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DENTAL TRAUMATOLOGY

Case Report

Intentional replantation – a 'last resort' treatment or a conventional treatment procedure? Nine case reports

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Abstract – Intentional replantation is an accepted endodontic treatment procedure in which a tooth is extracted and treated outside the oral cavity and then inserted into its socket to correct an obvious radiographic or clinical endodontic failure. This article reviews nine cases of intentional replantation (IR) that show the feasibility of the procedure in a variety of indications. Only one case of replantation showed evidence of pathosis that reflected root resorption or ankylosis. This report suggests that IR is a reliable and predictable procedure and should be more often considered as a treatment modality in our efforts to maintain the natural dentition.

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Key words: intentional replantation; ankylosis; periradicular surgery; apical periodontitis; apical surgery; external root resorption

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Although non-surgical endodontic procedures have a high success rate, failures do occur (1–3). These can be managed by root canal re-treatment or endodontic surgical intervention (4). The purpose of this article is to present intentional replantation (IR) as a reliable and predictable procedure that may be regarded as a potential option when considering endodontic periradicular surgery.

Definition

Intentional replantation is an accepted endodontic treatment procedure in which a tooth is extracted and treated outside the oral cavity and then inserted into its socket to correct an obvious radiographic or clinical endodontic failure (5).

Indications

Intentional replantation is indicated when other endodontic treatments performed to maintain the tooth have failed, or when endodontic periradicular surgery is not feasible.

- *Failure of root canal treatments*: If conventional root canal therapy, non-surgical re-treatment, and surgical re-treatment have failed, intentional replantation may be indicated.
- *Anatomic limitations*: Proximity of the treated root apex to nerves such as the mandibular or mental nerve, or to anatomic structures such as the maxillary sinus can present problems with periradicular surgery, and IR should be considered as an alternate treatment.
- *Accessibility problems*: Periradicular surgery on mandibular molars can be difficult because of dense buccal bone (external oblique ridge) and lingual root inclination.
- *Patient management*: A procedure such as periradicular surgery, which requires patient cooperation, especially when using the microscope, can be difficult to perform. Intentional replantation may facilitate the desired result.
- *Persistent chronic pain*: Sometimes, IR is an option as a diagnostic tool when all former treatments fail to alleviate chronic pain. It also permits evaluation of unsuspected pathosis such as resorption or fractures.

- *Accidental exarticulation*: Removing a fixed partial prosthesis may accidentally extract a tooth that can be replanted presuming the tooth has no periodontal defects.
- *Involuntary rapid orthodontic extrusion* (6).
- *Patient objection to periradicular surgery*: When there is strong patient objection to surgery, replantation provides a good alternative.
- *Trismus*: When non-surgical root canal treatment cannot be performed because of inadequate interocclusal space, replantation may provide an alternative.

Contraindications

- *Flared or curved roots*: Widespread or curved roots may fracture during extraction, thus hampering any attempt to replant the tooth.
- *Periodontal involvement*: A healthy periodontium is essential for long-term success. Ensure good oral hygiene, cohered self-care practices and completion of periodontal therapy before IR.
- *Broken tooth*: Vertically fractured teeth or non-restorable teeth.

Advantages of IR

Intentional replantation handles both the root end infection and the extraradicular infection. In this respect, it provides the combined benefits of re-treatment and periradicular surgery.

Intentional replantation is a less invasive procedure compared to apical surgery. Periradicular surgery has its risks when there is proximity to anatomic structures like nerves, blood vessels, sinuses or adjacent roots. This type of surgery requires considerable manipulation and is usually performed by oral surgeons or endodontic specialists with special instruments and microscopes. Contrarily, it is this author's view that IR is an easy procedure that can be performed by general practitioners.

In IR, access to the tip of the root is easy. The root-end preparation and filling are done better extraorally, thus achieving a more hermetic apical seal of the root canal system.

In IR, there is marginal bone loss, less risk of perforating the lingual plate or causing bone dehiscence (7), and of course no soft tissue injury or scars. In most cases of periradicular surgery, there may be postoperative discomfort such as pain and swelling, while IR is usually uneventful (8). Apical surgery of the maxillary premolars and molars may cause perforation of the maxillary sinus and the associated risk of displacing the resected root apex into the sinus (9).

Intentional replantation can also be a good diagnostic tool for cracks and fissures that are often missed in non-surgical treatments.

Finally, apical surgery is expensive in terms of direct (surgery cost) and indirect (sick leave and loss of income) costs. Intentional replantation, in contrast is an inexpensive and quick procedure.

Disadvantages of IR

Intentional replantation is not suitable for teeth with curved or flared roots because there is the risk of tooth fracture during manipulation and extraction. Intentional replantation cannot be performed with abutment teeth and requires removal of the fixed prosthesis prior to considering IR. There is the risk of root resorption and ankylosis in IR. Finally, IR is still an uncommon procedure, and is therefore perceived as a 'last resort' treatment with less experience.

Treatment procedure

- During extraction, any trauma, scraping or denudation of the periodontal ligament (PDL) or the cementum should be minimized. Damage to the cementum may result in root resorption (10).
- Extraction should be done with care using minimal pressure. Elevators should not be used because of the potential damage to the PDL.
- Extra-oral time should be as brief as possible. Proper organization is important for the efficient cutting of a root-end cavity and filling placement while keeping the periodontal ligament moist with physiologic solution throughout the procedure. The longer the tooth is left outside of its socket, the poorer the prognosis.
- Premedication with broad-spectrum antibiotics, such as amoxicillin is often indicated, especially when pain and swelling preceded the operation. The patient is instructed to use 0.12% chlorhexidine rinse (use 15 milliliters as a mouth wash for 30 s twice a day), starting 1 day before the procedure, in order to decrease the bacterial content in the oral cavity.
- When using the forceps, the beaks should be placed on the crown and should not reach the cemento–enamel junction. Placing a rubber band around the handle of the forceps can help to apply constant pressure on the crown and prevent the clinician from loosening his/her grip and dropping the tooth after it is extracted. (Fig. 2)
- Touching the socket walls should be avoided after the extraction. Only the apical part of the socket can be aspirated or curetted very gently. Avoid touching or desiccating the root surface (Fig. 1b).
- The root end is resected with a high-speed turbine using copious water. The root apex is flattened and a class I cavity is prepared with a small bur (Fig. 3a). The apex is dried gently and a filling is placed (Figs. 1c,d and 3b). Use of various filling materials such as zinc-free amalgam, desiccated

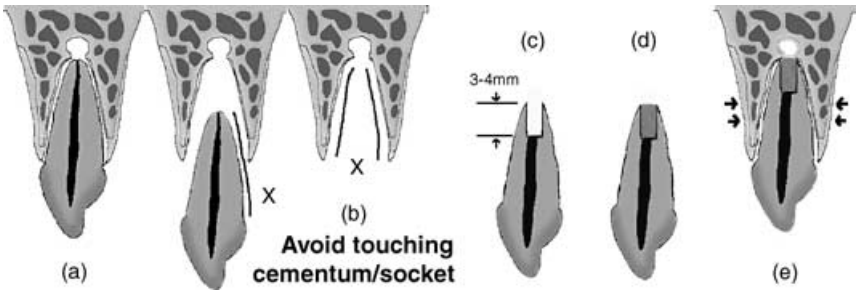

Fig. 1. Schematic steps for IR: (a) Tooth with periapical disease. (b) During extraction avoid touching cementum and socket. (c) Preparation of class I cavity. (d) Filling the apex. (e) After replacing the tooth the bone plates are pressed gently.

zinc oxide eugemol (ZOE), and gutta-percha is reviewed in the literature.

- After placing the tooth back in its socket, the clinician should gently press the buccal and lingual plates. The patient can bite on a wood stick to help stabilize the tooth. Splinting is not advocated and should be done only if necessary as in cases of short roots, lack of interseptal bone etc. Prolonged splinting does not allow physiologic mobility and can promote replacement absorption or ankylosis of the root (11, 12) (Fig. 1e).

Case reports

The following case reports show the feasibility of IR in a variety of indications. In each case, the rationale for the procedure was different.

Case no. 1

A 47-year-old sailor appeared in the clinic with massive swelling in the left mandibular area. Upon examination, the second lower left premolar appeared mobile and tender to the slightest touch. The X-ray (Fig. 4a,b) showed a large periapical radiolucent area surrounding about 80% of the root and almost

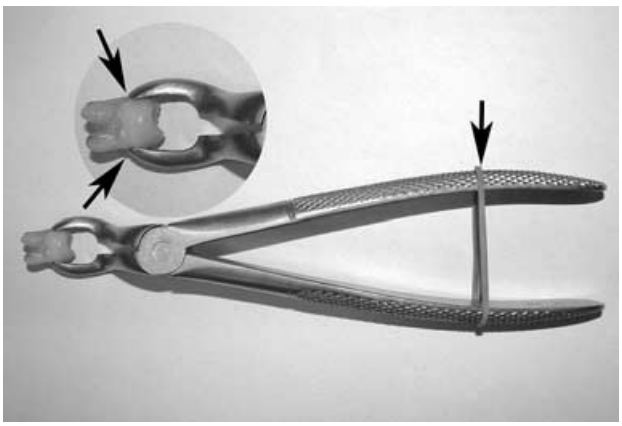

Fig. 2. Place a rubber band around the handle (arrow) to keep constant pressure on the crown. Inlet: the clinician must take care not to touch the cemento–enamel junction (two arrows) with the forcep beaks.

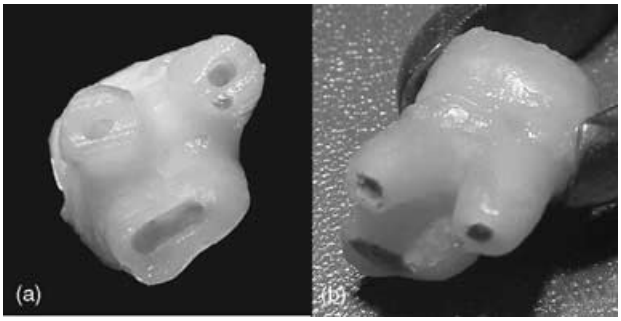

Fig. 3. (a) The tooth is prepared by leveling the apex and drilling with a small bur. (b) The apex is filled and the tooth is ready for replantation.

reaching the alveolar crest, leaving only about 3 mm of PDL in the coronal area. As the patient had only a short leave before departing to sea, it was decided that replantation should be tried as a last option to save the tooth. After a course of 1.5-g ampicillin given daily for a week, the swelling and the pain subsided, and the tooth was extracted and replanted with a retrograde amalgam filling. During extraction, the old post separated from the root and a temporary ZOE filling was carried out (Fig. 4c). Two months later, the clinical symptoms have completely disappeared and there are no evident radiographic changes (Fig. 4d). After 8 months, the periapical rarefaction showed a marked reduction in size with new PDL formation in the inter-radicular area (Fig. 4e). After 30-month post replantation, the tooth shows no radiolucency in the apical region and the PDL is completely renewed (Fig. 4f).

Case no. 2

A patient in his forties entered the clinic with massive swelling of the left cheek accompanied with excruciating pain. Clinical examination revealed a second lower left molar that served as an abutment to a 4-unit fixed partial denture (FPD). The X-ray showed rarefaction of the bone around both mesial and distal roots (Fig. 5a). A course of 1.5-g amoxicillin was given daily together with strong painkillers, with no apparent improvement in symptoms even after a few days. Non-surgical re-treatment was considered as an

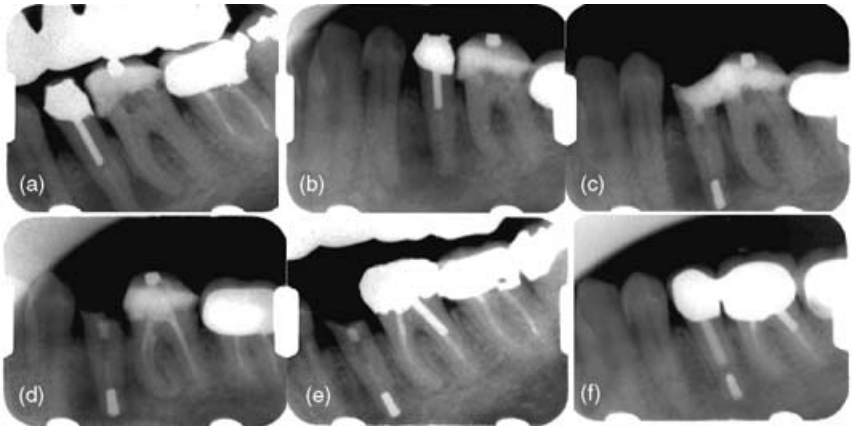

Fig. 4. (a, b) Mandibular premolar presented with periapical disease. (c) After replantation. (d) Two months after IR, still no radiographic changes. (e) Eight months after IR, the periapical rarefaction showed a marked reduction. (f) Thirty months post replantation the PDL is completely renewed.

option but handling the post in the distal root could be problematic.

As the patient could not tolerate the pain anymore, it was decided to extract the tooth, check for root fractures and replant it after performing an extra-oral retrograde filling. The tooth was separated by cutting the FPD, extracted without breaking the porcelain crown and replanted without any splint (Fig. 5b). A few hours after replanting, the pain disappeared completely. Fifteen months later, the periapical and panoramic X-rays shows good healing with no periradicular rarefactions (Fig. 5c,d).

Case no. 3

A 70-year-old patient presented with complaints of discomfort around the second lower right incisor. An examination revealed the presence of a sinus tract near the tooth. The X-ray report showed a periapical area encircling approximately 50% of the apical root

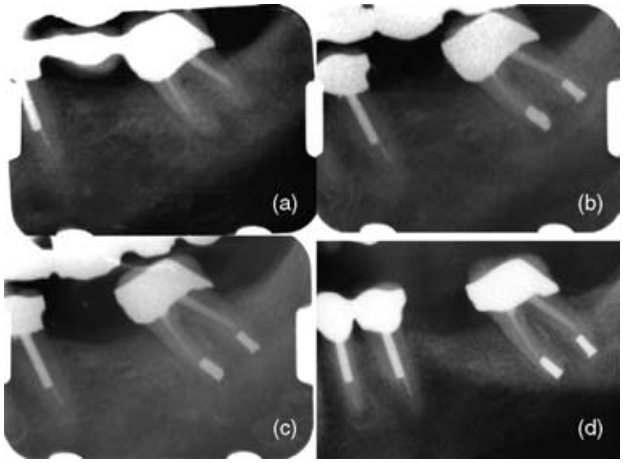

Fig. 5. (a) Mandibular second molar presented with periapical disease. (b) Immediately after IR. (c, d) Fifteen months later, periapical and panoramic X-rays show complete healing.

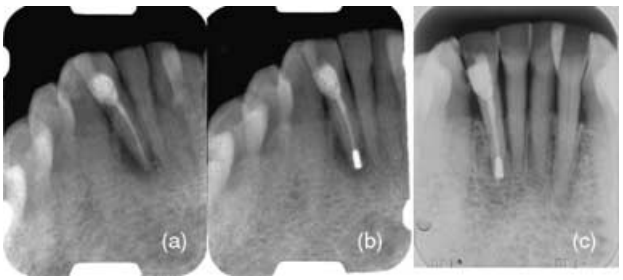

Fig. 6. Replantation of mandibular incisor presented with periapical disease and sinus tract. (a) Periapical radiolucency encircling 50% of root. (b) After IR and retrograde amalgam filling. (c) Four years later, periapical X-ray shows good healing.

area with disappearance of the PDL (Fig. 6a). As the patient refused to undergo any surgery, the tooth was extracted and replanted after an extra-oral retrograde amalgam filling was performed (Fig. 6b). After 4 years, the tooth shows no clinical problems, the sinus tract is long gone and the X-ray shows good apical healing (Fig. 6c).

Case no. 4

A 40-year-old patient arrived 12 years ago to the communal clinic with complaints of discomfort around the lower second left molar. Examination revealed a sinus tract near the tooth that served as an abutment to a 3-unit FPD. The X-ray showed an old root canal treatment with rarefaction around the roots. After removing the bridge, the root canals were retreated (Fig. 7a). Five years later, the fistula returned accompanied with pain and discomfort. The tooth was extracted, apicoectomy was done extra-orally with amalgam fillings on both roots, and then replanted with no splinting (Fig. 7b). Radiographs taken at 3-month intervals showed no improvement around the mesial root and a deep mesial periodontal pocket was evident. After 11 months, a hemisection was

Fig. 7. (a) Second mandibular molar after failed root canal re-treatment. (b) Several months after IR, periapical disease is still present around mesial root. (c) Eleven months after replantation, tooth was hemisected and mesial root extracted. (d) Twenty-five months after IR, an FPD is fabricated using the distal root as abutment. (e, f) Seven years after replantation, the root is asymptomatic and still well supports the 3-unit FPD.

performed and the mesial root was extracted (Fig. 7c). Fourteen months later, good healing around the remaining distal root allowed fabrication of a new FPD using that root as a distal abutment (Fig. 7d). Seven years after the replantation, the patient is asymptomatic and the root supports a 3-unit fixed partial denture (Fig. 7e,f).

Case no. 5

In this case, the patient was unable to chew on a recently treated right lower second molar. Examination revealed that the tooth is highly sensitive to direct vertical percussion. An X-ray showed a recent root canal treatment with suspected perforation

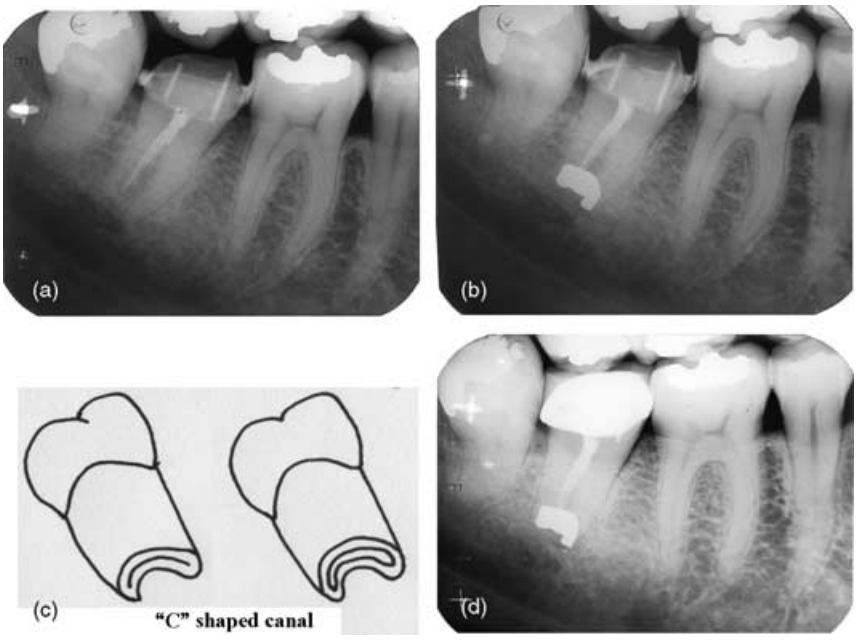

Fig. 8. (a) Second right molar presented with constant unbearable pain upon chewing. (b) Immediately after IR and apical amalgam filling. (c) Upon examination, the root appeared to be C-shaped and no evident perforation was present. (d) Six months after IR.

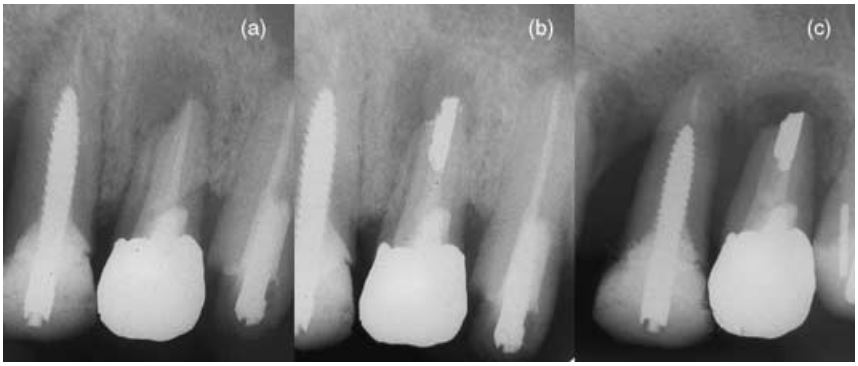

Fig. 9. An example of a poor case selection. (a) Maxillary first premolar in poor periodontal shape and apical disease. (b) After IR. (c) Sixteen months later, both the canine and the premolar were extracted because of extensive periodontal disease.

(Fig. 8a). After extraction, it turned out that the crescent-shaped root (Fig. 8c) is not perforated and the tooth was replanted after a retrograde amalgam filling was performed in the C-shaped canal (Fig. 8b). A few days later, the patient reported that the pain upon chewing had subsided. Six months after IR, the PDL shows no sign of ankylosis or resorption (Fig. 8d).

Case no. 6

This case displays how poor case selection results in failure. A patient presented with a periapical abscess in the upper left first premolar. The tooth was in a poor periodontal state along with adjacent teeth (Fig. 9a). Hoping to give the tooth a few more years of function, it was extracted and replanted with an apical amalgam filling (Fig. 9b). After 16 months, both the premolar and the adjacent canine were extracted because of extensive periodontal disease (Fig. 9c). This case should have been regarded as hopeless from the beginning.

Case no. 7

A lower second molar that was retreated endodontically was extracted and apically filled because of a persistent sinus tract (Fig. 10a). After IR, all symptoms subsided, the PDL is intact and the tooth is still functioning 16 years later (Fig. 10b). Note the presence of an asymptomatic chronic periradicular disease on the first molar with a prefabricated crown.

Case no. 8

A lower first premolar had a persistent inflammation with a sinus tract that seemed to originate from a deep mesial periodontal pocket (Fig. 11a). Only after computerized tomography CT, periradicular disease was found (Fig. 11d–f). The tooth was extracted and replanted with an amalgam retrograde filling (Fig. 11b,c). To restrict bucco-lingual movements, as a result of the problematic crown–root ratio, a simple composite splint was fabricated for a period of 10 days. After the splint was removed, the premolar stayed in good function with no clinical symptoms.

Case no. 9

A patient in her late sixties appeared in the clinic after starting treatment for a fixed partial prosthesis in the lower jaw. Because of earlier bad experience with periradicular surgery performed on the lower left canine (Fig. 12a), she refused to undergo such surgery again. Intentional replantation was the treatment of choice for the apical disease present in the lower right canine and second incisor (Fig. 12b–d). Three years later, the teeth show good healing except for some crestal bone loss in the canine area (Fig. 12e).

Failure

Intentional replantation can fail like other dental procedures. Various articles report success rates

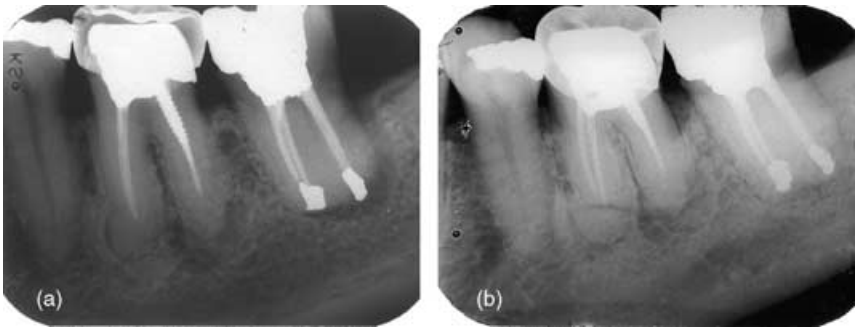

Fig. 10. (a) Mandibular second molar was replanted after failed endodontic retreatment, complicated by chronic sinus tract. (b) Sixteen years post replantation, the PDL is intact and the tooth still functions well.

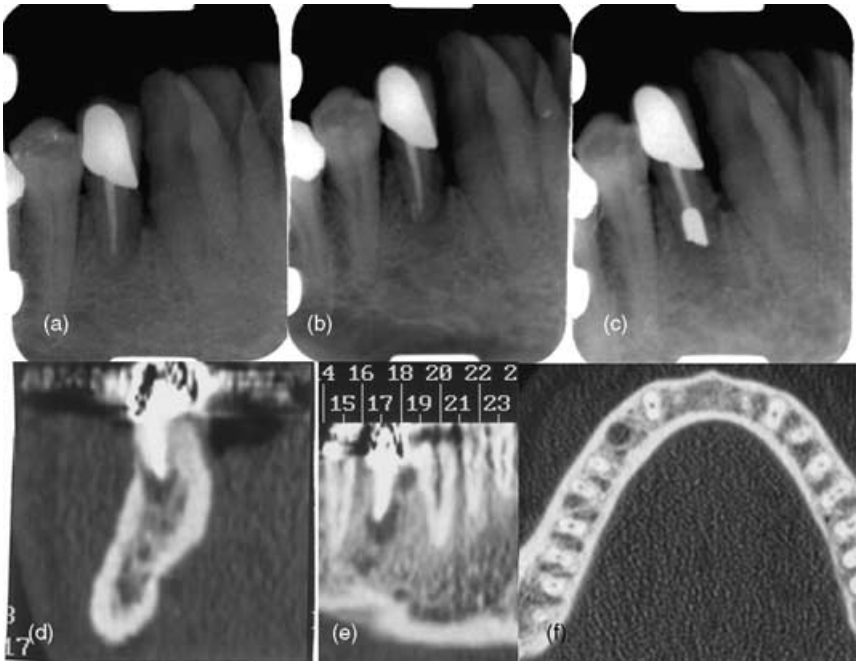

Fig. 11. This case required splinting because of problematic crown–root ratio. (a) First lower premolar presented with acute inflammation that appeared to originate from a deep mesial periodontal pocket. (b) Six months later, just before IR. (c) Immediately after IR. (d–f) CT showing evident apical disease.

between 72–85% (5, 13, 17) with failures as a result of the following: resorption of the roots, persistent chronic infection with or without sinus tract, tooth mobility, periradicular rarefaction, existence of chronic pain, or fracture of the root during extraction. Apical surgery might have a better success rate. Several studies reported in the last decade show an average success rate of 67% (14) but contemporary studies show a success rate passing 90% (20, 21).

Discussion

Intentional replantation should no longer be considered a 'last resort' treatment, prescribed to hopeless teeth (18) as Grossman phrased it (13), and certainly not as 'a procedure with the poorest prognosis' as Weine viewed it (16). Long-term studies show that success rates for IR are somewhat similar to those of apical surgery (5, 15), although recent studies tend to favor apical surgery (20, 21).

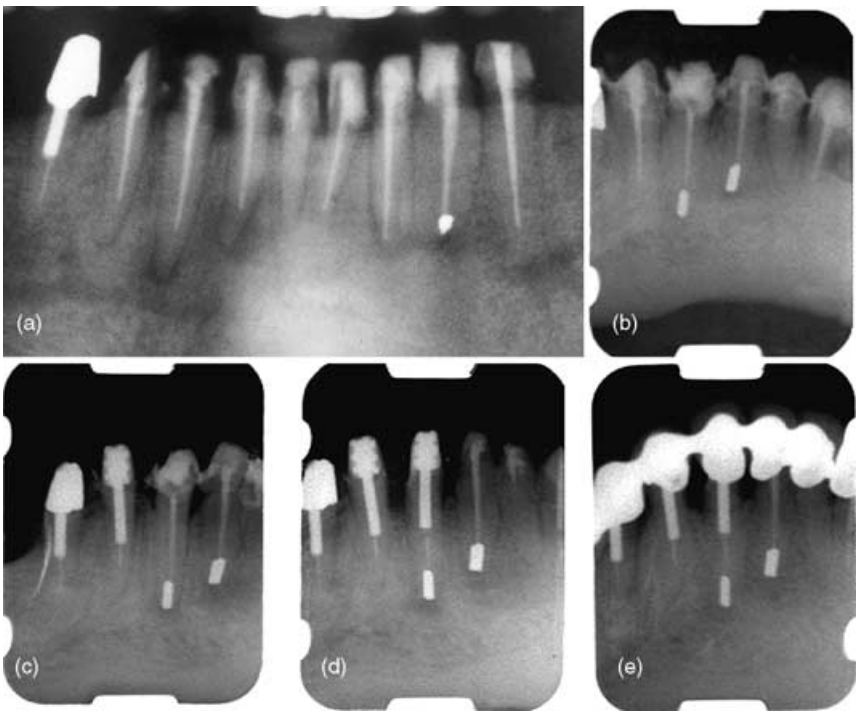

Fig. 12. In this case, the patient refused to undergo periradicular surgery because of earlier bad experience with surgery performed on the lower left canine. (a) Apical disease present in the lower right canine and second incisor. (b–d) Teeth after IR with retrograde amalgam fillings. (e) Three years later, there is good healing except for some crestal bone loss in the canine area.

None of the cases represented in this article have shown root resorption or ankylosis, which are the feared side effects of replantation. Only one case failed completely because of poor selection and one case is considered a success after hemisection. All the treatments were uneventful in terms of pain, swelling or any other side effect.

Several procedures that were once advocated (19) while performing IR are now considered unnecessary (15) as follows: splinting is done only when absolutely necessary and for a short period of 1–2 weeks. In our case reports, splinting was performed in only a single instance. Curettage of the socket is prohibited except the apical end. Care should be taken not to touch the cementum even with wet gauze. The most important factor for success is probably the time it takes to apically treat and replant the tooth. In all the cases shown above, the extra-oral time averaged 5 min and did not exceed 10 min.

The cases presented in this article show that IR is a reliable and even predictable procedure, and should be considered more often as a treatment modality in our efforts to maintain the natural dentition.

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