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Multidisciplinary management of a large trauma-associated anterior maxillary radicular cyst: A four-year follow-up case report

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Abstract
Radicular cysts are common inflammatory lesions of odontogenic origin that may cause extensive bone destruction when diagnosis and treatment are delayed. Large lesions involving multiple teeth often require multidisciplinary management to achieve favourable functional and esthetic outcomes. A 40-year-old male presented with a large anterior maxillary swelling associated with multiple non-vital teeth and a history of dental trauma. Panoramic radiography demonstrated a well-defined radiolucent lesion extending from teeth 11 to 24 with root resorption. Treatment included endodontic therapy, surgical enucleation, apicectomy, platelet-rich plasma placement, guided tissue regeneration using a collagen membrane, and definitive prosthodontic rehabilitation. Histopathological examination confirmed the diagnosis of a radicular cyst. Progressive bone healing was evident throughout the follow-up period, with complete resolution of the radiolucent defect and restoration of normal trabecular architecture observed after four years. This case highlights the successful multidisciplinary management of a large trauma-associated anterior maxillary radicular cyst, demonstrating complete radiographic healing and stable functional and esthetic outcomes over four years.

Keywords: Radicular cyst, periapical surgery, apicoectomy, platelet-rich plasma, guided tissue regeneration, bone regeneration, endodontic treatment

Introduction

Radicular cysts are the most common inflammatory odontogenic cysts and arise from epithelial rests of Malassez secondary to pulpal necrosis and chronic periapical inflammation. Although most lesions are small and asymptomatic, progressive enlargement may result in cortical expansion, root resorption, displacement of adjacent structures, and functional or esthetic impairment. The anterior maxilla represents a particularly important region because extensive lesions may compromise both dental function and facial appearance [1, 2].

Management of radicular cysts depends on lesion size, extent of bone destruction, and involvement of adjacent teeth. While small lesions may resolve following nonsurgical endodontic treatment, larger cysts frequently require surgical intervention to achieve complete removal of pathological tissue and facilitate bone regeneration [2, 3]. In recent years, regenerative adjuncts such as platelet-rich plasma and guided tissue regeneration have been increasingly employed to enhance healing of large osseous defects following cyst enucleation [4].

Despite the high prevalence of radicular cysts, reports describing comprehensive endodontic, surgical, regenerative, and prosthodontic management with long-term follow-up remain limited [5, 7]. The present report describes the successful management of a large trauma-associated anterior maxillary radicular cyst involving multiple teeth through an integrated endodontic, surgical, regenerative, and prosthodontic approach. Complete radiographic healing, restoration of function and esthetics, and absence of recurrence were achieved during a four-year follow-up period, highlighting the long-term effectiveness of comprehensive treatment planning.

Case Presentation

A 40-year-old male presented with swelling in the left anterior maxilla for four months, associated with difficulty in mastication. He reported pain in the same region one month earlier, for which root canal therapy was initiated on teeth 21-23 at a private clinic. The swelling gradually increased despite treatment. He had no relevant medical history but reported sustaining untreated anterior maxillary trauma in a road traffic accident three years earlier.

Clinical examination revealed a crown fracture of the right maxillary central incisor (tooth 11), consistent with the reported history of anterior maxillary trauma. Intraoral examination demonstrated a well-circumscribed, dome-shaped swelling on the palatal aspect extending from teeth 21 to 24, with intact overlying mucosa and no evidence of surface ulceration. [Figure 1A] A mild labial prominence

was noted with egg-shell crackling on palpation, indicating cortical thinning. [Figure 1B] Pulp vitality testing demonstrated the absence of response in the involved maxillary anterior teeth, whereas adjacent teeth responded within normal limits. No extraoral swelling or skin changes were noted.

Panoramic radiography showed a well-circumscribed unilocular radiolucency measuring approximately 45 × 35 mm, extending from teeth 11 to 24, with root resorption of teeth 21 and 22 [Figure 2]. Aspiration through the thin labial cortex yielded straw-colored fluid, supporting a cystic lesion. Aspiration yielded a straw-coloured fluid, and cytological examination demonstrated inflammatory cells and cholesterol clefts, findings consistent with a chronic inflammatory cystic lesion of odontogenic origin. Correlation of the clinical findings with the radiographic appearance and the presence of multiple non-vital teeth led to a provisional diagnosis of a radicular cyst in the anterior maxilla. Differential diagnoses included residual cyst, odontogenic keratocyst, glandular odontogenic cyst, traumatic bone cyst, and central giant cell lesion; however, the overall clinicoradiographic and cytological features were most consistent with a radicular cyst.

Endodontic therapy was completed for teeth 13-23 before surgical intervention. Calcium hydroxide was used as an intracanal medicament to promote canal disinfection and control persistent periapical infection before definitive surgical management. After adequate disinfection, surgical enucleation was performed under local anaesthesia through a full-thickness mucoperiosteal flap from teeth 11 to 25. Significant thinning and partial dehiscence of the labial cortical plate were observed. A well-encapsulated cystic lesion was identified and completely enucleated with care to preserve surrounding structures. [Figure 3] Apicectomy of teeth 11-13 was performed, and the defect was thoroughly debrided.

After complete cyst enucleation and debridement, autologous platelet-rich plasma prepared from the patient's venous blood according to the institutional protocol was placed within the defect to enhance wound healing and bone regeneration. A resorbable collagen membrane was subsequently adapted over the defect to facilitate guided tissue regeneration and stabilize the healing environment. The flap was repositioned and sutured to achieve tension-free primary closure.

Histopathological examination revealed a cystic cavity lined predominantly by non-keratinised stratified squamous epithelium with focal epithelial hyperplasia. Areas of ciliated columnar epithelial metaplasia were identified within the lining. The connective tissue wall demonstrated dense chronic inflammatory cell infiltrate composed mainly of lymphocytes and plasma cells, together with focal fibrous tissue proliferation. Correlation of the microscopic findings with the clinical and radiographic features confirmed the diagnosis of a radicular cyst with secondary chronic inflammation.

Following satisfactory soft-tissue healing, definitive prosthodontic rehabilitation was completed with porcelain-fused-to-metal crowns on teeth 13-23. [Figure 4A, 4B] Serial radiographic evaluations demonstrated progressive bone regeneration and trabecular maturation within the surgical defect. At the 48-month follow-up, complete radiographic healing with restoration of normal trabecular bone architecture was evident, with no signs of recurrence [Figure 5]. Throughout the follow-up period, the patient remained asymptomatic and exhibited stable functional and esthetic outcomes.

Fig 1A: Preoperative intraoral photograph showing palatal swelling extending from teeth 21 to 24.

Fig 1B: Preoperative intraoral photograph demonstrating labial prominence and fracture of the right maxillary central incisor.

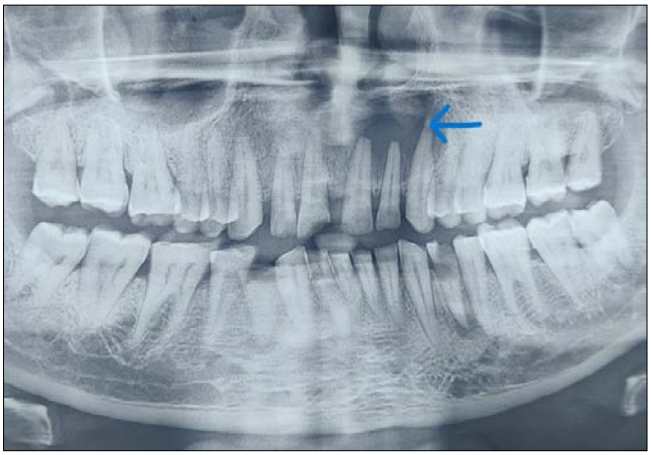

Fig 2: Preoperative panoramic radiograph showing a well-defined unilocular radiolucent lesion extending from teeth 11 to 24 with associated root resorption of teeth 21 and 22.

Fig 3: Intraoperative photograph following enucleation of the cystic lesion.

Fig 4A: Occlusal intraoral view demonstrating complete palatal healing after surgical treatment.

Fig 4: Frontal intraoral view showing definitive prosthodontic rehabilitation and satisfactory soft-tissue healing.

Fig 5: Panoramic radiograph obtained four years postoperatively demonstrating complete osseous healing and absence of recurrence.

Discussion

Radicular cysts are the most common inflammatory odontogenic cysts and represent the most frequent histopathological diagnosis among chronic inflammatory periapical lesions. In a large multicenter study evaluating 10,381 cases of chronic inflammatory periapical diseases, radicular cysts accounted for approximately 60% of all lesions, highlighting their continued clinical significance despite advances in preventive dentistry and endodontic care.[1] These lesions arise secondary to pulpal necrosis and chronic periapical inflammation, resulting in stimulation and proliferation of the epithelial rests of Malassez. Although dental caries remains the principal etiological factor, traumatic injuries may also initiate pulpal necrosis and subsequent cyst formation [1, 2].

The present patient reported a history of anterior maxillary trauma several years before presentation. Trauma-related pulpal necrosis is often asymptomatic and may remain undetected until significant periapical pathology develops. Similar delayed presentations have been reported in large anterior maxillary radicular cysts, where patients remained asymptomatic for prolonged periods before developing swelling or functional impairment [3, 4]. In our case, the lesion measured approximately 45 × 35 mm and involved multiple anterior teeth, indicating a long-standing

pathological process. The extensive size of the lesion, associated root resorption, and cortical plate involvement emphasised the aggressive local effects that may occur despite the benign nature of radicular cysts.

The diagnosis of large periapical radiolucencies may be challenging because several odontogenic and non-odontogenic lesions can demonstrate similar clinical and radiographic features. Differential diagnoses include odontogenic keratocyst, glandular odontogenic cyst, residual cyst, traumatic bone cyst, and central giant cell lesions. Tsesis et al. reported that although clinical and radiographic assessment demonstrates high diagnostic accuracy for lesions of endodontic origin, histopathological examination remains essential because non-endodontic cysts may mimic radicular cysts radiographically [2]. In the present case, the combination of non-vital teeth, aspiration findings, characteristic radiographic appearance, and histopathological confirmation established the definitive diagnosis. Histopathological evaluation remains indispensable because treatment planning and prognosis may differ considerably among cystic lesions of the jaws.

Management of radicular cysts depends on lesion size, location, and relationship to adjacent structures. Small lesions may heal following conventional root canal treatment alone; however, larger lesions frequently require surgical intervention. Previous investigations have demonstrated that true radicular cysts with a self-sustaining epithelial lining may exhibit limited healing following nonsurgical treatment alone, making surgical management necessary in selected cases [5]. The lesion described in the present report demonstrated extensive bone destruction, cortical thinning, and involvement of multiple teeth, thereby justifying complete surgical enucleation. Similar successful outcomes following enucleation of large maxillary radicular cysts have been reported by Deshmukh et al. and Gurav et al., both of whom observed satisfactory healing and preservation of adjacent structures after complete cyst removal [3, 6].

Adequate elimination of intracanal infection remains fundamental to successful management of inflammatory periapical lesions. Calcium hydroxide was used as an intracanal medicament before surgery because of its well-established antimicrobial properties, ability to neutralize bacterial endotoxins, and favorable effects on periapical healing. Reduction of the microbial burden before surgery is particularly important in extensive lesions where persistent infection may compromise healing. The favorable clinical and radiographic outcomes observed in the present case support the importance of combining endodontic disinfection with surgical intervention in large inflammatory cystic lesions.

Apicectomy was performed to remove potentially infected apical tissues and improve the long-term prognosis of the involved teeth. In a systematic review and meta-analysis, Pinto et al. reported pooled success rates exceeding 90% for modern endodontic microsurgical procedures, emphasizing the predictability of surgical intervention when infection control and appropriate root-end management are achieved [7]. Although the present case was managed using a conventional surgical approach rather than contemporary microsurgical techniques, the favorable outcome observed after four years supports the effectiveness of combining apical surgery with cyst enucleation in carefully selected cases.

Management of the residual osseous defect following cyst enucleation remains controversial. While spontaneous bone regeneration may occur after complete removal of the lesion, regenerative adjuncts are increasingly employed to enhance healing, particularly in large defects. In the present case, autologous platelet-rich plasma and a resorbable collagen membrane were used to support bone regeneration and preserve alveolar architecture in the esthetic zone. Recent evidence has highlighted the potential benefits of regenerative approaches in large maxillary cystic defects. La Rosa et al. evaluated bone regeneration after maxillary radicular cyst enucleation and reported substantial bone healing irrespective of grafting procedures, although larger lesions demonstrated slower rates of regeneration [8]. In comparison, our patient demonstrated progressive radiographic bone formation and restoration of normal trabecular architecture during a four-year follow-up period, suggesting successful regeneration of the surgical defect.

An additional strength of the present case is the multidisciplinary treatment approach. Previous reports by Diwan et al. and Sonar et al. emphasized the importance of integrating endodontic therapy, surgical management, and prosthodontic rehabilitation to achieve favorable outcomes in extensive anterior maxillary lesions [4, 9]. Similarly, the present patient underwent coordinated endodontic, surgical, regenerative, and prosthodontic treatment, allowing preservation of the involved teeth while restoring function and esthetics. Such interdisciplinary management is particularly important in the anterior maxilla, where both biological and cosmetic considerations influence treatment planning.

Long-term follow-up is essential when evaluating the outcome of treatment for large radicular cysts. Many published reports describe follow-up periods ranging from six months to two years [3, 6, 9]. In contrast, the present case demonstrated complete radiographic resolution, re-establishment of normal trabecular architecture, and absence of recurrence after four years. This prolonged follow-up provides valuable evidence regarding the long-term stability of treatment outcomes and supports the effectiveness of the therapeutic strategy employed.

The clinical significance of this case lies in the successful management of a large trauma-associated anterior maxillary radicular cyst involving multiple teeth through a combination of endodontic therapy, surgical enucleation, apicectomy, regenerative procedures, and definitive prosthodontic rehabilitation. Complete radiographic healing, preservation of function, restoration of esthetics, and

absence of recurrence over four years demonstrate that comprehensive multidisciplinary management can achieve favourable long-term outcomes in extensive anterior maxillary lesions.

Limitations of the present report include its single-case design and the absence of cone-beam computed tomography evaluation, which would have provided more accurate three-dimensional assessment of lesion extent and postoperative bone regeneration. Nevertheless, the diagnosis and treatment planning were based on a combination of clinical findings, vitality testing, aspiration cytology, panoramic radiography, intraoperative observations, and histopathological confirmation. Furthermore, the four-year clinical and radiographic follow-up provided reliable evidence regarding the long-term stability of treatment outcomes.

Conclusion

Large anterior maxillary radicular cysts may present significant diagnostic, functional, and esthetic challenges, particularly when multiple teeth are involved. This case demonstrates that a multidisciplinary approach combining endodontic treatment, surgical enucleation with apicectomy, regenerative therapy, and prosthodontic rehabilitation can achieve complete healing, restoration of function, and durable long-term results. Careful treatment planning and extended follow-up remain essential for ensuring stable bone regeneration, preservation of function, and prevention of recurrence.

Ethical Approval: Not required for a single case report according to institutional policy.

Patient Consent: Written informed consent was obtained from the patient for publication of clinical information and images.

Conflict of Interest: The authors declare no conflict of interest.

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