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Management of Large Periapical Lesions through Surgical And Non-Surgical Endodontic Treatment: A Case Series

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KEYWORDS

Periapical lesion, non-surgical root canal treatment, periapical surgery, apicoectomy, endodontic treatment failure, diabetes mellitus

ABSTRACT:

Background: Periapical lesions are a common consequence of pulpal necrosis and microbial invasion, leading to chronic inflammation in the periapical tissues. While non-surgical root canal treatment (NSRCT) remains the primary approach, large periapical lesions or treatment failures often necessitate surgical intervention. Advances in periapical surgery, including apicoectomy and biocompatible root-end filling materials, have improved success rates. The choice between non-surgical and surgical endodontic management depends on lesion size, anatomical factors, and systemic conditions such as diabetes mellitus.

Aim: This case series aims to evaluate the clinical and radiographic outcomes of non-surgical and surgical management of large periapical lesions in different patient scenarios, including failed NSRCT and cases with systemic considerations.

Methods This study was conducted at the **Postgraduate Institute of Dental Sciences, Rohtak, Haryana, between November 2022 and August 2024**. Four cases were included based on the presence of large periapical lesions diagnosed via (Cone beam computed tomography) CBCT and periapical radiographs. The cases were managed using NSRCT or periapical surgery, depending on clinical indications. Surgical interventions involved flap elevation, apicoectomy, curettage, and root-end filling with Mineral Aggregate Trioxide (MTA). All patients were followed up at **3, 6, and 12 months**, with clinical and radiographic assessments of periapical healing and symptom resolution.

Results

Case 1 (NSRCT): Complete periapical healing was observed at 12 months.

Case 2 (Failed NSRCT with sinus tract): Periapical surgery led to successful healing, with sinus closure by 3 months.

Case 3 (Diabetic patient with multiple periapical lesions): Surgical intervention showed gradual bone regeneration, with healing at 12 months.

Case 4 (Previously treated tooth with a non-negotiable apical third): Surgical management resulted in resolution of symptoms and periapical healing.

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Conclusion: Both non-surgical and surgical endodontic approaches were effective in managing large periapical lesions. NSRCT successfully resolved periapical pathology in one case, while surgical intervention was necessary in three cases with persistent infection or anatomical challenges. Systemic factors like diabetes must be considered when planning treatment.

Recommendations: Early CBCT evaluation improves diagnosis and treatment planning for large periapical lesions. While NSRCT should be the first-line approach, surgical intervention is necessary for persistent infections or anatomical challenges. Biocompatible root-end filling materials such as hydraulic calcium silicate cements (HCSC) enhance surgical success. Systemic conditions like diabetes must be considered, as they impact healing. Regular follow-ups are essential to monitor recovery and prevent recurrence. Future research should explore advanced biomaterials and surgical techniques for improved outcomes, especially in medically compromised patients.

INTRODUCTION

Periapical lesions are a common pathological consequence of pulpal infection, primarily arising due to bacterial invasion of the root canal system, leading to inflammatory and immunological responses at the periapex [1]. These lesions include periapical granulomas, radicular cysts, and periapical abscesses, with their incidence ranging between 30% to 70% in teeth with necrotic pulps [2]. The primary goal of endodontic therapy is to eliminate infection, promote healing, and restore periapical tissue integrity. The management of large periapical lesions poses a clinical challenge and often requires an individualized treatment approach [3].

Conventional **non-surgical root canal treatment (NSRCT)** is the first-line approach, aiming to disinfect and obturate the canal system effectively, allowing for periapical healing without surgical intervention. Studies have shown that large periapical lesions can heal successfully with NSRCT alone if adequate microbial control is achieved [4]. However, in cases where NSRCT fails due to persistent infection, anatomical complexities, or extraradicular biofilms, surgical endodontic intervention may be required [5].

Periapical surgery, including apicoectomy and retrograde root-end filling, has evolved significantly over the years. Advances in microsurgical techniques, improved magnification, and biocompatible materials such as mineral trioxide aggregate (MTA) have enhanced treatment success rates [6]. Recent literature suggests that surgical endodontic treatment can achieve up to 90% success when performed with modern techniques [7].

Systemic conditions, such as **diabetes mellitus**, can influence periapical healing by impairing immune responses and bone regeneration. Studies indicate that diabetic patients exhibit delayed periapical healing and increased susceptibility to endodontic infections [8]. Therefore, managing periapical lesions in such patients requires a more cautious approach, considering both local and systemic factors [9].

This case series presents the management of four patients with large periapical lesions using both non-surgical and surgical approaches. The cases highlight different clinical scenarios, including the successful resolution of a periapical lesion with NSRCT, surgical intervention for failed NSRCT, and the management of a diabetic patient requiring periapical surgery. The aim is to provide insight into treatment selection criteria and long-term clinical outcomes in challenging endodontic cases.

METHODOLOGY

Study Design

This study is a retrospective case series analyzing the management of large periapical lesions using surgical and non-surgical endodontic treatment. Four cases were included, each demonstrating different clinical scenarios requiring endodontic intervention.

Study Place and Duration

- **Study Place:** Postgraduate Institute of Dental Sciences, Rohtak, Haryana.
- **Study Duration:** November 2022 to August 2024.

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Patient Selection

Patients were selected based on the presence of large periapical lesions diagnosed using preoperative radiographs and CBCT scans. Inclusion criteria were:

- Presence of symptomatic or asymptomatic periapical pathology.
- Cases requiring either non-surgical root canal therapy or surgical intervention due to treatment failure or anatomical complexities.
- Minimum follow-up period of 12 months.
- Patients with systemic conditions (e.g., diabetes mellitus) were included to assess the impact on healing.

Clinical Procedures

Each case was managed using standard endodontic protocols, including:

1. **Non-Surgical Root Canal Treatment (NSRCT):**
   - Performed in a young female patient presenting with pain for one month.
   - Cleaning and shaping of the root canal system followed by obturation.
   - Radiographic evaluation post-treatment and at follow-up intervals (6, and 12 months).
2. **Surgical Management of Failed NSRCT:**
   - Indicated in cases where non-surgical treatment was unsuccessful leading to intraoral sinus formation and presence of a complex prosthesis would complicate non-surgical retreatment .
   - Flap elevation, apicoectomy, root-end preparation, and biocompatible root-end filling were performed.
   - Post-operative radiographs were taken, and healing was assessed over 12 months.
3. **Periapical Surgery in a Diabetic Patient:**
   - Included a 46-year-old male with HbA1c of 7.2 presenting with swelling and pain.
   - Surgical intervention involved apicoectomy and root-end filling.
   - Healing and resolution of symptoms were monitored through clinical and radiographic evaluations over 12 months.
4. **Surgical Management of a Previously Treated Tooth with Non-Negotiable Apical Third:**
   - A patient with persistent symptoms despite prior endodontic treatment.
   - Surgical intervention with flap elevation, apicoectomy, and root-end filling.
   - Immediate post-operative radiographs and long-term follow-up (up to 12 months).

Follow-Up and Outcome Assessment

- Post-treatment radiographs were taken immediately after the procedure and at 6, and 12 months.
- Clinical assessments included pain resolution, absence of sinus tracts, and normal function.
- Cases were evaluated for signs of periapical healing using radiographic and clinical criteria.

Ethical Considerations

- Informed consent was obtained from all patients before treatment.
- The study adhered to ethical guidelines for human research.
- Patient confidentiality was maintained throughout the study.

CASE REPORT

Case 1: Non-Surgical Root Canal Treatment in an 18-Year-Old Female

Clinical and Radiographic Presentation

An 18-year-old female presented with pain for one month in relation to a maxillary anterior tooth. A preoperative radiograph and CBCT revealed a large periapical radiolucency associated with the affected teeth, indicating a periapical lesion of size approximately 10mm with intact cortical plate. The teeth (#12, #11) tested non-vital through cold test and electric pulp testing.

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Treatment Plan

The patient underwent conventional NSRCT (tooth #12 and #11), which included:

- Local anesthesia and rubber dam isolation.
- Access cavity preparation and biomechanical cleaning of the root canal system.
- Irrigation with 5% sodium hypochlorite and normal saline.
- Intracanal medicament (Calcium hydroxide) placed for 10 days.
- Obturation with gutta-percha and sealer.
- Post obturation restoration using resin-modified glass ionomer liner as base followed by composite restoration in relation to #12 and #11 and full crown in relation to #11.
- Post-operative radiographs were taken to assess root canal filling.

Follow-Up and Outcome

- The patient remained asymptomatic, and follow-up radiographs at 6, and 12 months showed progressive periapical healing.
- At the 12-month follow-up, complete bone regeneration was observed.

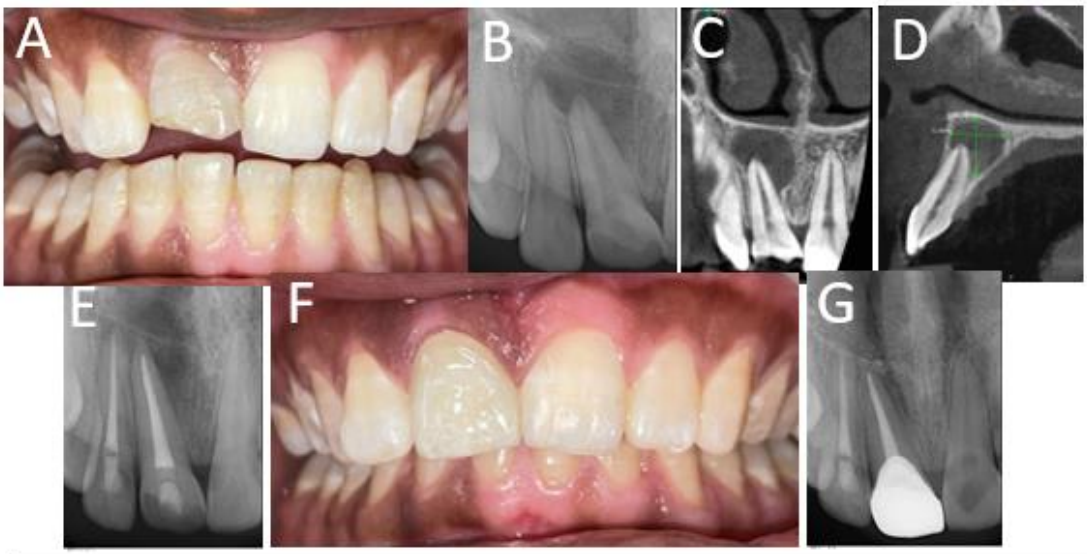

Figure-1. Non-Surgical Root Canal Treatment in an 18-Year-Old Female:

A, Preoperative clinical photograph; **B, C, D**, preoperative radiograph and CBCT; **E**, Immediate post operative radiograph; **F**, Post-operative prosthetic rehabilitation; **G,** Complete healing at 12 months follow-up.

Case 2: Surgical Management of Failed Non-Surgical Root Canal Treatment in a 32-Year-Old Female

Clinical and Radiographic Presentation

A 32-year-old female presented with persistent pain and swelling in the maxillary central incisor region (tooth #11). The patient had undergone NSRCT previously, but the symptoms persisted. A preoperative CBCT scan showed a large periapical lesion with an associated intraoral sinus.

Treatment Plan

Since the previous NSRCT failed even after an adequate obturation radiographically and as with the complex prosthesis present, non-surgical retreatment would have complicated the treatment further, surgical intervention was planned, which included:

- Administration of local anaesthesia (bilateral infraorbital nerve block, nasopalatine nerve block, and local infiltration) and full-thickness mucoperiosteal flap elevation.

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- Osteotomy was done, and the pathology was removed, followed by curettage of the residual granulation tissue.
- 3mm of root end resection was done followed by root end preparation using ultrasonic tip and retrograde filling with ProRoot MTA. A radiograph was taken to confirm adequate retrofilling.
- Sutures (5-0 polyamide monofilament) were placed, and post-operative radiographs were taken.
- The whole procedure of periapical surgery was done under dental operating microscope.

Follow-Up and Outcome

- The patient was followed up at 3, 6, and 12 months. The intraoral sinus healed, and radiographic images showed gradual resolution of the periapical lesion.
- By 12 months, complete periapical healing was observed.

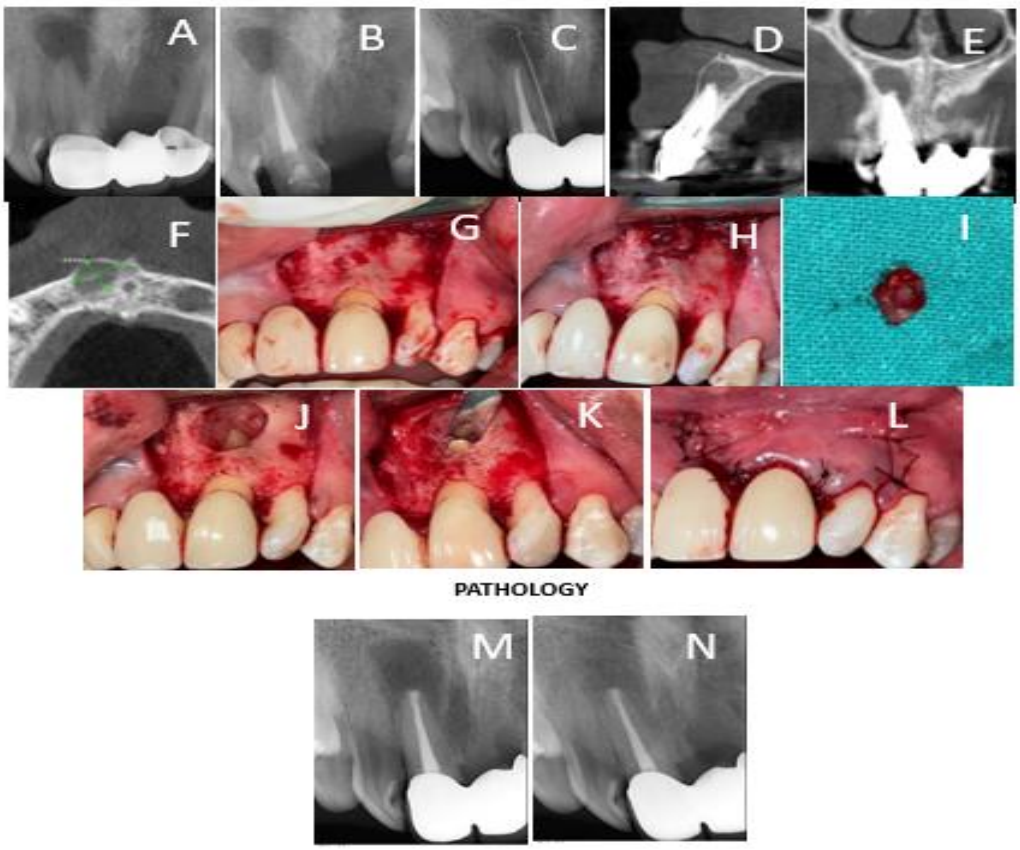

Figure 2. Surgical Management of Failed Non-Surgical Root Canal Treatment in a 32-Year-Old Female: A, preoperative radiograph; **B,** NSRCT carried out; **C,** At 3 months follow up patient presented with intra oral sinus; **D,E,F,** Presurgical CBCT; **G,** Flap elevation; **H,I,** Pathology; **J,** Bony crypt after curettage; **K,** Root end resection and root end filling with MTA; **L,** Suture placement; **M,** Immediate post-surgery radiograph; **N,** At 12 months follow-up

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Case 3: Periapical Surgery in a Diabetic Patient (46-Year-Old Male with HbA1c 7.2%)

Clinical and Radiographic Presentation

A 46-year-old male patient with a history of type 2 diabetes mellitus (HbA1c 7.2%) reported pain and swelling in the maxillary anterior region (teeth #11, #21, #22) for 1.5 months. Preoperative CBCT revealed a large periapical radiolucency with cortical bone perforation.

Treatment Plan

Due to the patient's systemic condition and lesion size, surgical management was planned:

- Root canal treatment was carried out i.r.t teeth #11, #21, #22
- Administration of local anaesthesia and surgical flap elevation.
- Curettage of the lesion and biopsy to rule out any cystic pathology.
- Apicoectomy of affected roots, root end preparation and retrograde filling with MTA.
- Sutures were placed, and post-operative antibiotics were prescribed.

Follow-Up and Outcome

- At 6 months, radiographs showed signs of bone regeneration.
- At 12 months, significant healing was noted, and the patient remained asymptomatic. Further follow-up imaging may be necessary to confirm complete resolution.

Figure 3. Periapical Surgery in a Diabetic Patient (46-Year-Old Male with HbA1c 7.2%): A, preoperative radiograph; **B,C,D**, CBCT showing periapical lesion size approximately 20mm with loss of buccal cortical plate; **E**, Root canal treatment i.r.t #11,#21,#22; **F**, Flap elevation; **G**, Removal of pathology in toto; **H**, Curettage of bony crypt; **I,J**, Root end resection and retro filling with MTA i.r.t #11,#21,#22; **K**, Suture placement; **L**, Immediate post-surgery radiograph; **M**, At 6 months follow up; **N**, At 12 months follow up.

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Case 4: Surgical Management of a Previously Treated Non-Negotiable Apical Third of the Root Canal (34-Year-Old Female)

Clinical and Radiographic Presentation

A 34-year-old female presented with persistent pain in relation to tooth #22 despite prior endodontic treatment. CBCT imaging showed a large periapical lesion with an uninstrumented, non-negotiable apical third of the root canal.

Treatment Plan

Since conventional retreatment was not feasible, a periapical surgery was performed:

- Retreatment done i.r.t tooth #22
- Administration of local anaesthesia, flap elevation and granulation tissue removal.
- Apicoectomy of the affected root tip.
- Root-end preparation and retrograde filling.
- Sutures were placed, and post-operative radiographs were taken.

Follow-Up and Outcome

- The patient was monitored for 12 months.
- Radiographs demonstrated progressive periapical healing, and symptoms resolved completely.

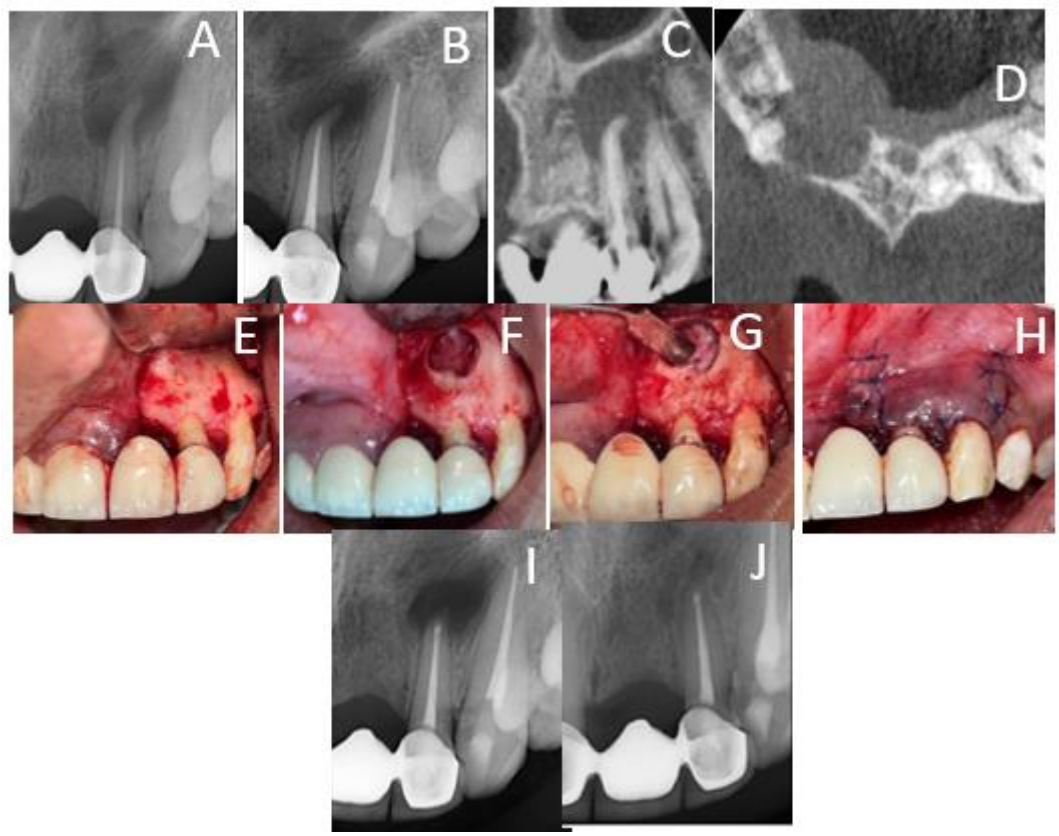

Figure 4. Surgical Management of a Previously Treated Non-Negotiable Apical Third of the Root Canal (34-Year-Old Female): A, preoperative radiograph; **B**, Retreatment i.r.t 22; **C**,**D**, CBCT showing periapical lesion extent; **E**, Flap elevation; **F**, Removal of pathology and curettage of bony crypt; **G**, Root end resection and retro filling with MTA; **H**, Suture placement; **I**, Immediate post-surgery radiograph; **J**, At 12 months follow up.

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Table: Summary of Case Reports on Management of Large Periapical Lesions

Case No.	Age & Gender	Chief Complaint	Diagnosis	Treatment Approach	Follow-Up & Outcome
Case 1	18-year-old Female	Pain for 1 month	Large periapical lesion	Non-Surgical Root Canal Treatment (NSRCT)	Complete healing at 12 months
Case 2	32-year-old Female	Persistent pain & swelling after NSRCT	Failed NSRCT with intraoral sinus	Periapical surgery (Apicoectomy, Root-end filling)	Sinus healed; full recovery at 12 months
Case 3	46-year-old Male (Diabetic, HbA1c 7.2%)	Swelling & pain for 1.5 months	Large periapical lesion in multiple teeth (#11, #21, #22)	Periapical surgery (Apicoectomy, Root-end filling)	Radiographic healing at 6 months, full recovery at 12 months
Case 4	34-year-old Female	Persistent pain after previous treatment	Non-negotiable apical third of root canal	Periapical surgery (Apicoectomy, Root-end filling)	Complete periapical healing at 12 months

DISCUSSION

The cases presented in this series highlight the successful management of large periapical lesions using both non-surgical and surgical endodontic approaches. The selection of treatment was based on clinical presentation, radiographic findings, and the response to previous treatment attempts. Each case was followed up for 12 months to evaluate the healing process and long-term treatment outcomes.

In the first case, non-surgical root canal treatment (NSRCT) alone was sufficient to achieve complete healing of the periapical lesion. The absence of post-treatment symptoms and the gradual reduction of periapical radiolucency over 12 months indicated that conservative endodontic therapy can be effective in cases where the canal system can be thoroughly decontaminated. This supports the principle that many large periapical lesions can resolve with adequate cleaning, shaping, and obturation without the need for surgical intervention.

The second and fourth cases required surgical management due to persistent infection despite previous endodontic treatment. The presence of an intraoral sinus and non-negotiable apical third of the root canal system necessitated apicoectomy and retrograde filling. These cases demonstrate the limitations of NSRCT in certain anatomical and pathological conditions and highlight the importance of surgical endodontics in ensuring complete periapical healing. Post-surgical follow-ups revealed progressive resolution of periapical pathology, confirming that surgical intervention is a reliable treatment option for cases with persistent periapical infections.

The third case involved a diabetic patient, where systemic factors could have influenced the healing process. Despite diabetes being a known risk factor for delayed wound healing, the patient showed significant periapical healing after surgical intervention. This emphasizes that with proper infection control, periapical surgery can be successful even in medically compromised individuals. The case also underlines the necessity of considering systemic conditions in treatment planning and patient management.

Large periapical lesions pose a clinical challenge in endodontics, often requiring surgical intervention when NSRCT fails. In this case series:

- **Case 1** demonstrated successful healing through non-surgical treatment.

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- **Case 2 and Case 4** required periapical surgery due to persistent infection and anatomical limitations.
- **Case 3** highlighted successful surgical management in a diabetic patient, emphasizing the importance of systemic health in treatment planning.

Periapical surgery, including apicoectomy and retrograde filling, proved to be an effective approach when non-surgical methods failed. The use of biocompatible materials contributed to favorable healing outcomes.

Overall, the results of this case series demonstrate that the choice between non-surgical and surgical endodontic treatment depends on the individual case. While NSRCT remains the first-line treatment for periapical lesions, surgical intervention is invaluable when non-surgical methods fail. Long-term follow-up confirmed favorable outcomes, with all cases showing complete resolution of periapical pathology and restoration of function. These findings reinforce the importance of a tailored, case-by-case approach in endodontic management to achieve optimal clinical success.

The management of large periapical lesions through surgical and non-surgical endodontic treatment has been widely studied, with a growing preference for non-surgical approaches due to their minimally invasive nature and favorable healing outcomes. Several case series have demonstrated the efficacy of conservative endodontic therapy in resolving large periapical lesions without surgical intervention.

Mitra and Adhikari reported two cases of large periapical lesions successfully managed through non-surgical endodontic treatment using calcium hydroxide-iodoform paste as an intracanal medicament. Radiographic evaluations confirmed complete healing, highlighting the effectiveness of conservative approaches [10]. Similarly, Peeters presented cases where large periapical radiolucent lesions were treated non-surgically, emphasizing the importance of proper cleaning, shaping, and obturation for successful healing. The study concluded that some lesions may still require surgical intervention if conservative methods fail [11].

Ezmeci and Cilt detailed three cases where large periapical lesions were treated with calcium hydroxide as an intracanal medicament followed by gutta-percha obturation. Follow-up examinations after one year revealed complete periapical healing, reinforcing the potential of non-surgical approaches [12]. In another study, Ghorbanzadeh et al. described the non-surgical management of a large cyst-like periapical lesion in a 16-year-old patient. The application of calcium hydroxide resulted in significant bone regeneration within 12 months, further demonstrating the effectiveness of conservative treatment [13].

These studies collectively support the notion that large periapical lesions can be successfully managed using non-surgical endodontic therapy when proper cleaning, disinfection, and intracanal medication are employed. However, in cases where conservative treatment fails, surgical intervention may still be necessary.

CONCLUSION

This case series demonstrates the successful management of large periapical lesions through both non-surgical and surgical endodontic approaches. While NSRCT was effective in cases with adequate canal decontamination, surgical intervention was essential for persistent infections and anatomical challenges. The inclusion of a diabetic patient highlights the need for systemic considerations in treatment planning. Long-term follow-ups confirmed complete healing in all cases, emphasizing the importance of individualized treatment selection to optimize clinical outcomes.

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