Conservative Non-Surgical Management of a Large Periapical Lesion Using A Calcium Hydroxide Based Sealer For Obturation: A Case Report

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Abstract

Introduction: Periapical lesions often result following dental caries, pulpal infection or trauma. Their management may include both surgical and non-surgical endodontic management.
Case report: The aim of this case report was to report the successful non-surgical management of a large periapical lesion in relation to maxillary right central and lateral incisors using calcium hydroxide based sealer Sealapex for obturation. The case was periodically reviewed and showed signs of almost complete periapical healing after six months.
Discussion: Traditionally, calcium hydroxide is the material of choice for inducing periapical healing when used as an intracanal medicament or as a root canal sealer. In this case, the non-surgical healing of the large periapical lesions using a calcium hydroxide based sealer provided favorable clinical and radiographic response.
Conclusion: The calcium hydroxide based sealer when used for obturation in non-surgical management of a large periapical lesion showed a successful treatment outcome.

Key words: *Calcium hydroxide based sealer, non-surgical management, periapical lesion.*

Introduction

Periapical lesion is a sequelae to endodontic infection caused due to dental caries or trauma. It manifests itself as the host defense response to microbial challenge emanating from the root canal system resulting in localised inflammation, hard tissue resorption, destruction of other periapical tissues and eventual formation of a periapical lesion (1,2,3,4,5,6).The chronic inflammatory periapical lesions are the most common pathology found in relation to alveolar bone of the jaw (90%) and can be classified as dental granulomas, radicular cysts or abscesses (7). Mostly they are diagnosed during the radiographic examination or following acute pain in tooth. The radiographic techniques may be conventional, digital or recent advances such as three-dimensional cone beam computed tomography (CBCT).The management strategies for these periapical lesions include non-surgical endodontic treatment, periapical surgery or even extraction (1,2,3,4,5,6,7). Various studies have reported a high success rate (85%) and a high percentage (94.4%) of complete and partial healing of periapical lesions following non-surgical endodontic treatment (1,3,7), while for surgical treatment it is 69% (8). The ultimate goal of endodontic therapy should be to return the involved teeth to a state of health and function without surgical intervention (3).
Although traditionally, the large periapical lesions have been treated by invasive surgical modalities, few studies have concluded that surgical removal of all large periapical lesions is not mandatory. Besides, periapical surgery has many drawbacks, which limit its use in the management of periapical lesions. Thus, every effort should be made to treat such lesions by a more conservative non-surgical approach using calcium hydroxide based materials, irrespective of the size of the lesion (1,3,4,7,8).

Calcium hydroxide has been used in the clinical practice of dentistry for over a century. It was originally introduced to endodontics by Hermann in 1920 as a pulp-capping agent. Its uses today are widespread in endodontic therapy such as for pulp capping procedures, as an intracanal medicament, in some apexification techniques, and as a component of several root canal sealers (5,9,10). Calcium hydroxide has outstanding action as an inter-appointment intracanal medicament in non-surgical endodontic management and has reported to be successful in 75 % of cases (1,3). Its inclusion in salicylate resin or zinc oxide-eugenol-based root canal sealers for filling root canals also may lead to a better treatment outcome (11). When the root canals are filled with a solid core material, some form of cement is required for a fluid tight seal that fills the minor gaps between the core material and the dentinal wall of the canal to prevent leakage. Thesealers play a significant role in sealing the root canal system, entombing remaining microorganisms and filling inaccessible areas of the prepared canals. The sealer selection may influence the outcome of endodontic treatment. Calcium hydroxide–based sealers such as Sealapex and Apexit have been used in endodontic treatment since over a quarter of a century (9). Till date, there have been very few clinical studies reporting their role in the healing of large perapical lesions.

Thus, the objective of this case report was to evaluate the healing of a large periapical lesion following non-surgical endodontic treatment using a calcium hydroxide based root canal sealer.

Case Report

A 25 year old healthy male patient reported with a chief complaint of pain since 1 week. There was history of trauma due to fall 5 yrs back. Onclinical examination,tooth 11 was found to be discolored with a draining sinus tract in relation to it (Figure 1A). Vitality pulp testing (electric and thermal) showed no response in 11 and 12. Intraoral periapical (IOPA) radiograph revealed a large sized ill-definedradiolucent area surrounding apices of teeth 11 and 12 (Figure 1B). CBCT images taken in coronal, sagittal and axial planes as well the three-dimensional reconstructed CBCT image revealed the presence of a considerable large periapical lesion in relation to t11and 12 (Figure 1C-F). A gutta-percha point was then placed into the sinus tract (Figure 1G) and the IOPA radiograph confirmed its relation to tooth 11 (Figure 1H).

The clinical andradiographic signs were suggestive of periapical pathology in relation to 11 and 12. A provisional diagnosis ofpulp necrosis with chronic periapical abscess in relation to 11 and 12 was made.Hence, non-surgical endodontic treatment was planned for its management withpatient's consent.

On the first visit, access cavity was prepared on 11 and 12 under rubber dam isolation (Figure 2A). Exudate drainage was obtained from the canal. The working length was determined radiographically (Figure 2B). The canals were cleaned and shaped using K-files by step back technique alongwith irrigation using 3% sodium hypochlorite and metrogyl. After the completion of the cleaning and shaping, master cones were selected for both teeth (Figure 2C). Then, interappointment intracanal calcium hydroxide dressing was placed in the canals using lentulospirals for a week and the access cavity was sealed with interim restorative material (Figure 2D). Clinical examination performed after a week showed that the teeth were asymptomatic, the sinus tract was healed and there was no drainage from the root canal. The obturation was done using gutta-percha and calcium hydroxide based sealer Sealapex (Kerr, Italy) using lateral condensation technique under rubber dam isolation (Figure 2E-F).

The patient was recalled regularly for follow-ups after 1 month (Figure 2G) and 6 months(Figure 2H). Although complete radiographic resolution of the periapical lesion was not observed six months after the obturation, but there was a significant progressive reduction in size of periapical lesion. During this period of time, the patient did not have any symptoms of pain and discomfort. Thus, non-surgical treatment of the large periapical lesion in this case provided favorable clinical and radiographic response alongwith signs of good periapical healing.

Discussion

Periapical lesions of endodontic origin may develop asymptomatically and become large over a period of time. They can be assessed clinically as well as radiographically. IOPA radiographic evaluation has been the most widely used method for detection of periapical lesions (6). The recently introduced three-dimensional CBCT has been found to be more accurate in determining the presence, relatively true size, location, extent and density of periapical lesions as compared to IOPA radiography (12).

Making a differential diagnosis between the periapical lesions may have some importance in the selection of an effective therapeutic protocol for their management. It was reported that elimination of bacteria from the root canal is most important factor for the successful treatment of periapical lesion (7). Periapical tissues have a rich blood supply, lymphatic drainage and undifferentiated mesenchymal cells, hence they have a good healing potential by a treatment directed at removing the causative factors (8). Therefore, conventional rootcanal treatment is aimed primarily at eliminating these bacteria as completely as possible (6).Proper cleaning and shaping of the root canals followed by calcium hydroxide medication for a long period of time represents a conservative non-surgical approach to resolve extensive inflammatory periapical lesions (4,6,7). Generally, it is the treatment of choice for teeth with large periapical lesions because it seems to provide the maximum benefit with the least risk. Surgical treatment of all periapical pathologies is not always necessary and is indicated only when non-surgical treatment or retreatment is not possible or unlikely to provide the desired outcome.

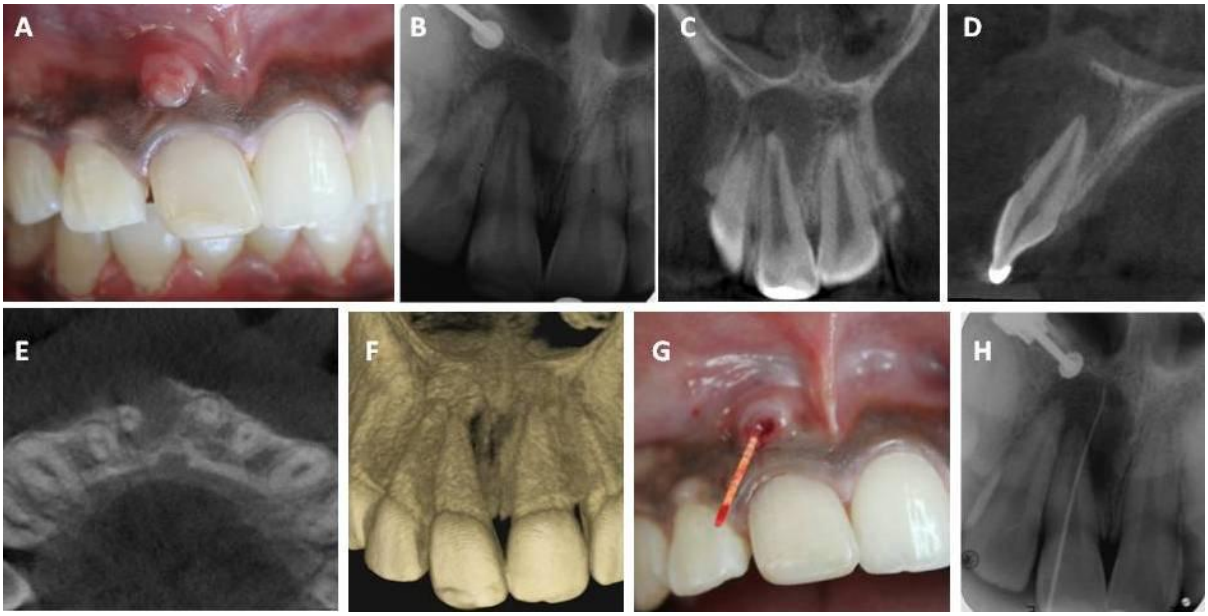

Figure 1. A. Pre-operative photograph showing a draining sinus tract in relation to tooth 11; B. Pre-operative IOPA radiograph showing a large periapical lesion in relation to teeth 11 and 12; C. Pre-operative CBCT image in coronal plane showing mesio-distal extent of the peripaical lesion in relation to 11 and 12; D. Pre-operative CBCT image in sagittal plane showing peripaical lesion in relation to 11; E. Pre-operative CBCT image in axial plane showing bucco-lingual extent of the periapicallesion; F. Pre-operative three-dimensional CBCT image; G. Gutta-percha point tracing of the sinus tract; H. IOPA radiographic view confirming relation of sinus tract to 11.

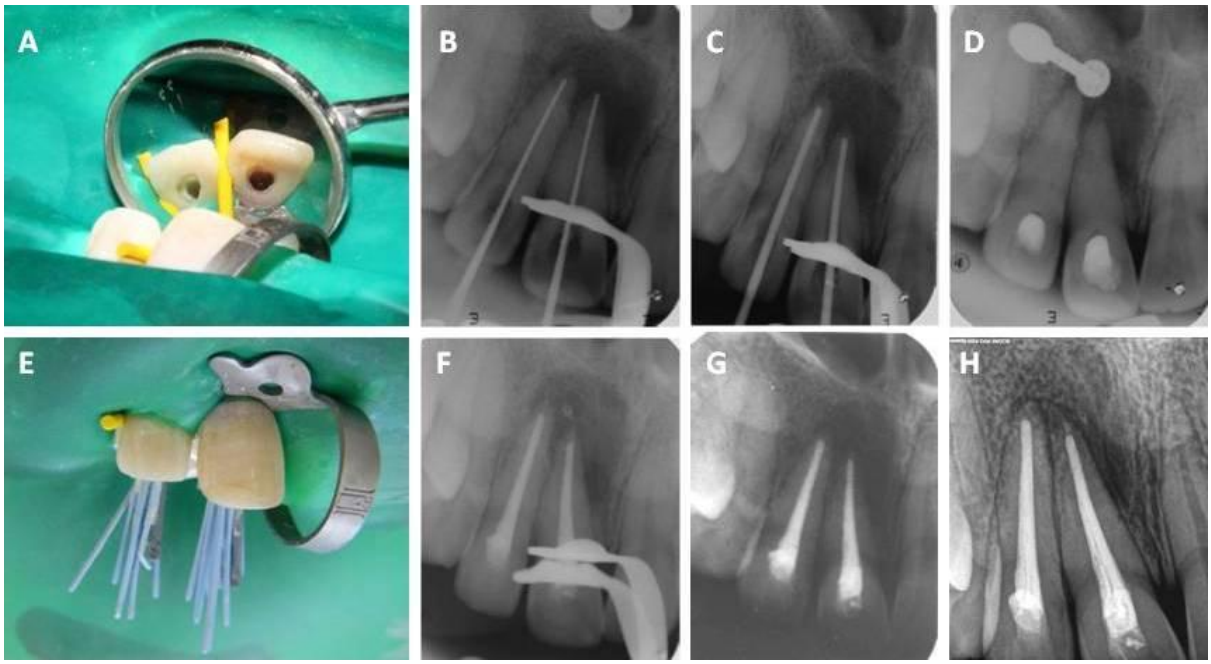

Figure 2.A. Photograph showing access opening done in teeth 11 and 12 under rubber dam isolation; B. IOPA radiograph showing working length determination; C. IOPA radiograph showing master cone determination; D. IOPA radiograph showing intracanal medicament placement; E. Photograph showing obturation done by lateral condensation technique; F. Post-obturation IOPA radiograph; G. 1 month follow-up IOPA radiograph showing reduced size of the periapical lesion in relation to 11 and 12; H. 6 months follow-up digital radiograph revealing progressive healing of the periapical lesion in relation to 11 and 12.

It is believed that the activated macrophages in the periapical lesions are the responsible for the delayed healing of these lesions in absence of bacterial antigens. Thus a novel way of treating the periapical lesions include placement of biodegradable local sustained drug delivery points into the lesion to deactivate the macrophages and enhancing healing rate of the lesions. One of such methods includes the use of calcium hydroxide based sealers for obturation of teeth with periapical lesions. It is necessary to observe and monitor these periapical lesions over a period of time following the non-surgical approach to assess their healing.

Calcium hydroxide has been widely used as an intracanal medicament, due to its high alkalinity, tissue dissolving effect, induction of repair by hard tissue formation and antibacterial effect (6,7). In case of large periapical lesion, placement of calcium hydroxide as an intracanal medicament or as a sealer in obturation has a direct effect on inflamed tissues and epithelial cystic linings and thus favors periapical healing and encourages osseous repair. Thus, non-surgical management of the periapical lesions may provide favorable clinical and radiographic signs of healing (9).

The endodontic treatment aims at initial complete disinfection and cleaning of the root canal followed by its filling. It is during the filling stage of the root canal that the sealers are used, along with gutta-percha. Sealers containing calcium hydroxide have been widely used, both in clinical and research purposes (13). The rationale for use of calcium hydroxide based sealers is from various studies done on bases and liners containing calcium hydroxide which demonstrates their antibacterial and tissue repair abilities. This action is exerted via the leaching of calcium and hydroxyl ions to surrounding inflamed periapical tissues, which due to very high pH encourages repair by an initial degenerative response in the immediate vicinity followed rapidly by a mineralization and ossification response. The alkaline pH of calcium hydroxide also neutralizes lactic acid from osteoclasts and prevents dissolution of mineralized components of teeth. It also activates alkaline phosphatase and calcium-dependent adenosine triphosphatase reaction that plays an important role in hard tissue formation. It denatures proteins found in the root canal and makes them less toxic. It also diffuses through dentinal tubules to the inaccessible areas and may communicate with the periodontal ligament space to accelerate periapical healing (5, 8,9,14).

The primary function of root canal sealers is to fill gaps during obturation; thus, evaluation of their solubility, leakage, and adhesion are important. The sealers should be insoluble and not disintegrate in fluids. But unless calcium and hydroxyl ions dissociate out of the calcium hydroxide based sealer, it will not promote the expected healing effects on surrounding tissues. Thus the long-term sealing ability of the calcium hydroxide sealers and their therapeutic effects are controversial (9,10,13).

All sealers have been shown to leak. The leakage of sealers is mainly related to their solubility and adhesion to dentin and gutta-percha. In a study, the calcium hydroxide based sealer Sealapex, when in contact with tissue was dissolved and partially replaced by ingrowths of connective tissue. The sealer particles were mostly seen in cells and tissues at some distance from the study sample. Thus, based on current literature, it can be concluded that in terms of leakage, calcium hydroxide based sealers are not superior rto other groups of sealers. However, it should also be noted that most studies conducted till date are in-vitro or animal studies and directly relating their results to clinical situations may not be appropriate (9,13).

Periapical healing after endodontic treatment features bone regeneration, resumption of intact periodontal ligament space, and deposition of cementum around the root apex (8,9,14). When calcium hydroxide comes directly in contact with water, it releases calcium ions during ionic dissociation which determines its potential to induce mineralized tissue. Free calcium ions are needed for cell migration, differentiation, and mineralization. In various studies, Sealapex has demonstrated a high dissociation of calcium ions (9). Animal studies done to the evaluate effects of calcium hydroxide based sealers such as Sealapex on direct contact with the living tissue have shown favorable outcomes such as formation of a calcified, bone-like tissue and apical closure by cementum deposition (13). A few clinical studies done to evaluate the effects of different calcium hydroxide based sealers on the outcome of root canal treatment concluded that these sealers had a statistically insignificant effect on treatment outcome and periapical healing (9). But another clinical study done to evaluate the effect of Sealapex in the treatment of chronic apical periodontitis revealed that Sealapex sealer could obtain satisfactory effect for the treatment of chronic apical periodontitis (15). It has also been shown that root fillings with salicylate resin containing calcium hydroxide may induce more rapid healing of apical periodontitis or operative trauma, but the long term results i.e. after 3 and 4 years were similar for all the other sealers (11).

The incorporation of antibacterial components in the root canal sealers may prevent the regrowth of residual bacteria and reduce bacterial re-entry into the root canalsystem (5). The antibacterial effect of calcium hydroxide is mainly based on its alkalinity and ability to release hydroxyl ions. The pH of calcium hydroxide intracanal medicament has been shown to be as high as 12.5. Sealapex sets in 2 to 3 weeks in 100% relative humidity and does not set in a dry environment. The studies done on Sealapex showed a slow and gradual rise in pH (upto 9.57) in the first hour, which reached 11.5 during 30 days and upto 9.1 in a week.Thus, calcium hydroxide sealers have limited antibacterial activity due to a lack of sufficient pH elevation, limited solubility and diffusibility of calcium hydroxide into dentinal tubules and possibly buffering ions present in the tubules (9).

Various studies done to compare the radiopacity of various root canal sealers showed Sealapex to be least radiopaque, as compared to other sealers (9). The radiopacity has been increased by the addition of

bismuth trioxidein the recent formulation which is evident in the post-obturation IOPA and digital radiographs taken in this case.

At present, most of the literature on calcium hydroxide based sealers includes either laboratory based or animal studies, whichmay differ significantly from the clinical situation. This case report showed the favorable effect of use of calcium hydroxide based root canal sealer on the periapical healing in teeth associated with a peripaical lesion.

The draining sinus tract which may be present alongwith chronic periapical lesion has traditionally been managed by extraction of the affected tooth, phenol cauterization or apicectomy combined fistula curettage. Recently, sinus tracts of endodontic origin have been shown to require no special therapy because they heal on their own after appropriate root canal treatment (6). The exudate which was present initially was treated and clean and dry canal was attained using calcium hydroxide due to its alkaline pH which neutralizes the acidic exudate (8). In this case, the sinus tract healed and the canals became dry only a week after the beginning of the endodontic therapy, after which the obturation was done using gutta-percha and calcium hydroxide based sealer Sealapex.

Upon the end of the endodontic treatment, the clinical and radiographic follow-up of the teeth and their adjacent areas is important, and this should be done by regularly monitoring the changes that occur on the periapical area (13). The healing of the periapical lesion in this case occurred over a period of 6 months, which was similar to the time taken when calcium hydroxide is used as an intracanal medicament as documented (8,10). It was also observed that when calcium hydroxide was used as a sealer, it eliminated the need to repeatedly change the intracanal dressings which is necessary when it is used as an intracanal medicament.

Conclusion

This case report revealed that the conventional non-surgical endodontic therapy using a calcium hydroxide based sealer provided a favorable contributed effectively in the healing of a large periapical lesion over a period of six months. This proves that even large periapical lesions can respond favourably to non-surgical treatment and thus non-surgical approaches should be considered before intervening surgically.

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