be the last chance for a compromised tooth. The key factors are atraumatic extraction, the use of adequate instruments and materials, minimum extraoral time, to keep PDL cells viability and maintenance of the entire aseptic chain.

As reported previously in this article, all steps were realized under dental microscope. And the CBCT follow-ups have showed that the choice for intentional replantation was completely correct. In CBCT sections is possible to observe the total regression of the lesions and neo-formation of bone tissue in the apical area – so, no doubts about the success of the treatment employed and the preservation of the teeth in the oral cavity, as it was desired by the patients since the first appointment.

Intentional replantation is a scientific-based procedure that requires technical skills and knowledge about many surgical steps. It is essential the use of dental microscope and properly instruments this kind of approach. In conclusion, it could be one more tool in endodontic box to maintain the natural dentition as long as possible.

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