

A CBCT Guided Surgical Approach in Conjugation with Platelet Rich Fibrin Graft for the Management of Infected Radicular Cyst: A Case Report

Kalpana S. Pawar¹ Suraj V. Rath^{2*} Sadashiv G. Daokar³ Aishwarya R. Mantri⁴ Gargi Patil⁵
Vishwas Kadam⁶

¹Professor, Department of Conservative Dentistry and Endodontics, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

²PG Student, Department of Conservative Dentistry and Endodontics, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

³Professor and Head, Department of Conservative Dentistry and Endodontics, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

⁴PG Student, Department of Conservative Dentistry and Endodontics, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

⁵PG Student, Department of Oral Medicine and Radiology, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

⁶Reader, Department of Oral Medicine and Radiology, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

ABSTRACT

Background: Radicular cysts are the most common cystic lesions which affect the jaw with incidence of 52 to 68% amongst the all jaw cysts. A radicular cyst arises from epithelial remnants stimulated to proliferate by an inflammatory process originating from pulpal necrosis of a non-vital tooth. They are generally asymptomatic and are diagnosed during routine radiologic investigations. The treatment of radicular cysts includes conventional nonsurgical root canal therapy when lesion is localized or surgical treatment, when lesion is large. This case report discusses the management of radicular cyst associated with maxillary anterior region after performing apicoectomy with Biodentine as a retrograde filling material followed by placement of PRF graft.

Keywords: Apicoectomy, Enucleation, Biodentine, Platelet rich fibrin graft, CBCT, Radicular cyst.

INTRODUCTION

Periapical pathology could be the fate of untreated or unsatisfactorily treated traumatically injured teeth. Surgical endodontics is a reliable method for the treatment of teeth with periapical lesions which do not respond to conventional root canal treatment. The incidence of periapical cysts has been reported 6% to 54% of all periapical lesions, determining whether periapical radiolucency is a cyst or a periapical granuloma cannot be done alone with conventional radiographic methods.⁽¹⁾

Diagnosis of orofacial pathology is difficult with the two-dimensional (2D) images obtained alone from conventional radiograph. Conventional radiography has limitation as they do not allow differentiation between cyst and tumors. CBCT gray value can be

considered as a major tool in diagnosis of cyst and tumor and other soft or hard tissue lesion without any microscopic evaluation. CBCT gray scale measurement is superior to conventional intraoral radiographic methods for diagnosing the nature of lytic lesion of jaw. CBCT scans have shown to aid in bone density assessment, complex diagnostic and treatment planning, surgical assessment of pathology, and many more.⁽²⁾

Radicular cyst is the most common odontogenic cystic lesion of inflammatory origin. Other synonyms used as periapical cyst, apical periodontal cyst, root end cyst, or dental cyst. It arises from epithelial residues in the periodontal ligament as a result of inflammation. The resulting cyst commonly

Received: Oct. 12, 2019; Accepted: Jan. 3, 2020

*Correspondence Dr. Suraj V. Rath.

Department of Conservative Dentistry and Endodontics, CSMSS Dental College and Hospital, Aurangabad, Maharashtra, India.

Email: svrathi001@yahoo.com

involves the apex of the affected tooth. The treatment of radicular cysts includes conventional nonsurgical root canal therapy when lesion is localized or surgical treatment, like enucleation, marsupialization or decompression when lesion is large. ⁽³⁾

Periapical cysts can be classified into two types: the periapical true cyst and the periapical pocket cyst. The true cysts have contained a lumen without a continuous epithelial lining, and so they are isolated from the tooth. Pocket cysts have contained a lumen which is opened to the root canal of the affected tooth. ⁽⁴⁾

The goal of a periapical surgery is to gain access to the affected area, evaluate the root circumference and root canal anatomy, and place a biocompatible seal in the form of root end filling that stimulates the regeneration of periapical hard and soft tissues. Its success rate varies from 86 –92% while failure rate is 4.7%.¹ Management of cyst can be done by surgical or non-surgical method; in surgical method either by marsupialization or enucleation, depending on the size and location of the lesion, the bone integrity of the cystic wall and its proximity to vital structures. ^(1,5)

With regard to the root-end filling material, Biodentine appears to become the standard. Although it is a comparatively expensive material and the clinician has to become familiar with its handling, Biodentine has excellent biocompatibility, ideal adherence to the cavity walls, and low solubility. Clinical (comparative) studies have reported excellent success rates for BIODENTINE ranging from 90% to 92% (follow-up periods from 1 to 5 years). ⁽⁶⁾

Autologous PRP is a source for obtaining growth factors especially, platelet-derived growth factor (PDGF) and transforming growth factor- β (TGF- β) that are essential for bone regeneration. The use of RP can accelerate and enhance body's natural wound healing mechanisms. It has the benefit to form a biological gel that may provide containment, clot stability, and function as an adhesive. ⁽⁷⁾ Platelet-rich fibrin (PRF) is a modification of PRP. It is indicated for alveolar bone augmentation, sinus lift procedure, extraction socket preservation, defect reconstruction following cyst enucleation or tumor excision, and alveolar cleft repair. ⁽⁸⁾

CASE REPORT

A 20-year-old male patient reported to the department of conservative dentistry and endodontics with a chief complaint of pain and swelling in the upper front region of jaw since 2-3 months. Patient gave history of trauma in upper anterior teeth, 2 years back. Post trauma he had dull intermittent pain in relation to the maxillary anteriors which subsided without medication. Patient had h/o swelling in upper front region of jaw before 2-3 months and visited local dental clinic for same and was on medications. The RCT treatment was attempted with 21 and 22 by local dentist.

Intraoral examination showed a labial swelling extended from the left central incisor to the distal part of the maxillary canine. Draining sinus tracts were seen in relation with 22 and 23 (Fig.1). Tenderness was positive with 21, 22 and 23 and negative response was recorded on Electric Pulp testing with 21, 22 and 23.



Fig 1: Preoperative intraoral clinical view and radiographic view.

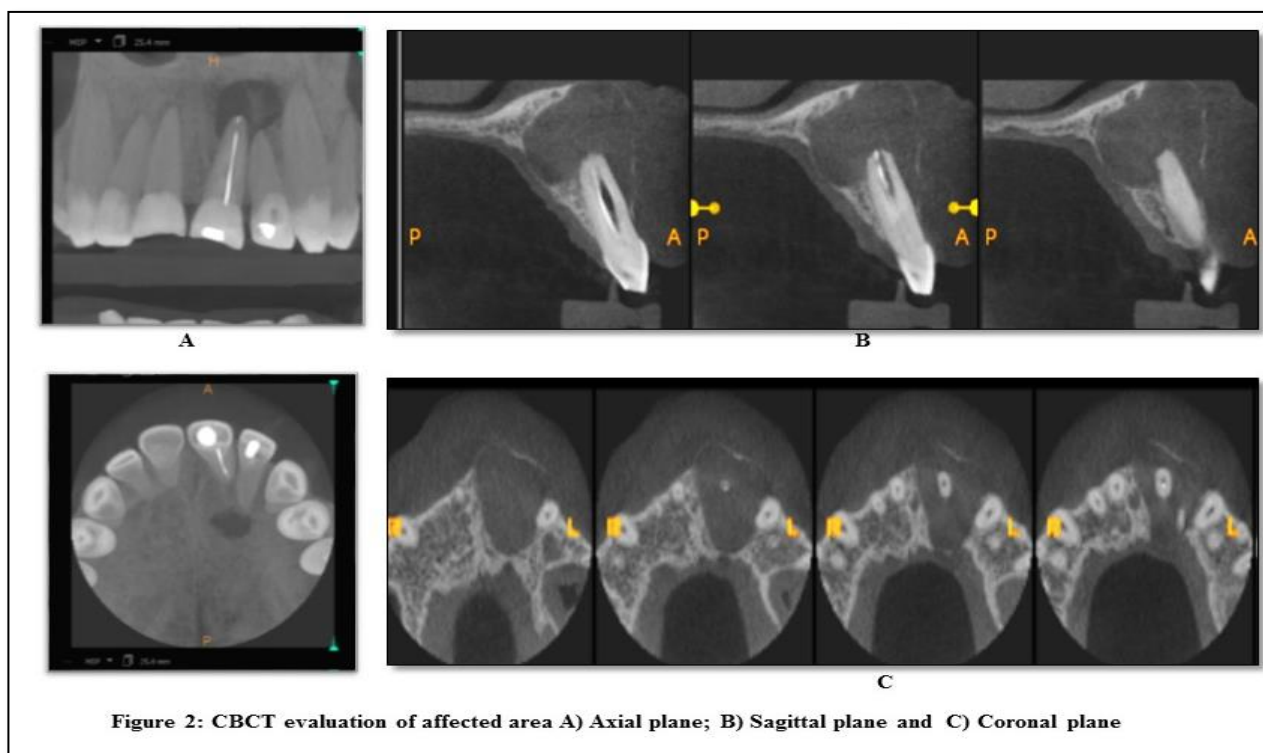
Investigations:

Maxillary occlusal radiograph and IOPA with 21, 22 and 23 revealed well-circumscribed periapical radiolucency, about 2.5.0 x 2.0 cm in dimension, extending from mesial aspect of root apex of left maxillary central incisor to distal aspect of left maxillary canine, suggesting the size of the cyst (Fig. 1). Internal structure is totally radiolucent. No evidence of root resorption of the involved teeth was present. The patient was subjected to cone beam computed tomography (CBCT) scan for further exploration of the finding, to check proximity or any involvement of lesion with nasal floor, since lesion was extensive (Fig. 2). CBCT showed that the nasal floor was intact and the radiolucency was seen in relation with tooth 21 and

22 in sagittal and coronal planes. The dimension of the lesion was measured using measurement scale which was around 2.5 cm *2 cm in maximum diameter. Palatal perforation was seen with respect to 22 on CBCT examination. On the basis of history, clinical examination and radiographic finding, a provisional diagnosis of **infected periapical cyst** related to tooth 21,22 and 23 was made. Final diagnosis was confirmed on basis of

Fibrin graft. A multi-visit endodontic therapy was planned with respect to 21, 22 & 23.

Root canal preparation and Obturation was carried out in relation to 21, 22 and 23. Canals were irrigated with normal saline. After determination of working length and biomechanical preparation. Then, triple antibiotic paste was placed as an intracanal dressing for 10 days. Triple antibiotic paste was made by mixing three potent



histopathological findings.

The differential diagnosis included

- ☐ Nasopalatine Cyst
- ☐ Globulomaxillary Cyst
- ☐ Dentigerous Cyst
- ☐ Odontogenic keratocyst

Treatment Plan

The treatment plan included root canal therapy with respect to 21, 22 & 23. Surgical management of the cyst was planned which included cyst enucleation, apicectomy in relation to 21 and 22 followed retrograde preparation and Biodentine placement followed by placement of Palate Rich

antimicrobial agents, metronidazole (400 mg), ciprofloxacin (500 mg) and minocycline (100 mg) in 1:1:1 proportion. After ten days, obturation of the root canals was completed (Fig. 3A). The patient was prepared for surgical procedure in next visit after 3 days, which included surgical enucleation of cyst, apicectomy and retrograde filling of involved teeth with BIODENTINE.

After administration of local anaesthesia, a labial crevicular incision was made in the region of 21 to 24, and a releasing incision was given mesial to 21 and distal to 24. A full thickness mucoperiosteal trapezoidal flap was reflected. Periapical exposure must be achieved after full thickness flap elevation by using a sterile round surgical burr. Mostly the cortical bone overlying the apex has been resorbed due to underlying apical pathosis, exposing a soft tissue lesion. If the opening is small, it is enlarged,

until approximately half the root and the lesion are visible. A window was created on the buccal cortical plate to get the access for removal of the cystic tissue. Enucleation of the cystic lesion and thorough curettage to remove any remaining granulation tissue was done using curettes, and the enucleated specimen was sent for histopathological evaluation (Fig. 3D).

Apical 3 mm of the root of 21 and 22 were resected normal saline irrigation. A cavity for the retrograde filling was prepared using ultrasonic handpiece. BIODENTINE (Septodont, USA) was mixed as per manufacturer's instructions, and the retrograde filling was done with 21 and 22 (Fig. 3B). The bony cavity was then filled with Platelet-rich fibrin (PRF) prepared using patient's blood and flap closure was done with 3-0 silk suture using single interrupted sutures (Fig. 3C). After three days, patient was recalled for follow up. After one week, patient was

again recalled for the removal of sutures.

The armamentarium for preparation of PRF includes a PC-02 table centrifuge and a blood collection kit that contains in it a 24G butterfly needle and 9-ml blood collection tubes. The collected patient's blood sample in 10-ml tubes that is devoid of any anticoagulant is centrifuged immediately at a rate of 3000 rpm for 10 min. After centrifugation, the blood separated into three layers. The middle layer, which represents PRF (0.6-0.8 mL), was taken. The time lapse between blood collection and centrifugation should be as minimal as possible and is an important parameter deciding the success and clinical outcome of PRF.

Postoperatively, intraoral periapical radiograph after 3, 6 and 9 months (Fig. 4A) revealed

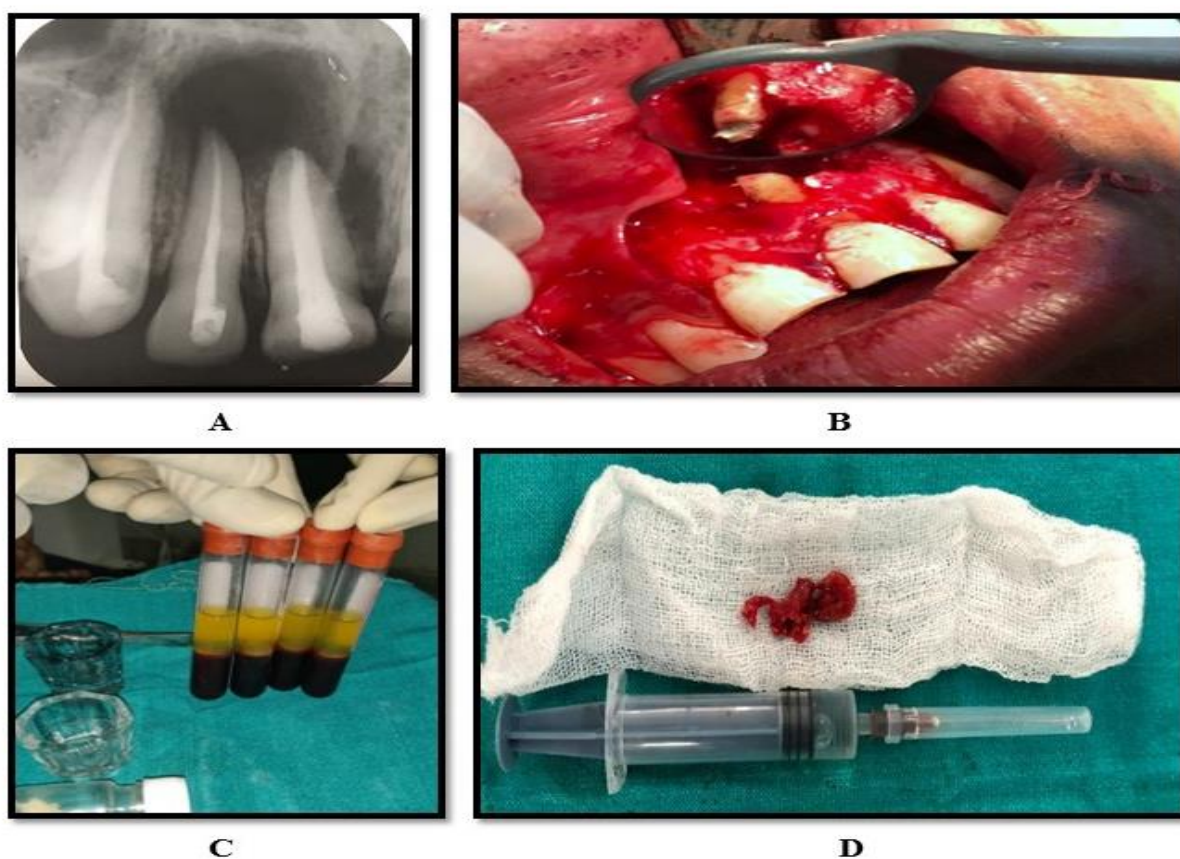


Figure 3: A) Post obturation radiograph; B) Retrograde BIODENTINE placement; C) Platelet Rich Fibrin graft and D) Excised lesion for histopathological examination

regression of the cystic lesion and Maxillary occlusal radiograph after 9 months revealed formation of bony trabeculae (Fig. 4C).

Histopathological report

Showed cystic lumen lined by stratified squamous epithelium surrounded by connective tissue capsule. The lining epithelium is thin, discontinuous and absent in many areas. The overlying connective tissue capsule consists of dense bundles of collagen fibres interspersed with fibroblasts, endothelial lined blood vessels, dense inflammatory cell infiltrates chiefly consists of lymphocytes, plasma cells and red blood cells.

become symptomatic when infected or with great size due to nerve compression. ⁽⁹⁾ The periapical cyst is the most common odontogenic cyst (52.3-70.7 percent of all odontogenic cysts) followed by the dentigerous cyst (16.6-21.3 percent of all odontogenic cysts) and odontogenic keratocyst, or OKC (5.4- 17.4 percent of all odontogenic cysts). ⁽¹⁰⁾

There is a dilemma between surgical and non-surgical intervention for the management of a radicular cyst. Thus, it has been accepted as the first line of treatment to remove the etiological agent from root canal system through non-surgical method which helps to create a favourable environment for repair of the lesion. The choice of

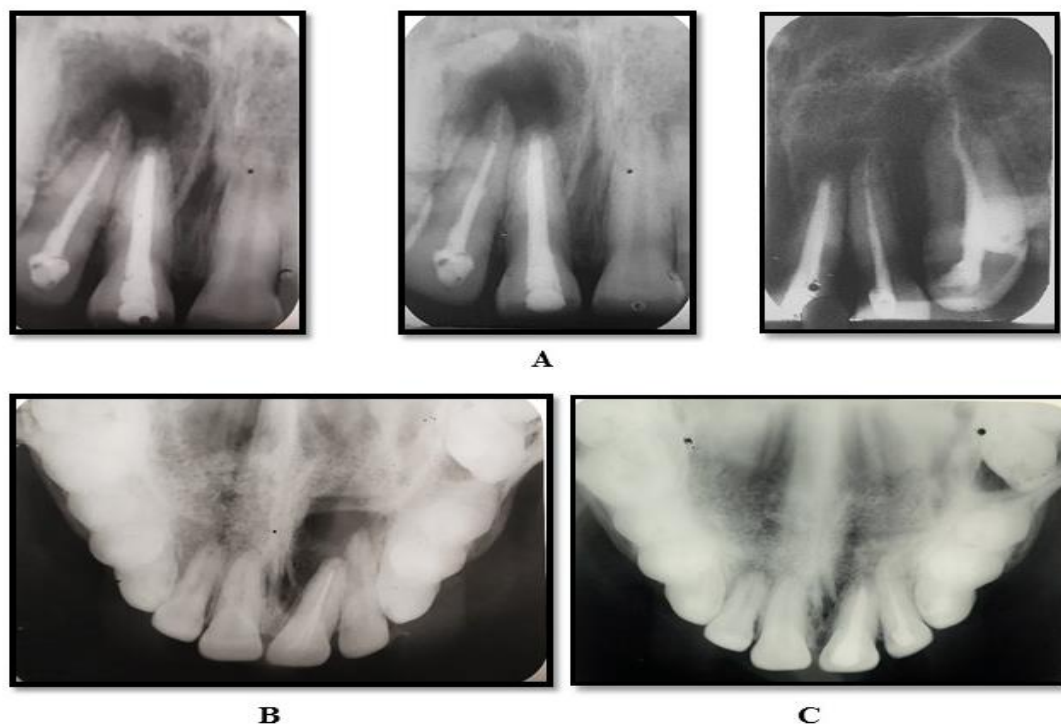


Figure 4: A) 3,6 and 9 months follow-up IOPA; B) Pre-operative Occlusal radiograph and C) 9 months follow up Occlusal radiographs

DISCUSSION

A radicular cyst is an odontogenic cyst of inflammatory origin preceded by a chronic periapical granuloma and stimulation of cell rests of Malassez. Although the source of the epithelium is cell rest of Malassez, other sources can be crevicular epithelium, sinus lining, or epithelium lining of fistulous tracts, have been suggested. Radicular cysts are inflammatory lesions leading to bone resorption and can reach great dimensions and

treatment may be determined by factors such as the lesion extension, relation with noble structures, origin, and clinical characteristics, and cooperation and patient's systemic condition determine the choice of treatment. ⁽¹¹⁾

The pathogenesis of radicular cyst is initiated by the activation of proliferation of cell rest of malassez by the microbial antigens, endotoxins and the cytokines from the apical foramen of the tooth. Complement fixation and antigen antibody complex formation are the two-mechanism involved in the

initiation of cell rest proliferation. Later the growth factors like TGF-Beta, IL 1, IL6 and IL8 play an important in fibroblastic proliferation phase of the cell rest to form a periapical granuloma. The two main theories for cyst formation is that the epithelial cell proliferates around the connective tissue surface of the periapical abscess cavity to form cyst or the cyst is formed from the central degeneration of the epithelial proliferations of periapical granuloma.

The central cystic degeneration was believed to be from a vascular compromise but later it was proved to be an immunologic reaction causing the epithelial clefts formed by intercellular fluids to collide forming a cavity leading to formation of cyst. The cystic contents are a straw-coloured fluid with numerous cholesterol crystals formed from degenerated Red blood corpuscles. Histologically the cyst is lined by stratified squamous epithelium the thickness of lining increases with the duration. Hyaline bodies otherwise called as Rushton bodies which are derived from the degeneration of epithelial lining are also present in radicular cyst [11,12]. The osmolality of the content was 290 ± 14.93 mOsm which is greater than the serum osmolality of 79 ± 4.68 mOsm [13].⁽¹²⁾

Elimination of the microorganisms, in case of large periapical lesions, has been a challenge for the clinician. The polymicrobial infection makes sterilization of the root canal system difficult. As a consequence, the endodontic treatment may fail if the root canal treatment has not adequately eliminated or reduced the intraradicular burden, leading to persistent infections. Mechanical instrumentation alone is unable to completely eradicate the root canal system from bacteria. Therefore, some form of chemical irrigation and disinfection is necessary to optimally disinfect the root canal system. Calcium hydroxide has been commonly used as an intracanal medicament; however, it has been reported that it is not effective in disinfecting the root canal system associated with persistent endodontic infections. Various combinations of antibiotics have also been used and among them a mixture of ciprofloxacin, metronidazole, and minocycline has been shown to be very effective in eliminating endodontic pathogens *in vitro* and *in situ*.⁽¹³⁾

Orthograde root canal therapy should be the first option for treatment of all inflammatory periapical lesions which have 85% of success rate. Periapical surgery remains the last resort when orthograde treatment fails or is not possible. After a surgical procedure, healing usually occurs by repair or regeneration. Regeneration has been defined as the reproduction or reconstitution of a lost or injured part to restore the architecture and function of the periodontium. Repair is defined as healing of dead tissue at least partly by fibrous patching (replacement with scar tissue lacking functional capacity of whatever it replaces).

Regenerative surgery with the use of barrier membrane and graft material can support the formation of new tissue and allows for regenerative rehabilitation with functional reconstruction. The four critical factors that influence bone regeneration after the periapical surgery are primary wound closure, angiogenesis as a blood supply and source of undifferentiated mesenchymal cells, space maintenance, and stability of the wound (PASS principle).⁽¹⁴⁾

First introduced by **Whitman et al. in 1997**, the use of PRP in oral surgical procedures proved to enhance cellular proliferation but also carried potential risk due to generation of antibodies against factors V, XI, and thrombin, leading to coagulopathies that may endanger life. PRP was developed by Dohan *et al.* in 2001 and was classified as a second-generation platelet derivative. Unlike PRP, PRF strictly being an autologous fibrin matrix contains a large quantity of platelets and leukocytes with a simpler preparation technique that avoids artificial or exogenous biochemical modifications such as the use of anticoagulants or bovine thrombin or another jellifying agent. Platelet-rich fibrin (PRF) is coming up as a biological revolution in dental field which is an immune and platelet concentrate with specific composition, three-dimensional architecture, and associated biology that collects all the constituents of a blood sample to favour wound healing and immunity.^(8,14)

Dohan Ehrenfest *et al.* classified PRF into two types according to the leukocyte content:

1. Pure PRF or leukocyte-poor PRF
2. Leukocyte-rich PRF (also called advanced PRF or Choukroun's PRF).

The main component of PRF is high concentration of growth factors present in the platelets which are required for wound healing. Among the various growth factors, PRF contains PDGF, TGF- β 1 and β 2, IGF, epidermal growth factor (EGF), vascular EGF-, and fibroblast growth factors which are believed to play a major role in bone metabolism and potential regulation of cell proliferation. PDGF is an activator of collagenase which promotes the strength of healed tissue. TGF- β activates fibroblasts to form procollagen which deposits collagen within the wound. PRF facilitates healing by controlling the local inflammatory response.⁽⁸⁾

The treatments of these cysts are still under discussion and many professionals option for a conservative treatment by means of endodontic technique (Hoen,1990; Rees, 1997). However, in large lesions the endodontic treatment alone is not efficient and it should be associated to a decompression or a marsupialization or even to enucleation (Neaverth; Burg, 1982; Hoen Et Al.,1990; Rees, 1997; Danin 1999). The advantage of enucleation is the immediate rehabilitation resulting in fewer control appointments, which makes it a good choice for patients with poor compliance.

Disadvantages are the large defect and possible damages to adjacent structures owing to the surgical procedure. Another aspect is the higher risk of wound infection. In fact, even more aggressive lesions such as odontogenic keratocysts are more often being first treated with decompression and then further treated with enucleation when the lesion is smaller and lining epithelium thicker.⁽¹⁰⁾

The reported success rate for periapical surgery varies between 44% and 90%. Harty et al. (1970) found that the success rate of 1016 cases of apicoectomy was 90%. Oginni and Olusile concluded that the success rate of apicoectomy of anterior teeth was 71.9%. Peterson and Gutmann reported a success rate of 64%. 11-15 The reason for this great variation may be the lack of agreement on a definition of success and failure of surgery, the difference in the expertise of those who perform the operations, and the decision to operate or not to

operate on teeth with unfavorable prognosis. better case selection can be achieved through obtaining quality information pre-surgically using digital imaging, which helps establish a more accurate prognosis.⁽¹⁾

The success-failure criteria laid down by Strindberg is primarily a system designed to detect changes in radiographic appearance. The criteria for success are that: (a) the contours, width, and structure of the periodontal margin are normal; (b) the periodontal contours are widened mainly around the excess filling; and the criteria for failure are: (a) a decrease in the periradicular rarefaction; (b) unchanged periradicular rarefaction; (c) a appearance of new rarefaction or an increase in the initial rarefaction.⁽¹⁵⁾

The extent of radicular cyst can be studied by ultrasonography, Orthopantomogram, Computerised Tomography and Magnetic Resonance Imaging. In this scenario the cost-effective option of OPG was chosen which revealed the medial and lateral extent but for the antero posterior extent, a computerised tomography was necessary to show the extent in axial, coronal and saggital planes and was cost effective than MRI. Other advantages of CT are lesser distortion of images, physical densities of tissue can be differentiated based on Hedstorm units, no superimposition, no magnification, higher resolution.⁽¹²⁾

The ability of CBCT to display differences in attenuation is related to the ability of the detector to detect subtle contrast differences. This parameter is called the bit depth of the system and determines the number of shades of gray available to display the attenuation. CBCT unit uses detector capable of recording gray scale difference of 12 bit or higher. A 12-bit detector provides 212 or 4096 shades to display contrast. A 16-bit detector provides 216 or 65,536 shades of gray.⁽²⁾

CONCLUSION

This case report concluded that combined root canal and cyst enucleation method with retrograde filling using Biodentine and PRF graft placement proved the better result in radicular cyst with non-vital pulp. PRF is a healing biomaterial as it contains all the factors required for optimal wound healing. Previous research and clinical experience indicate

that PRF improves early wound closure, maturation of bone, and the final aesthetic result of the periodontal soft tissues. This successfully managed case scenario highlights that Computerized Tomography is an irreplaceable tool for diagnosing maxillofacial lesions for its advantages like cost effectiveness, short duration procedure, reproducibility and patient friendly and higher resolution than orthopantomogram.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Chowdhury D, Samanta S, Das A, Desai P, Das UK. Management of a large periapical pathology in maxillary anterior region with mineral trioxide aggregate using retrograde filling technique. *Management*. 2018 Mar;3(2).
2. Nasim A, Mohan RP, Nagaraju K, Malik SS, Goel S, Gupta S. Application of cone beam computed tomography gray scale values in the diagnosis of cysts and tumors. *Journal of Indian Academy of Oral Medicine and Radiology*. 2018 Jan 1;30(1):4.
3. Ziada S, Mohamed C, Tebbeb N, Ehsen A, Sana B, Najet A, Lotfi B. Multidisciplinary approach in management of large-infected periapical cyst. *Endodontology*. 2018 Jul 1;30(2):166.
4. Agarwal A, Singhal A, Vinayak V, Gurtu A, Sharma SM. Management of Radicular Cyst. *J Dent Sci Oral Rehab* 2015;6(3):151-155.
5. Singh C, Agarwal T, Gupta S. Surgical and supportive management of radicular cyst with palatal perforation: A case report. *International Journal of Applied Dental Sciences* 2017; 3(2): 224-227.
6. von Arx T. Apical surgery: A review of current techniques and outcome. *The Saudi dental journal*. 2011 Jan 1;23(1):9-15.
7. Dutta SR, Punga R, Varghese D, Bhalodia M. Surgical management of radicular cyst associated with maxillary central incisor. *Dent Impact* 2013; 5:58-61.
8. Maniyar N, Sarode GS, Sarode SC, Shah J. Platelet-Rich fibrin: A "wonder material" in advanced surgical dentistry. *Medical Journal of Dr. DY Patil Vidyapeeth*. 2018 Jul 1;11(4):287.
9. Byakod P, Shaikh S, Vora R, Aher U, Shah A, Mota I. Management of Infected Radicular Cyst by Surgical Approach using Bone Graft as an Adjunct. *Pravara Medical Review*. 2014 Dec 1;6(4).
10. Thomas G, Kuttappa M, Govind GK. Management of a large periapical cyst (apical matrix & surgical complications)-A case report. *President's Message* 4:84.
11. Varghese LJ, Haridas AK, Mubasheer M, Kurian SD, Naveen OP, Peter CD. Surgical and Non-surgical Intervention for the Management of Radicular Cyst – A Comparative Study. *Int J Oral Care Res* 2018;6(2):8-12.
12. Kumar ND, Sherubin JE, Jose M, Swaminathan C (2017) Surgical Management of Large Radicular Cyst in Mandible. *Int J Dent Oral Health* 3(3).
13. Dhillon JS, Amita SK, Bedi HS, Ratol SS, Gill B. Healing of a large periapical lesion using triple antibiotic paste and intracanal aspiration in nonsurgical endodontic retreatment. *Indian journal of dentistry*. 2014 Jul;5(3):161.
14. Prasanthi NN, Chittem J, Simpsy GS, Sajjan GS. Surgical management of a large inflammatory periapical lesion with platelet-rich fibrin. *Journal of Interdisciplinary Dentistry*. 2017 May 1;7(2):76.
15. Fernandes M, de Ataíde I. Nonsurgical management of periapical lesions. *Journal of conservative dentistry: JCD*. 2010 Oct;13(4):240.