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Endodontic treatment of large periapical lesions: An alternative to surgery

Asunción Mendoza-Mendoza, Carolina Caleza-Jiménez, Alejandro Iglesias-Linares, Beatriz Solano-Mendoza, Yañez-Vico RM

ABSTRACT

Introduction: Non-surgical treatment with calcium hydroxide offers a high success rate in the healing of large periapical lesions. Case Series: We present the healing of large periapical lesions with conservative, non-surgical treatment in three young patients presenting large periapical lesions and diagnosed with chronic periapical periodontitis. Non-surgical endodontic treatment was carried out involving canal preparation, irrigation with 2.5% sodium hypochlorite, filling of the canal with 75% calcium hydroxide and 25% Kri-1 iodoform paste mixed with sterile saline solution, and sealing of the cavity with composite. The filling was replaced several times, after which endodontic treatment was finally carried out. Complete apical healing was observed in all cases. Conclusion: Non-surgical treatment as a first option allows us to avoid the trauma of surgery in young individuals.

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INTRODUCTION

The formation of periapical lesions is not fully understood, though is accepted that pulp necrosis produces an ideal environment for the growth of microorganisms which in turn release toxins into the periapical tissues, inducing an inflammatory reaction and thus the formation of a periapical lesion [1]. Immunopathological mechanisms and genetic susceptibility may also play a role in the development of periapical lesions, in view of the abundant presence of immunocompetent cells and of different mediators within the lesions [2].

Most periapical lesions can be classified as dental granulomas, root cysts and abscesses [1]. Periapical lesions cannot be identified as either root cysts or apical granulomas based only on the radiographic evidence [3]. A number of studies have found that when the radiological lesion size reaches ≥ 200 mm^2, the incidence of cysts is ≥ 92% [3].

Two different categories of root cysts can be considered, based on histological criteria: (a) true apical cysts, in which the lesion is independent of the apex and presents an intact epithelial lining [3]. Such lesions may be self-perpetuating and fail to heal if not treated surgically; and (b) apical pocket cysts, where the periapical lesion may be directly communicated with the root canal system and respond favorably to non-surgical treatment [3]. Since it is clinically and radiographically impossible to distinguish between pocket cyst and true cysts, a conservative approach to treatment would be advisable in these cases [3].

The treatment options in large periapical lesions are non-surgical management, apical surgery and extraction [4]. The current tendency is to initially offer non-surgical treatment, and when such treatment fails, other additional measures must be considered: repetition of the non-surgical treatment, surgery, or simpler techniques such as marsupialization [4]. Different clinical studies have confirmed that non-surgical treatment with adequate infection control can favor the healing of large periapical lesions [5].

In recent years, there has been increased awareness of the complexity of root canal systems, leading to the development of new techniques, instruments and materials [1]. These advances have greatly improved the working options of the dental professional, as a result of which fewer patients require periapical surgery [1]. Knowledge of the root canal morphology and careful interpretation of the preoperative X-rays are necessary for adequate access and control of infections in endodontic treatment [1]. This in turn probably exerts a decisive influence upon the outcome of the non-surgical treatment of the lesion [1].

This study describes the remission and healing of large periapical lesions (periapical index score were 5) using conservative, non-surgical treatment as a first choice.

CASE SERIES

Inclusion criteria were teeth with closed apex that present a chronic periapical periodontitis and a high periapical index (PAI) score. Exclusion criteria included teeth with open apex and a low PAI score. Three patients with large periapical lesions diagnosed with chronic periapical periodontitis were treated. After signing the informed consent, cleansing, drainage and antibiotic treatment were required, followed by non-surgical endodontic treatment. We removed the pulp tissue, establishing the working length at 0.5–1 mm from the radiographic apex. The canals were instrumented with number 15–40 k-files (Maillefer Instruments S.A., Ballaigues, Switzerland). Irrigation was carried out with 2.5% sodium hypochlorite, and the canals were filled with 75% calcium hydroxide powder (Merck, Darmstadt, Germany) and 25% Kri-1 iodoform paste (2.025% 661-P-chlorophenol, 4.86% camphor, 1.21% menthol, 80.8% iodoform, 6.5% lanolin and 4.6% glycerin), mixed with sterile saline solution. Filling was performed using a reamer rotated counterclockwise. Posteriorly, sealing of the cavity was carried out with composite resin (Enamel Plus HRi, Micerium, Italy). The mixture was replaced after 15 days to counter the acidity produced by the inflammatory process. Further replacements of the calcium hydroxide and Kri-1 iodoform paste were made at intervals of approximately six months, with radiological monitoring. Once healing was radiographically confirmed, the canals were filled with Gutta-percha (Hygenic, Akron, OH, USA) and AH26 cement (De Trey, Konstanz, Germany), using the lateral condensation technique.

Case 1: A 16-year-old patient presented with pain and a phlegmon affecting tooth 36. Clinical examination revealed the presence of a crown placed two years before, and the X-ray study showed a large radio-transparency encompassing the entire furcal zone and mesial and distal root (Figure 1A). The periapical index (PAI) score was 5. The canal filling was replaced twice: after 15 days and after six months (Figures 1B–C). Follow-up after one year showed complete periapical healing of both roots and the furcal zone; endodontic treatment of tooth 36 was therefore carried out (Figure 1D).

Case 2: A 14-year-old patient presented with pain and a phlegmon affecting tooth 22. The case history revealed trauma in the anterior sector several years before. The X-ray study showed root fracture in the middle third of tooth 21 and a large apical image extending from distal to tooth 21 to distal to tooth 22 (Figure 2A). The PAI score was 5. Vitality was confirmed in the apical fragment of 21, as a result of which endodontic treatment in this tooth was limited to the incisal fragment. The canal filling material was replaced several times in both 21 and 22, followed by endodontic treatment (Figures 2B–C). Follow-up after three years showed complete healing of the periapical lesion and healing of the root fracture of tooth 21 (Figure 2D).

Case 3: A 16-year-old patient presented with blood and purulent suppuration from the right nostril and mobility of teeth 12, 11 and 22. The clinical examination revealed old and poorly sealed restorations in the pulp chamber, while the X-ray study showed radio-transparencies from canine to canine, extending to both nasal fossae, with perforation of the floor of the nasal sinus (Figures 3A–D). These lesions showed a PAI score of 5. Apical surgery was planned, though performing it at this time would have implied the removal of several teeth. We therefore decided to start canal treatment in an attempt to induce bone neoformation. After confirming a positive course, conservative treatment was continued, with complete healing apical. The different clinical controls showed no sensitivity to percussion or palpation, and the soft tissues were healthy. The X-rays in turn confirmed progressive healing (Figures 4A–D).

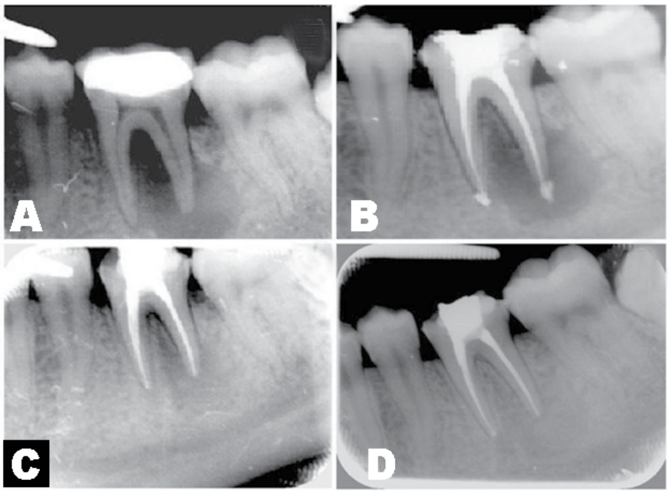

Figure 1: X-rays showing the evolution of Case 1. (A) Pretreatment X-ray, (B) At first canal filling material replacement after 15 days, (C) Following second replacement after six months, and (D) View following endodontic treatment after one year. Note the progressive radiographic normalization and repair of the affected bony tissue.

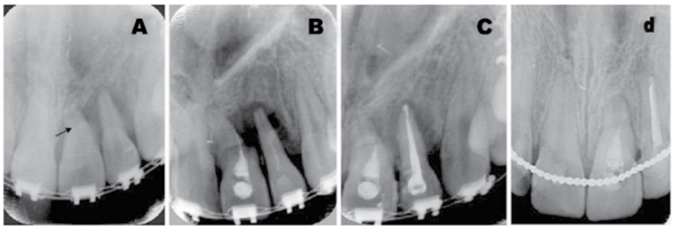

Figure 2: X-rays showing the evolution of Case 2. (A) Pretreatment X-ray: the arrow indicates the fracture of the middle third of the root, (B) View after introducing calcium hydroxide and Kri-1 iodoform paste, leaving the apical fragment of tooth 21 vital, (C) View following endodontic treatment, and (D) Result three years after the intervention, showing complete radiographic recovery of bone health of the three affected teeth.

DISCUSSION

Radiographic changes in bone density are the most constant feature of periapical inflammation. Our patients presented chronic apical periodontitis, assessed by means of the periapical index (PAI) developed by Orstavik [6]. Despite the scored severity of the cases, this index is relatively subjective and to a certain point imprecise, due to its vague grading and potential variability depending on the type of radiographic projection involved [6]. The PAI has been used in studies to identify and radiographically evaluate teeth with apical periodontitis [6]. It comprises an ordinal scale of 1–5 with descriptors ranging from "healthy" to "severe" periodontitis:

1 = normal structures,
2 = minor bone changes,
3 = some bone changes with mineral loss,
4 = periodontitis with well defined radio-transparent areas, and
5 = severe periodontitis with exacerbated features [6].

However, this grading system is based on the evaluation of Brynolf [7], who established comparisons with the periapical appearance and histological changes in human necropsy studies, in order to determine how these changes are reflected in the X-ray images.

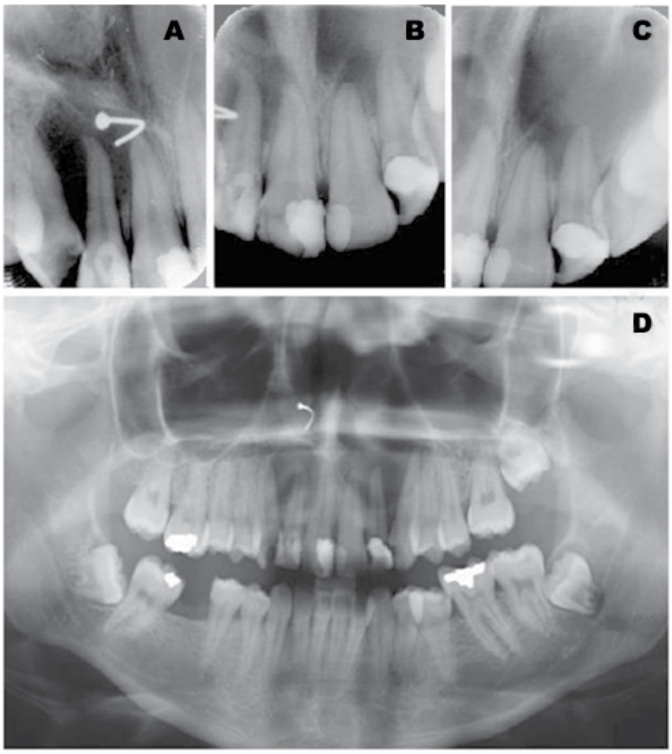

Figure 3: Pretreatment X-rays of Case 3 (A, B, C, and D), superior-right, frontal, superior-left and panoramic X-rays, respectively. The X-rays study showing the large periapical lesions encompassing the region from canine to canine, with extensive bone sequestration.

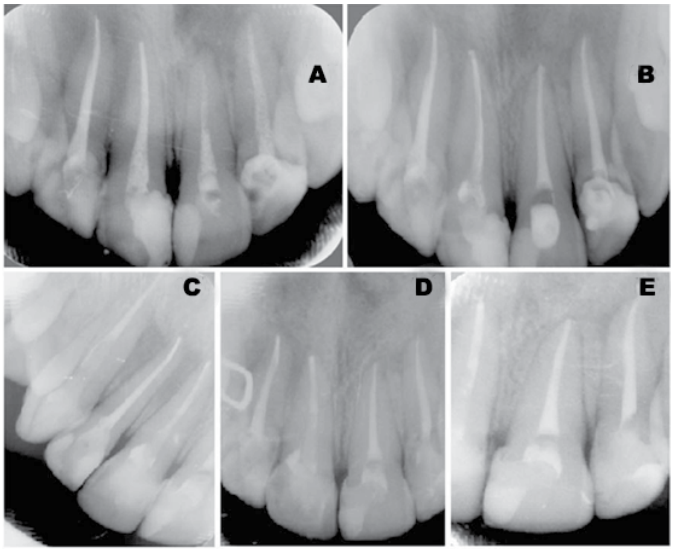

Figure 4: X-rays showing the evolution of Case 3. (A) Following root canal material replacement after six months, (B) X-ray view of the lesion one year after the start of root canal treatment. (C, D, E) Evolutive X-ray views, superior-right, frontal and superior-left, respectively, showing healing of the periapical lesions after five years of follow-up.

The periapical tissues have a rich blood supply, lymphatic drainage and abundant undifferentiated cells that afford good healing potential [1]. The first choice of treatment of periapical lesions should aim to eliminate microbial infection through treatment of the canals, in order to establish an environment favorable to healing [1] because of this heading potential. Bhaskar suggested that if instrumentation is expanded to 1 mm beyond the apical foramen, the resulting inflammatory reaction destroys the cyst lining and transforms the lesion into a granuloma [8]. In turn, as the causal factors are eliminated, the granuloma heals spontaneously [8]. Bender added that exceeding the apical zone with penetration into the radiotransparent area could contribute to healing by establishing drainage and affording pressure relief [9]. However, the added trauma could also increase epithelial proliferation and cyst expansion, and thus not favor healing [9]. Seltzer suggested that excess instrumentation allows drainage of the cyst fluid, with degeneration of the epithelial cells through strangulation, as a result of the proliferation of fibroblasts and collagen – exerting pressure upon the cyst wall capillary supply [10]. In our study, we started instrumentation of the canals after establishing the working length at 0.5–1 mm from the radiographic apex.

Irrigating solutions help reduce the microbial flora of the infected canals, and the use of a tissue-dissolving formulation can help eliminate the necrotic tissue [11]. In our patients, the canals were irrigated with abundant 2.5% sodium hypochlorite – this contributing to improve bacterial elimination. However, the concentrations used in other studies are 1% [11] and 5.25% [12].

Instrumentation and irrigation reduce bacterial presence, though an agent with bactericidal action is still needed to ensure optimum disinfection [13]. Intracanal medication using calcium hydroxide has been described as an efficient disinfection option, and has been recommended for the cleaning of root canals, with success in dissolving pulp tissue remnants from the canal walls [13]. Clinically, this material has been used to promote periapical healing in non-vital teeth with associated periapical lesion [14]. In all of our cases, we filled the root canals with calcium hydroxide and Kri-1 iodoform paste mixed with sterile saline solution, which affords a series of properties: anti-inflammatory activity, neutralization of acid products, activation of alkaline phosphatase, antibacterial action and radiopacity [14]. Calcium hydroxide mixed with an aqueous vehicle (in this case sterile saline solution) loses radiopacity and becomes difficult to visualize on X-rays. This is the main reason why we added a radiopaque material (Kri-1) to the paste. Recent studies have found that teeth treated with intracanal medication show a less intense periapical inflammatory reaction [15].

Sjögren et al. found that the use of calcium hydroxide as a dressing for one week effectively eliminates bacteria from the root canal [16]. It has been shown that treatment with calcium hydroxide affords a high periapical healing rate, and some lesions – particularly in young individuals – decrease or even disappear entirely between 1–4 months after treatment [17]. In our study, calcium hydroxide and Kri-1 iodoform paste were used for a prolonged period of time in order to afford an environment favorable to periapical bone regeneration. However, there is controversy regarding the frequency and timing of calcium hydroxide replacement. According to different authors, replacement should be made when the X-rays show dissolution of the material (every six months, approximately) [17]. In all of our cases, first replacement was carried out after 15 days to counter the acidity produced by the inflammatory process, and posteriorly calcium hydroxide replacement was repeated until apical healing was confirmed radiographically in coincidence with Leonardo and Leal [18], who found that in teeth with periapical lesions the treatment should comprise two or more sessions.

Possible infection of the canal on sealing the crown with temporary material for prolonged periods of time was avoided by filling with definite composite resin.

Radiological signs such as changes in lesion density, trabecular formation and the formation of lamina dura are indicative of healing, particularly when associated to asymptomatic teeth and healthy soft tissues [1]. Estrela and Figueiredo found that the clinical and radiographic determinants evaluated after periods of over two years are able to establish treatment outcome [19]. In our study, the follow-up results were obtained after three and five years in Cases 2 and 3, respectively, though in Case 1 the data were obtained after one year of follow-up. Nevertheless, while not indicated for these purposes, other more sophisticated techniques such as computed tomography and magnetic resonance imaging scan may offer better intrabony visualization, at least from an experimental perspective [20].

CONCLUSION

Complete apical healing was observed in all three of our patients. This study confirms that non-surgical treatment with calcium hydroxide is an initial treatment option of choice in patients with large periapical lesions, affording complete periapical healing. Calcium hydroxide and Kri-1 iodoform paste used for a prolonged period of time afford an environment favorable to periapical bone regeneration. More importantly, non-surgical treatment as a first option allows us to avoid the trauma of surgery in young individuals.

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Author Contributions

Asunción Mendoza-Mendoza – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Carolina Caleza-Jiménez – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Alejandro Iglesias-Linares – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Beatriz Solano-Mendoza – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Yañez-Vico RM – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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