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Case Report

Endodontic Microsurgical Management of a Persistent Large Cyst-Like Periapical Lesion Following Nonsurgical Root Canal Treatment: A Case Report

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Abstract: ***Background*:** Large cyst-like periapical lesions are often managed initially with conventional nonsurgical root canal treatment. However, persistent clinical signs despite adequate disinfection and obturation may necessitate endodontic microsurgery. Careful case selection, advanced imaging, and modern microsurgical techniques are essential for predictable healing. ***Case Presentation*:** A 35-year-old male presented with pain, swelling, and a draining sinus tract in the maxillary right anterior region for one month, with a history of dental trauma ten years earlier. Clinical examination revealed tenderness to percussion, purulent discharge, and negative pulp sensibility responses in teeth 11 and 12, while tooth 13 exhibited an exaggerated lingering response suggestive of symptomatic irreversible pulpitis. Cone-beam computed tomography (CBCT) demonstrated a large cyst-like periapical lesion measuring 20.1 × 12.7 × 18.5 mm with buccal and palatal cortical plate perforation, extension to the nasal floor, and involvement of the nasopalatine canal. Conventional root canal treatment was performed for teeth 11, 12, and 13. Teeth 11 and 12 underwent sequential intracanal medication using calcium hydroxide and double antibiotic paste alternatively for 5 visits. Following successful canal drying and obturation, the persistent sinus tract and extensive osseous destruction warranted endodontic microsurgery. Apicoectomy and ultrasonic root-end preparation were performed under a dental operating microscope, followed by retrograde filling with Biodentine. The osseous defect was managed using sticky bone prepared with Osseograft® and injectable platelet-rich fibrin (i-PRF), covered with a platelet-rich fibrin (PRF) membrane. At six-month follow-up, the patient was asymptomatic, with resolution of the sinus tract and radiographic evidence of progressive periapical healing. ***Conclusion*:** This case demonstrates that endodontic microsurgery is a predictable treatment option for persistent large cyst-like periapical lesions following appropriate nonsurgical root canal treatment. Integration of CBCT-based diagnosis, microsurgical techniques, bioceramic root-end filling, and regenerative adjuncts may contribute to favorable clinical and radiographic outcomes in extensive periapical defects.

Keywords: Endodontic Microsurgery, Apicoectomy, Biodentine, CBCT, Cyst-Like Periapical Lesion, Platelet-Rich Fibrin, Sticky Bone.

INTRODUCTION

Apical periodontitis is an inflammatory disorder of periradicular tissues resulting from microbial infection of the root canal system. The primary objective of endodontic treatment is the elimination or substantial reduction of intracanal microorganisms through adequate chemomechanical preparation, effective irrigation, intracanal medication, and three-dimensional obturation, thereby facilitating healing of the periapical tissues. Conventional nonsurgical root canal treatment remains the treatment of choice for teeth with apical periodontitis and demonstrates high success rates when appropriate biological and technical principles are followed. Large periapical radiolucencies are frequently suggestive of cyst-like lesions; however, clinical and radiographic examinations alone cannot reliably distinguish granulomas from true cysts. Cone-beam computed tomography (CBCT) provides valuable three-dimensional information regarding lesion size, cortical plate involvement, proximity to adjacent anatomical structures, and surgical planning, although definitive diagnosis requires histopathological examination. Consequently, lesions managed without histopathological analysis should be described as cyst-like periapical lesions rather than true radicular cysts. Current position statements from the European Society of Endodontology (ESE) and the American Association of Endodontists (AAE) recommend nonsurgical root canal treatment as the initial management for teeth with apical periodontitis. Endodontic microsurgery is indicated when persistent disease remains despite appropriate orthograde treatment or when orthograde retreatment is unlikely to achieve resolution. The incorporation of the dental operating microscope, ultrasonic root-end preparation, bioceramic root-end filling materials, and regenerative adjuncts has significantly improved the predictability of microsurgical outcomes. The present report describes the management of a persistent large cyst-like periapical lesion associated with maxillary central and lateral incisors in a patient with a history of dental trauma. Following comprehensive nonsurgical root canal treatment, persistent clinical signs together with extensive CBCT findings justified endodontic microsurgery. Microsurgical root-end management using Biodentine, combined with regenerative therapy using sticky bone and a platelet-rich fibrin membrane, resulted in favorable clinical and radiographic healing at six months.

CASE REPORT

Case Presentation

A 35-year-old male presented to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain and swelling in the upper right anterior region for one month. The pain was described as dull, throbbing, and continuous, and was aggravated during mastication. The patient also reported intermittent purulent discharge from the affected region during the same period. The patient's medical history was non-contributory. He reported a history of trauma to the maxillary anterior teeth approximately ten years earlier, for which no dental treatment had been sought. There was no history of previous endodontic treatment involving the affected teeth.

Clinical Examination

Extraoral examination revealed mild diffuse swelling over the right anterior maxillary region without regional lymphadenopathy. Intraoral examination revealed a diffuse labial vestibular swelling in relation to teeth 11 and 12, associated with a draining sinus tract exhibiting purulent discharge irt 12, as shown in Figure 1. Mild discoloration of tooth 12 was evident. Teeth 11 and 12 were tender to percussion, and palpation of the labial swelling elicited pain with expression of purulent exudate through the sinus tract. Grade I mobility was present in relation to teeth 11 and 12. Pulp sensibility testing using cold and electric pulp tests elicited no response from teeth 11 and 12. Tooth 13 demonstrated an exaggerated response that persisted for several minutes after removal of the stimulus.

Fig. 1: Sinus tract exhibiting purulent discharge irt 12

Radiographic and CBCT Examination

Preoperative intraoral periapical radiography demonstrated a well-defined periapical radiolucency associated with teeth 11 and 12 (Figure 2A). For detailed assessment of the lesion, cone-beam computed tomography (CBCT) was performed. CBCT revealed a well-defined radiolucent lesion measuring approximately 20.1 × 12.7 × 18.5 mm, extending from the periapical region of tooth 13 to tooth 11 with slight extension across the midline. Buccal and palatal cortical plate perforation with mild buccal cortical expansion was evident. Superiorly, the lesion perforated the floor of the nasal cavity and involved the nasopalatine canal and anterior nasal spine. Loss of lamina dura extending to the middle third of the roots of teeth 11 and 12 was observed, whereas no periapical radiolucency was associated with tooth 13 (Figure 2B–C).

Based on the clinical and radiographic findings, a provisional diagnosis of a large cyst-like periapical lesion associated with teeth 11 and 12 was established.

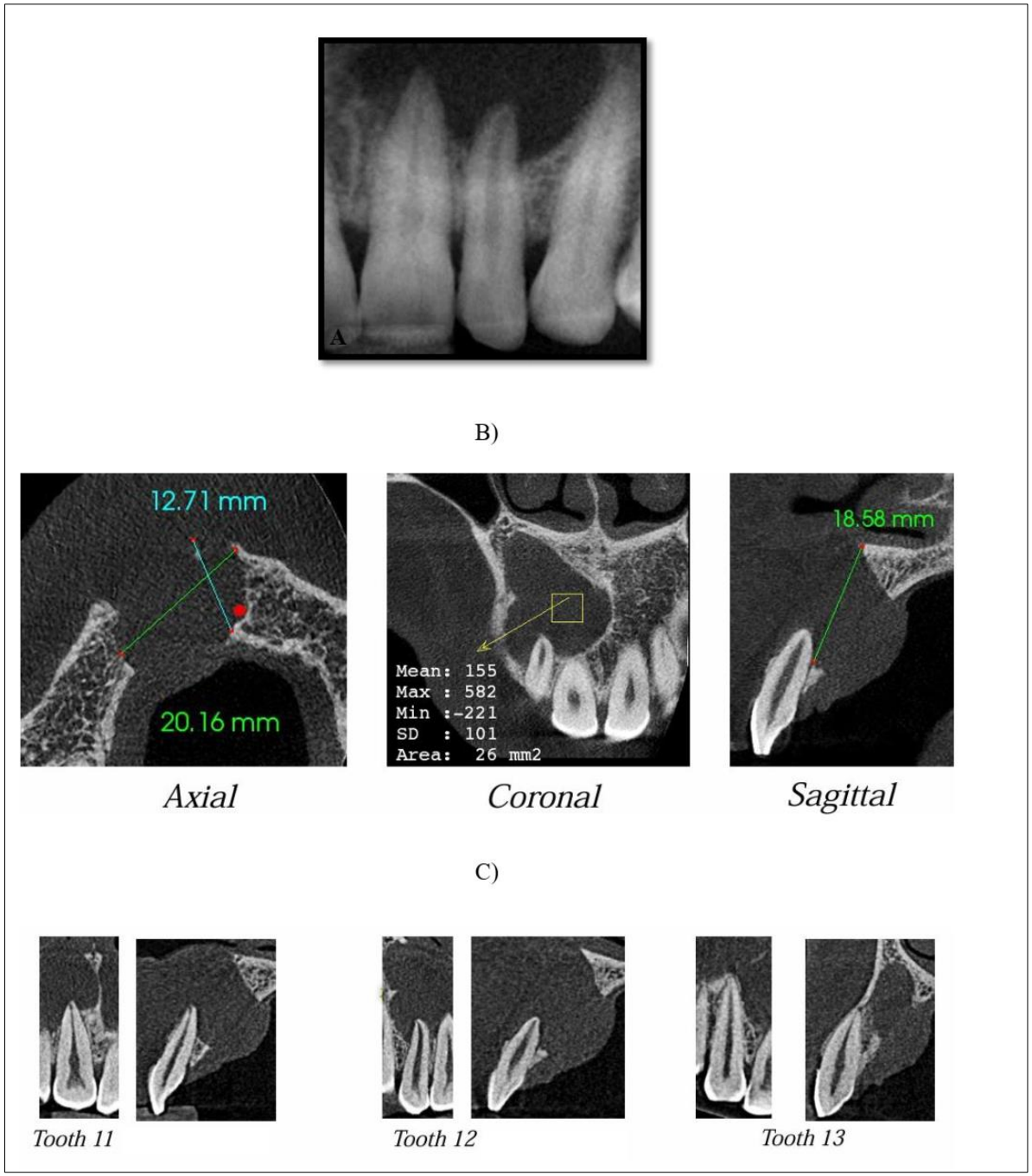

Fig. 2: Preoperative radiographic and CBCT assessment of the lesion A) Intraoral periapical radiograph demonstrating a well-defined periapical radiolucency associated with teeth 11 and 12 B) CBCT axial, coronal, and sagittal sections demonstrating the extent of the lesion with measurements. C) CBCT sagittal sections of teeth 11, 12 & 13

Diagnosis

According to the American Association of Endodontists (AAE) diagnostic terminology, the pulpal and periapical diagnoses were as follows:

- **Tooth 11:** Pulp necrosis with chronic apical abscess.
- **Tooth 12:** Pulp necrosis with chronic apical abscess.
- **Tooth 13:** Symptomatic irreversible pulpitis with normal apical tissues.

Therapeutic Intervention

Following diagnosis, conventional nonsurgical root canal treatment was initiated for teeth 11, 12, and 13 under local anesthesia with rubber dam isolation. Access cavity preparation was completed, and working lengths were determined using an electronic apex locator and confirmed radiographically (Figure 3A).

Chemomechanical preparation was performed using ISO stainless steel K-files employing a step-back preparation technique. The canals of teeth 11, 12 and 13 were enlarged to master apical file sizes #60, #40 and #45, respectively. Throughout instrumentation, copious irrigation with 3% sodium hypochlorite (Hyposol®, Prevest DenPro Limited, India) was used. Following completion of instrumentation, the canals were irrigated with 17% EDTA (Prevest DenPro Limited, India) to remove the smear layer, followed by a final rinse with 2% chlorhexidine (Maarc Chloro-HX 2%, Aadi Med Private Limited, India).

Due to persistent purulent exudation from teeth 11 and 12, obturation was deferred, and intracanal medicaments were placed. Calcium hydroxide paste (Maarc, Aadi Med Private Limited, India) mixed with sterile saline was used as the intracanal medicament during the first and fifth visits, while a freshly prepared double antibiotic paste consisting of ciprofloxacin (500 mg) and metronidazole (500 mg) mixed with sterile saline was placed during the second and fourth visits. During the third visit, calcium hydroxide mixed with 2% chlorhexidine was used as the intracanal medicament. At the subsequent appointment, the canals were dry, allowing completion of root canal obturation.

Master cone fit was verified radiographically (Figure 3B), and obturation was completed using the cold lateral condensation technique with bioceramic sealer (Cerafill RCS, Prevest Denpro, India) (Figure 3C). The access cavities were restored with resin composite. Despite completion of nonsurgical root canal treatment, the draining sinus tract persisted clinically. Considering the extensive cyst-like periapical lesion demonstrated on CBCT, associated buccal and palatal cortical plate perforation, and the long-standing nature of the lesion, endodontic microsurgery was planned as the definitive treatment.

Fig. 3: A) working length determination B) master cone selection C) final obturation Under local anesthesia using 2% lignocaine with 1:100,000 adrenaline, a rectangular full-thickness mucoperiosteal flap with two vertical releasing incisions was reflected to expose the surgical site (Figure 4A). Access to the cyst was made (Figure 4B). Granulation tissue and the cyst-like lesion were carefully enucleated and curetted using surgical hand curettes (Figure 4C). Approximately 3 mm of the root apices of teeth 11 and 12 were resected using a sterile round bur under copious sterile saline irrigation. Root-end cavities approximately 3 mm deep were then prepared using Woodpeckers ultrasonic retro-tips under magnification provided by a dental operating microscope. Following irrigation with sterile saline and inspection of the resected root surfaces, the prepared root-end cavities were sealed with Biodentine® (Septodont, France) (Figure 4D).

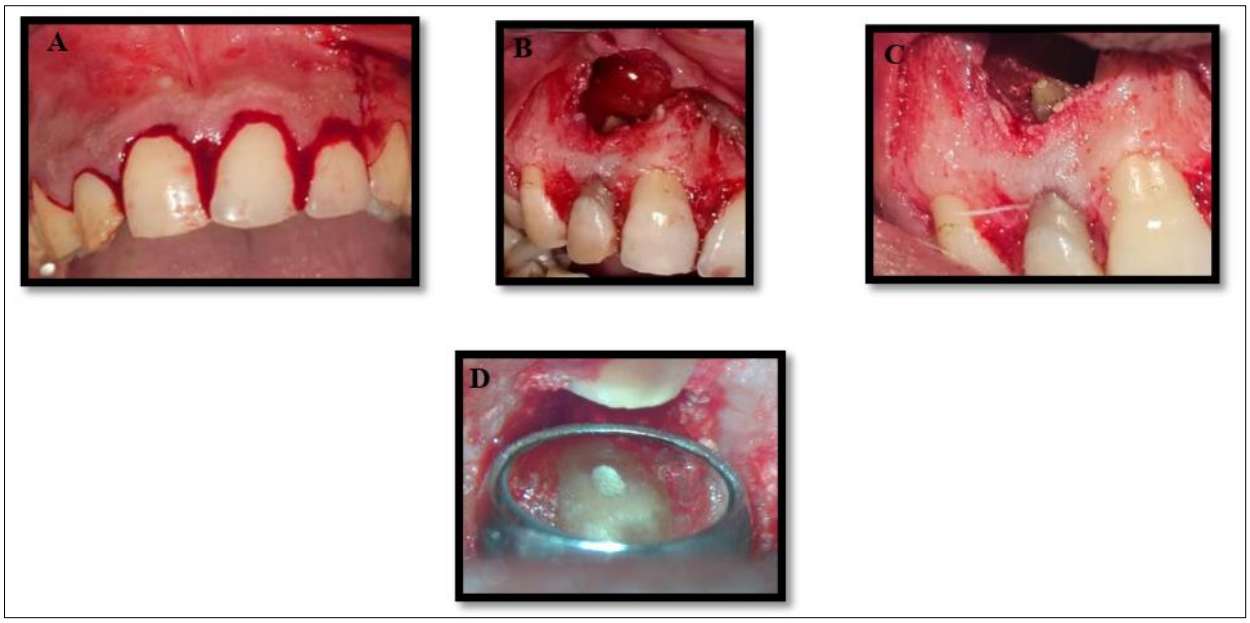

Fig. 4: A) Intra-sulcular and two vertical releasing incisions are made. B) Flap reflected and access to the cyst is made. C) Enucleation of cyst and apicoectomy. D) Root end cavities restored with Biodentin. To facilitate regeneration of the extensive osseous defect, injectable platelet-rich fibrin (i-PRF) was mixed with Osseograft® (DMBM Xenograft; Advanced Biotech Products (P) Ltd., India) to prepare sticky bone, which was packed into the surgical cavity. A platelet-rich fibrin (PRF) membrane was then adapted over the graft before flap repositioning (Figure 5A). The flap was repositioned and secured using 3-0 black silk interrupted sutures (Figure 5B).

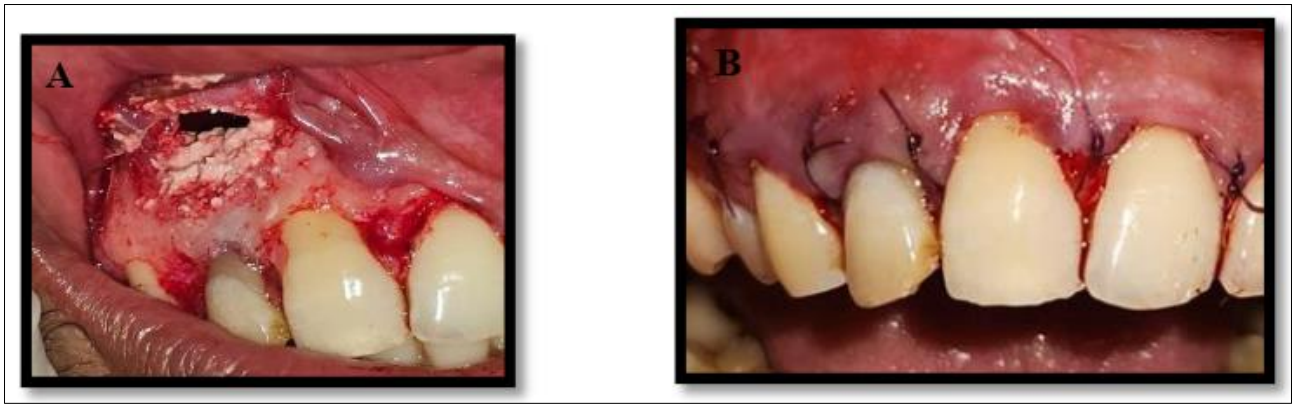

Fig. 5: A) sticky bone packed into surgical cavity B) The flap was repositioned and secured using interrupted sutures

Postoperatively, the patient was prescribed amoxicillin, metronidazole, ibuprofen, and 0.2% chlorhexidine mouth rinse. Postoperative instructions were provided, and sutures were removed after one week.

Follow-Up and Outcome

The postoperative period was uneventful, and the patient was prescribed amoxicillin, metronidazole, ibuprofen, and 0.2% chlorhexidine mouth rinse along with routine postoperative instructions. Sutures were removed one week after surgery, and satisfactory soft tissue healing was observed. The patient was recalled periodically for clinical and radiographic evaluation. At the six-month follow-up, the patient remained completely asymptomatic, with complete resolution of pain, swelling, and the draining sinus tract. Clinical examination revealed no tenderness to percussion or palpation, normal tooth mobility, and satisfactory soft tissue healing.

6-month follow-up intraoral periapical radiography demonstrated a marked reduction in the periapical radiolucency with evidence of progressive bone regeneration around the apices of teeth 11 and 12, suggestive of satisfactory periapical healing (Figure-6). The patient expressed satisfaction with both the functional and esthetic outcomes of the treatment.

Fig. 6: 6-month follow-up IOPAR

DISCUSSION

Apical periodontitis develops primarily as an inflammatory response to microbial infection of the root canal system, and successful endodontic treatment therefore depends on effective reduction of the intracanal microbial burden and prevention of reinfection [1, 2]. Conventional nonsurgical root canal treatment remains the primary treatment approach for teeth with apical periodontitis because adequate chemomechanical disinfection and obturation can result in periapical healing even in teeth presenting with extensive periapical lesions [3]. Current evidence-based recommendations from the European Society of Endodontology (ESE) support a conservative, biologically based approach to the management of apical disease, with treatment directed toward elimination of the root canal infection and preservation of the natural tooth [4].

In the present case, nonsurgical root canal treatment was selected as the initial treatment approach despite the large periapical lesion. Thorough chemomechanical preparation using the step-back technique, copious irrigation with sodium hypochlorite and EDTA, and sequential intracanal medicaments were employed to maximize microbial reduction. Irrigation is an essential component of root canal treatment because mechanical instrumentation alone cannot adequately contact all areas of the complex root canal system. Sodium hypochlorite provides antimicrobial activity and dissolution of organic tissue, whereas EDTA facilitates smear-layer removal [5, 6]. The use of intracanal medication in conjunction with chemomechanical preparation may further contribute to microbial control in selected cases of apical periodontitis [6].

The canals were intentionally not obturated until adequate drying could be achieved. In the present case, persistent intracanal exudation was considered an indication for continued treatment and monitoring rather than immediate definitive obturation. This approach allowed further control of the clinical signs before completion of the orthograde treatment. Although the evidence does not establish prolonged multi-visit treatment as universally superior to single-visit treatment, clinical management should be individualized according to the presence of persistent symptoms, exudation, infection and other patient- and tooth-related factors [6].

Although canal dryness was eventually achieved and orthograde root canal treatment was completed successfully, the patient continued to exhibit a persistent draining sinus tract. Furthermore, CBCT demonstrated a large cyst-like periapical lesion associated with buccal and palatal cortical plate perforation, perforation of the nasal floor, and involvement of the nasopalatine canal. Persistent apical disease may be associated with residual intraradicular infection, extraradicular infection, or other factors that cannot always be eliminated by conventional nonsurgical treatment alone [7]. In such circumstances, endodontic microsurgery can provide direct access to the apical portion of the root and periapical tissues and may be considered when persistent disease remains despite appropriate nonsurgical treatment [4-8].

The decision to perform surgery after completion of orthograde treatment was therefore based on the persistence of clinical signs together with the extensive anatomical destruction demonstrated on CBCT. Contemporary endodontic microsurgery has demonstrated favorable long-term outcomes, with systematic reviews reporting high success rates when microsurgical techniques are appropriately performed [8, 9]. Thus, in the present case, surgical intervention was considered

appropriate rather than continuing observation in the presence of persistent clinical disease and extensive periapical pathology.

CBCT played a pivotal role in treatment planning. Although conventional periapical radiographs provided evidence of the periapical lesion, CBCT permitted three-dimensional assessment of the lesion, cortical plate perforation, its relationship to adjacent anatomical structures, and involvement of the nasopalatine canal. The ESE position statement recommends that CBCT should not be used routinely but may provide additional diagnostic and treatment-planning information in selected complex endodontic cases [10]. A systematic review has similarly demonstrated that CBCT can influence treatment planning, particularly in complex cases and in the planning of endodontic surgery [11]. In the present case, the three-dimensional information provided by CBCT was particularly valuable for determining the extent of the surgical defect and anticipating the relationship of the lesion to important anatomical structures.

As no histopathological examination was performed, the lesion is appropriately described as a cyst-like periapical lesion rather than definitively diagnosing it as a radicular cyst. This distinction is important because radiographic appearance alone cannot reliably differentiate a true radicular cyst from other forms of apical inflammatory lesions. Consequently, the present case should not be interpreted as histologically confirmed cystic disease.

Modern endodontic microsurgery has evolved considerably with the introduction of the dental operating microscope, ultrasonic root-end preparation, microsurgical instruments and biologically compatible root-end filling materials [8, 9]. High magnification and illumination improve visualization of the surgical field and facilitate identification of anatomical details, while ultrasonic root-end preparation permits conservative preparation of the root end with improved access and minimal removal of sound root structure [8, 9]. Meta-analytic evidence has demonstrated higher success rates for endodontic microsurgery compared with traditional root-end surgery, supporting the role of contemporary microsurgical principles in the management of persistent apical disease [8, 9].

Biodentine was selected as the root-end filling material because of its favorable biological and physicochemical properties. Biodentine is a calcium-silicate-based material with good biocompatibility and sealing characteristics and has demonstrated favorable performance as a root-end filling material in experimental studies and systematic reviews [12, 13]. Its ability to interact with tissue fluids and promote apatite formation at the material–dentin interface has also been demonstrated [14]. Compared with conventional MTA formulations, Biodentine offers favorable handling characteristics and mechanical properties, although its clinical superiority over MTA has not been conclusively established [13-15]. Therefore, in the present case, Biodentine was selected primarily because of its favorable handling, biological properties and suitability for root-end repair rather than on the assumption that it is universally superior to MTA.

The extensive osseous defect remaining after enucleation was managed using sticky bone, prepared by combining Osseograft® (DMBM xenograft) with injectable platelet-rich fibrin (i-PRF), followed by placement of a PRF membrane. The xenograft served primarily as an osteoconductive scaffold, while the PRF component provided a fibrin matrix containing platelets, leukocytes and various growth factors that may support angiogenesis, cellular migration and tissue repair [16, 17]. The combination of PRF with particulate bone substitutes has been investigated as a regenerative approach for osseous defects, with experimental and clinical evidence suggesting potential benefits in bone healing [18].

The use of i-PRF in regenerative dentistry has received increasing attention because of its potential effects on soft- and hard-tissue regeneration. A systematic scoping review identified evidence supporting its potential role in wound healing, bone regeneration and other regenerative applications, although considerable heterogeneity exists among the available studies [17]. More recent experimental evidence has also demonstrated that i-PRF can be incorporated with xenograft material to form a cohesive fibrin-enriched graft, providing a biologically active matrix within the grafted defect [19]. However, the evidence supporting routine use of i-PRF or sticky bone specifically in endodontic microsurgery remains limited. Therefore, the use of these regenerative adjuncts in the present case should be regarded as a selected, biologically plausible approach for management of an extensive osseous defect rather than an established standard of care.

At the six-month follow-up, the patient remained asymptomatic, with complete resolution of the sinus tract and progressive radiographic bone healing. The favorable clinical and radiographic response observed in the present case is consistent with the generally favorable prognosis reported for appropriately performed endodontic microsurgery. [8,9] However, the six-month observation period represents a relatively short follow-up for definitive assessment of periapical healing, and longer-term evaluation would provide greater evidence of treatment success. The outcome observed in this case may reflect the combined effects of meticulous infection control during nonsurgical treatment, appropriate selection for surgical intervention, contemporary microsurgical principles, effective root-end sealing with Biodentine, and regenerative management of the extensive surgical defect. Nevertheless, because this is a single case without histopathological confirmation and with limited follow-up, the contribution of each individual treatment component cannot be established independently.

CONCLUSION

The present case highlights the importance of a systematic, evidence-based approach in the management of persistent large cyst-like periapical lesions. Conventional nonsurgical root canal treatment should be considered the first-line treatment; however, persistent disease following adequate orthograde therapy may necessitate endodontic microsurgery. Careful diagnosis using CBCT, meticulous microsurgical technique, effective root-end sealing with Biodentine, and the use of regenerative adjuncts in selected cases can contribute to favorable clinical and radiographic outcomes. The successful healing observed at six months reinforces the predictability of modern endodontic microsurgery when performed following sound biological principles and appropriate case selection.

Clinical Significance

This case highlights the importance of a structured, evidence-based approach in managing persistent large cyst-like periapical lesions. Completion of meticulous nonsurgical root canal treatment should precede surgical intervention whenever feasible. CBCT-guided diagnosis, modern endodontic microsurgical techniques, effective root-end sealing with Biodentine, and selective use of regenerative adjuncts can contribute to successful healing in complex periapical lesions while preserving the natural dentition.

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