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CLINICAL DECISION-MAKING IN SURGICAL AND NONSURGICAL ENDODONTICS: A REPORT OF TWO CASES

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ABSTRACT

The primary goal of endodontic therapy: Root canal systems must be cleaned and shaped: cleaned of their organic remnants and shaped to receive a three-dimensional hermetic/fluid-tight seal filling of the entire root canal space. However, prolonged intraradicular infection, missing canals, insufficient obturation, or coronal leakage, all can lead to treatment failure. Thus retreatment of the tooth becomes necessary in certain situations, leading to surgical or non-surgical endodontic procedures. Endodontic Retreatment is a procedure to remove root canal filling materials from the tooth followed by cleaning, shaping, and obturating the canals. (3) A nonsurgical retreatment approach should always be considered as the first line of management before proceeding with endodontic or periapical surgery.

Diagnosis of the affected tooth plays a vital role in decision making of suitable treatment plan which must be carried out to have a favourable outcome. Decision-making should be based on case selection, root canal anatomy, periodontal status, and restorative considerations. Both surgical and non-surgical retreatment options are effective in managing failed endodontic cases. The integration of advanced techniques and biomaterials has enhanced prognosis for both modalities.

KEYWORDS: endodontic retreatment, nonsurgical retreatment, root canal therapy, treatment failure, and obturation

INTRODUCTION

Periapical lesions are commonly classified as cysts, granulomata, or abscesses. Criteria to distinguish granulomas from cysts have been described by numerous writers. Size (60–67% frequency of cysts in periapical lesions greater than 10mm) is one of the characteristics predictive of cysts (1,2). 92% of periapical lesions larger than 200 mm (2,3), multiple teeth with necrotic pulp, straw-colored aspirate or discharge ,cholesterol crystals , etc.

The applicability of this classification in endodontic practice, however, is very debatable. For periapical lesions, endodontic therapy alone has been shown to provide up to 85% therapeutic success suggesting that endodontic therapy alone could be effective for the majority of periapical diseases, including cysts, especially pocket cysts that have an open lumen to the root canal system which gets resolved when intracanal irritants are removed (10).

This can be explained by the impact of biomechanical preparation on intracanal microbiota, (10,11) enzymatic mechanisms, (12) immunological mechanisms involving antigenic toxin neutralization, (13,14,15), and epithelial lining breakdown involving macrophages, non-killer T lymphocytes, and Langerhans cells (10,16)

Lastly, selection of treatment strategy can depend on clinical circumstances, the operator's expertise and experience, the possibility of consequences, the cost and technological viability. (17)

Case Report 1: Non Surgical Retreatment: 11,22

A 19 year old patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in upper front tooth region for the past 3 months, dull and intermittent in nature which aggravates on mastication.

He had undergone root canal treatment 3 years back followed by full coverage prosthesis and he also had a history of dental trauma 7 years back which caused avulsion of 21. The dull and intermittent pain subsided after the first visit.

Intraoral Photographs

Upper And Lower Arch

Radiographs

Figure 1A

Figure 1B

Radiograph of 11, 21, 22 (Fig 1A ,1B) reveals radio opacity in the coronal and radicular aspect suggestive of previously endodontically treated tooth & radiolucency in the periapical region suggestive of periapical pathology, persistent infection and missing 2. The canals were severely underfilled and short of working length.

After emergency procedure, Subsequent to intraoral periapical radiography, a three-dimensional cone-beam computed tomography (CBCT) examination was performed to facilitate accurate diagnosis and treatment planning.

The CBCT revealed a confined lesion with a size of 15mm (maximum diameter of the radiolucent area measured using rulers in digital imaging system) with intact cortical plates both labially & palatally.

Figure 2- CBCT Analysis

Based on comprehensive clinical examination and radiographic evaluation, a final diagnosis of previously root canal–treated teeth with persistent apical periodontitis was established with respect to teeth 11 and 22. Access was gained through the coronal prosthesis, and the old gutta percha removed utilizing Gates Glidden drills, hand instrumentation with Hedstrom files.

Figure 3- Access gained through prosthesis

On removal of old filling in 22, discharge was noted. Access preparations were sealed with temporary filling material, after the frank discharge subsided.

Figure 4A

Figure 4B

In the next visit, the temporary filling material was removed, copious irrigation was done using normal saline and 3.25% sodium hypochlorite (NaOCl), and a closed dressing was placed. On the subsequent visit, complete chemomechanical preparation was performed using the step-back technique. Throughout instrumentation, irrigation was carried out with 3.25% NaOCl, followed by 17% ethylenediaminetetraacetic acid (EDTA) to facilitate smear layer removal and enhance canal disinfection. A final rinse with saline was performed, and the canals were dried with sterile paper points.

Calcium hydroxide paste was placed as the initial intracanal medicament, and the access cavities were temporarily sealed. The intracanal medicament was periodically replaced over a period of six months based on clinical and radiographic findings. Long-term calcium hydroxide therapy was employed to achieve sustained antimicrobial activity, neutralization of bacterial endotoxins, and promotion of periapical healing in teeth presenting with persistent apical periodontitis. During the initial phase, conventional calcium hydroxide was used; this was subsequently replaced with a combination of calcium hydroxide and iodoform to enhance antimicrobial efficacy during the later stages of healing. (Fig 5A,5B,5C,5D)

Figure 5A&5B: Intracanal medicament: Ca(OH)2 placed; Figure 5C&5D: $Ca(OH)_2$ + I placed

At the end of the six-month follow-up period, the teeth were asymptomatic, and radiographic examination demonstrated evidence of progressive periapical healing. The root canals were then obturated using gutta-percha in conjunction with a bioceramic sealer (Septodont Bioroot RCS), followed by placement of a definitive coronal restoration. (Fig 6C, 6D)

Fig 6A-ICH completely removed; Fig 6B-Master cone xray; Fig 6C&6D-Obturated with bioceramic sealer

Case Report 2: Surgical Retreatment-11,12

A 18 year old male patient reported to the Department of Conservative Dentistry and Endodontics seeking for further opinion and treatment as he was advised root canal treatment for a tooth at a private clinic.

The patient reported a history of trauma to the maxillary anterior region approximately four years earlier following an impact with a stick, which was associated with pain and swelling, the tooth in the maxillary left anterior region was endodontically treated and it was followed by full-coverage crown placement. One week prior to presentation, the patient reported to a private dental clinic with a recurrence of pain and swelling in the maxillary right anterior region, where root canal treatment was initiated. When further root canal treatment was advised for the adjacent tooth too, the patient reported to the department seeking a second opinion for further evaluation and management.

Intraoral Photographs:

Upper And Lower Arches:

Radiographs:

Figure 7- preoperative radiograph

IOPA of 21 revealed presence of radio-opaque material within the root canal space, suggestive of a root canal–treated tooth, followed by placement of a PFM crown. Periapical region appears normal.
IOPA of 11 revealed presence of radio-opaque material within the root canal space, suggestive of a poorly obturated root canal treated tooth. The periapical area shows a large, well-defined radiolucency, suggestive of a chronic periapical lesion and demonstrated a deficient root canal filling characterized by inadequate length and density.
IOPA of 12 revealed periapical radiolucency continuous with the lesion of 11, indicating secondary involvement of 12 due to spread of periapical infection from 11.
To finalize the diagnosis, a cold test was further performed to confirm the pulpal status of 12 which revealed no response to the cold stimulus, indicating loss of pulpal sensory nerve function, consistent with non-vital pulp tissue.
Following intraoral periapical radiographic examination, a three-dimensional cone-beam computed tomography (CBCT) scan was advised to obtain a more detailed view that could guide on diagnosis and treatment planning.

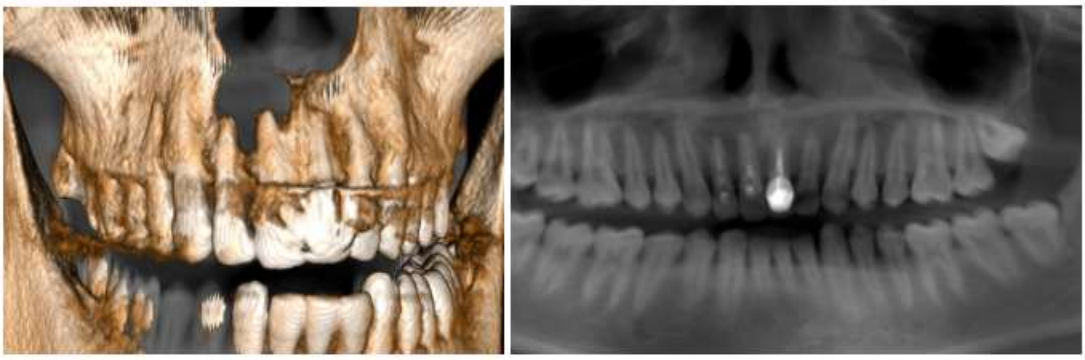

Figure 8- CBCT Analysis

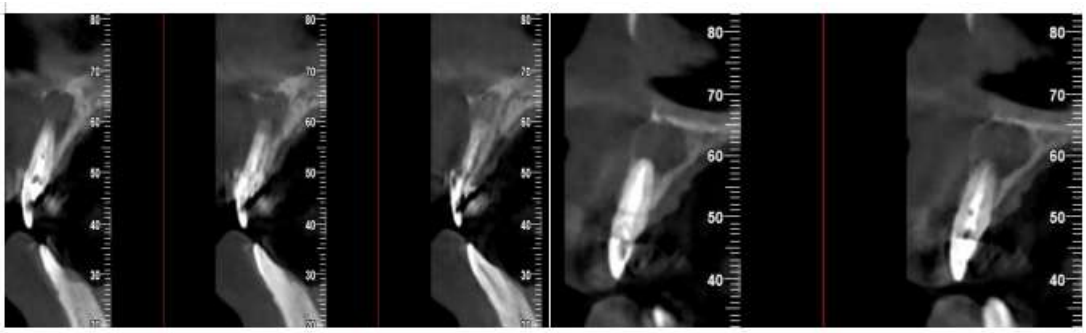

Figure 8- sagittal view

After a thorough clinical and radiographic examination, a definitive diagnosis was established. Tooth 11 was diagnosed as a previously root canal–treated tooth associated with a periapical lesion, suggestive of persistent apical pathology. Tooth 12 exhibited pulp necrosis with an associated periapical lesion, indicating apical periodontitis. These findings guided the subsequent treatment planning.

The most conservative course of treatment, which involves non-surgical root canal therapy for tooth 11 and follow-up to monitor the healing of both teeth, was discussed with the patient (11,12). Endodontic microsurgery is the second choice following root canal therapy for teeth 11 and 12. The final alternative is to plan for an implant-supported prosthesis and remove the teeth that are affected by the lesion.

Accordingly, non-surgical endodontic retreatment was initially planned and attempted for teeth 11 and 12 in order to eliminate intracanal infection and promote periapical healing, while preserving the natural teeth. An established irrigation regimen was strictly adhered during treatment to achieve optimal canal decontamination. Sodium hypochlorite (5.25%) was used as the primary irrigant, followed by 17% EDTA for smear layer removal, with a final rinse using saline to eliminate residual irrigants. Irrigant activation was performed using a sonic activation system (Endoactivator, Dentsply,sirona), which facilitated improved irrigant penetration into complex canal anatomies and enhanced removal of debris and microorganisms.

Figure 9A-Non surgical retreatment

Figure 9B-sonic agitation

Figure 9C- Ca(OH)2 placed

Fig 10- obturation

However, at the 6-month follow-up, the patient reported with persistent unresolved symptoms and acute pain. Radiographic evaluation revealed no evidence of reduction in the size of the periapical lesion. Notably, the pre operative lesion was considerably larger than that typically observed, exceeding the expected dimensions for predictable healing following non-surgical retreatment, which is recognized as a negative prognostic factor. The persistence of symptoms along with the unchanged large lesion size indicated an unfavourable response to non-surgical management and necessitated consideration of alternative treatment approaches.

In view of the continued acute symptoms, lack of radiographic evidence of healing, and persistence of a comparatively large periapical lesion following non-surgical retreatment, surgical intervention was considered necessary.

Figure 11-preoperative photographs before surgical intervention

Local anaesthesia was administered using labial and palatal infiltrations. Using a BP blade No. 15, a horizontal sulcular incision was placed along the gingival margin, extending from the mesial aspect of tooth 11 to the distal aspect of tooth 12. Two vertical releasing incisions were then made apically at the ends of the horizontal incision, parallel to the long axis of the teeth, forming a full-thickness mucoperiosteal rectangular (trapezoidal) flap. The flap was carefully reflected to obtain adequate access to the surgical site. The mucoperiosteal flap was carefully elevated using a periosteal elevator with gentle, controlled movements and minimal pressure. The flap was reflected in its entirety while preserving vascular integrity to aid haemostasis. Trauma to the soft tissues was avoided, and the reflected flap was kept moist using intermittent irrigation with sterile saline.

Figure 12A- Full thickness mucoperiosteal flap elevation **Figure 12B- Osseous defect**

After flap reflection, the osseous defect was identified. The lesion was carefully curetted by defining its margins and removing the soft tissue contents. Supplemental local anaesthesia was administered as needed to ensure patient comfort.

Fig 13A -osseous defect with granulation tissue **Fig 13B- After removal of granulation tissue**

Following the complete debridement of the granulation tissue, Apicoectomy was performed by resecting approximately 3 mm of the root apex using a Lindemann bur, oriented perpendicular to the long axis of the root. Complete removal of the surrounding granulation tissue was ensured to facilitate optimal periapical healing.



Figure14A-Apicoectomy **Figure 14 B-GP at the root apex visualised** **Figure 14C- retro preparation of root canal space**

Retrograde preparation was performed by removing approximately 3 mm of gutta-percha from the root canal using ultrasonic tips with an extremely light touch and no applied pressure. Followed by retrograde filling using MTA placed using plastic instrument and condensed using micro pluggers (Dentsply Maillefer).


Fig 15A-MTA placement **Fig 15B- Post operative xray**

Following this, a bone graft material (Osseograft® – Advanced Biotech Products (P) Ltd) was placed into the osseous defect to promote bone regeneration and support periapical healing. The flap was repositioned and secured using 3-0 BBS sutures placed in a simple interrupted pattern, followed by irrigation of the surgical site with povidone-iodine (Betadine).



Fig 16A- Bone graft placement **Fig 16B-Flap repositioned** **Fig 16C- Sutures placed**

Ten days postoperatively, sutures were removed, and satisfactory soft tissue healing was observed.


Fig 17 A & 17B- Post operative photograph & radiograph

DISCUSSION

The main goal of root canal therapy is to eliminate microbial infection from the intricate root canal system in order to repair periapical lesions. In addition to helping to lower the microbial flora in infected canals, irrigants can dissolve necrotic tissues when a tissue-solvent solution is used. Endodontic treatment can be carried out more easily with the assistance of a number of adjunctive procedures, including improved radiography methods like CBCT and magnification

equipment like loupes and DOMs. (6) During endodontic procedures, especially the DOMs, the use of magnification improves the visualization of the operating field, enabling better anatomic detail discrimination, better instrument control and dental material placement, and better detection and management of obstructions, anatomic variations, or fractures. (1,2)

The selection of endodontic treatment should be guided by an accurate diagnosis and a critical assessment of multiple prognostic factors rather than a routine preference for surgical intervention. Non-surgical management is often sufficient in cases with smaller periapical lesions, absence of persistent symptoms, and adequate canal debridement, as many lesions demonstrate favorable healing following conventional or retreatment procedures. Surgical intervention is generally reserved for situations involving large or long-standing periapical lesions, persistent clinical symptoms, lack of radiographic healing despite adequate non-surgical therapy, or the presence of factors inaccessible to orthograde treatment, such as extraradicular infection or apical anatomical complexities. (4,5)Therefore, not all periapical pathologies require surgical management, and a case-specific, evidence-based approach remains essential to optimize treatment outcomes while minimizing unnecessary surgical procedures.

Treatment planning in endodontics should be based on a comprehensive diagnosis that considers clinical findings, radiographic features, and lesion characteristics rather than adopting a uniform surgical approach. Non-surgical treatment or retreatment is generally effective for small to moderate periapical lesions (≤5–8 mm), particularly when symptoms subside and adequate canal disinfection can be achieved. In contrast, large lesions (>10 mm in diameter), long-standing pathologies, persistent symptoms, or absence of radiographic healing after an adequate observation period following non-surgical therapy are associated with a reduced likelihood of spontaneous resolution. (12) In such cases, surgical endodontic intervention may be indicated to directly address apical pathology and factors beyond the reach of orthograde treatment. Thus, not every periapical lesion necessitates surgery, and treatment decisions should be individualized using lesion size, healing response, and overall prognosis as guiding parameters.

ESE-based considerations for non-surgical vs surgical endodontic management:

- A non-surgical approach is the first line of treatment for teeth with apical periodontitis whenever orthograde access and adequate canal disinfection are feasible.
- Healing should be assessed clinically and radiographically over time, as periapical lesions may require several months to show signs of resolution.
- Persistent symptoms, lack of radiographic healing, or disease progression following adequately performed non-surgical treatment indicate an unfavorable response.
- Surgical endodontic intervention is indicated when persistent apical pathology is present and cannot be predictably managed by orthograde retreatment alone.
- Surgery is particularly justified in cases involving large or long-standing lesions, suspected extraradicular infection, or anatomical complexities limiting orthograde management.
- Treatment decisions should be individualized, balancing biological factors, tooth restorability, patient-related considerations, and long-term prognosis.
- Not all periapical lesions require surgical management, and unnecessary surgical intervention should be avoided when conservative treatment is likely to succeed. (12)

Employing a noninvasive, nonsurgical approach as the initial treatment option, even in the presence of large and extensive periapical lesions, offers several notable advantages. This approach reduces psychological stress and postoperative morbidity, enhances patient acceptance, and avoids the potential risk of damage to adjacent vital anatomical structures that may accompany surgical intervention. Additionally, nonsurgical endodontic treatment can provide a predictable and favorable outcome by facilitating effective canal disinfection and subsequent periapical healing. In the present case, strict adherence to aseptic protocols, aided by magnification under a dental operating microscope (DOM), enabled thorough cleaning and disinfection of the root canal system. Complete resolution of the periapical lesion was achieved and subsequently confirmed using cone-beam computed tomography (CBCT), highlighting the effectiveness of conservative nonsurgical management. (15,16)

However, the choice between nonsurgical and surgical management ultimately depends on multiple diagnostic criteria and clinical decision-making factors. A comprehensive assessment including pulp vitality tests, conventional 2-D radiographs, FNAC (fine-needle aspiration cytology) where indicated, and advanced imaging such as CBCT guides the clinician in determining the most appropriate treatment plan based on lesion size, extent, location, and response to initial therapy. CBCT in particular enhances diagnostic accuracy and aids in distinguishing persistent pathology or anatomic complexities that may necessitate surgical intervention. (10,11) Treatment planning should also integrate findings from histopathological analysis when available, alongside clinical signs and symptoms, to ensure the lesion's etiology and the likelihood of healing with conservative measures. Regardless of the approach chosen, clinicians must maintain diligent follow-up to monitor healing and identify any signs of failure in both nonsurgical and surgical interventions. Finally, the clinician's depth of knowledge, skill, and judgment in selecting and executing the appropriate modality remains central to achieving successful outcomes.

Evidence indicates that nonsurgical root canal treatment (NSRCT) and nonsurgical retreatment (NS ReRCT) generally exhibit high success rates, often reported between 80–90% under conventional criteria (14). Some reports specifically note up to 85–94% success for large periapical lesions treated nonsurgically when strict asepsis and adequate disinfection are achieved (15). Systematic reviews comparing endodontic surgery with nonsurgical retreatment have shown that surgical procedures may demonstrate modestly higher early healing rates (e.g., ~90% vs ~80% at one year) (16), and modern apical microsurgery with magnification, CBCT-guided planning, and biocompatible root-end filling materials can achieve success rates of approximately 61–90%. Importantly, long-term outcomes often favor nonsurgical management

for tooth survival, while surgical intervention remains indispensable when nonsurgical methods fail or when apical anatomy (e.g., apical ramifications and complex root morphology) prevents adequate disinfection, since apical surgery allows direct access to the apical 3 mm -the area where lateral canals and ramifications frequently harbor persistent infection. Apicoectomy removes these anatomical complexities and reduces the residual microbial burden. Subsequent root-end cavity preparation enables removal of the infected apical canal contents and placement of a bioactive root end filling material (MTA angelus), which provides an effective apical seal owing to its excellent sealing ability, biocompatibility and bioactive properties. (17)

CONCLUSION

Surgical and Nonsurgical endodontic treatments are complementary and should be selected based on accurate diagnosis and appropriate case assessment. Not all periapical lesions require surgical intervention, nor can all cases be successfully managed non surgically. Comprehensive diagnostic evaluation, including clinical findings and advanced imaging, is essential for informed decision-making. Ultimately, sound clinical judgment, adherence to diagnostic criteria, and careful follow-up are key to achieving predictable endodontic outcomes.

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