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Apexification and Laser Carbonization of a Periapical Cyst: A Novel Interdisciplinary Approach

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Abstract: ***Periapical cyst is the most common odontogenic cystic lesion of inflammatory origin. It is also known as radicular cyst, apical periodontal cyst, root end cyst, or dental cyst. It arises from epithelial residues in the periodontal ligament as a result of inflammation. This condition is usually asymptomatic but can result in a slow-growth tumefaction in the affected region. Radiographically, the archetypal description of the lesion is a round or oval, well circumscribed radiolucent image involving the apex of the infected tooth. In the management of these lesions the endodontic treatment only is not sufficient and it should be associated with surgical management. This paper presents a case of endodontics cum surgical management of large radicular cyst in the maxillary anterior region.***

Keywords: apexification, laser, mineral trioxide aggregate, periapical cyst, surgical decompression

1. Introduction

Radicular Cysts are thought to be formed from epithelial cell rests of Malassez (ERM), which are remnants of Hertwig's epithelial root sheath, present within the periodontal ligament. Proliferation of these epithelial cell rests is frequently associated with stimuli from periapical periodontal inflammation secondary to pulpitis.[1] During periapical inflammation, host cells in the periapical tissues release many inflammatory mediators, proinflammatory cytokines, and growth factors which induce proliferation of the ERM in all directions to form a three-dimensional ball mass.[2,3] As the epithelial mass grows, the central cells move further away from their source of nutrition and undergo necrosis and liquefaction degeneration, forming central cystic cavity lined by epithelial wall.[4,5]

Following its formation, radicular cysts grow by periapical bone resorption mediated by prostaglandins and cytokines.[6] It is interesting to note that most inflammatory mediators which induce proliferation of epithelial cell rests also mediate bone resorption in inflammatory periapical lesion.[7-9] Smaller periapical cysts can often be treated conservatively by nonsurgical endodontic therapy.[10]

Proper endodontic therapy of the involved teeth removes irritants in the canals by chemo-mechanical instrumentation.[9] As the root canal is completely sealed, all cell components participating in inflammatory reaction gradually resolve.[10] Most common location is apices of involved non-vital tooth, however other times it may be present on the lateral aspect of the root. These cysts can be seen at any age and can occur in periapical area of any teeth.[11] Shear[12] reported that they have particularly high incidence in the maxillary anterior region with male predilection. Non-surgical endodontic therapy is the first line treatment for the management of these lesions.[10] Oztan and Kalaskar et al.,[13] have confirmed that large periapical lesions including cysts can respond favourably to nonsurgical treatment using calcium hydroxide paste.[14] But when root canal treatment is either not possible or fails, periapical surgery can be considered as a predictable option.[12] This case describes the treatment of periapical cyst with an endodontic approach involving apexification with Mineral trioxide aggregate to save the tooth and surgical approach involving the use of CO_2 laser rather than conventional approach to prevent recurrence of lesion.

2. Case Report

A 31 years old male patient reported to the department of Oral Medicine and Radiology, M.A. Rangoonwala dental college and hospital, Pune with the chief complaint of pain and pus discharge in upper right front region of jaw since one and a half month. He gave a history of pus discharge and trauma history for which no treatment was sought. Intraoral investigation revealed Anderson class 1 and discolouration with 11 **as shown in figure 1.** Tenderness on percussion was positive, also the vitality tests gave a negative response.

Figure 1: Discolouration of the affected tooth

An Intra Oral Periapical radiograph (IOPA) was taken in relation to 11 which revealed large well-defined periapical radiolucency sorrounding the apex of the affected tooth and approaching the nasal floor **as shown in figure 2.**

Figure 2: Preoperative IOPA in relation to 11

Patient was subjected to CT scan for further exploration of the finding, to check for proximity or any involvement of lesion with nasal floor, since lesion was extensive. CT showed that the nasal floor was intact and the radiolucency was seen in relation with 11 in axial, sagittal and coronal sections **as shown in figure 3 (a), (b) and (c).** On the basis of clinical, radiological examination, a provisional diagnosis of Periapical abscess was made. Differential diagnosis included Nasopalatine cyst, Median palatal cyst, Traumatic bone cyst, and globulomaxillary cyst. On FNAC, about 0.8 ml of straw coloured, shimmering fluid, serous in consistency was aspirated and sent for cytological examination and a final diagnosis of Radicular cyst was made.

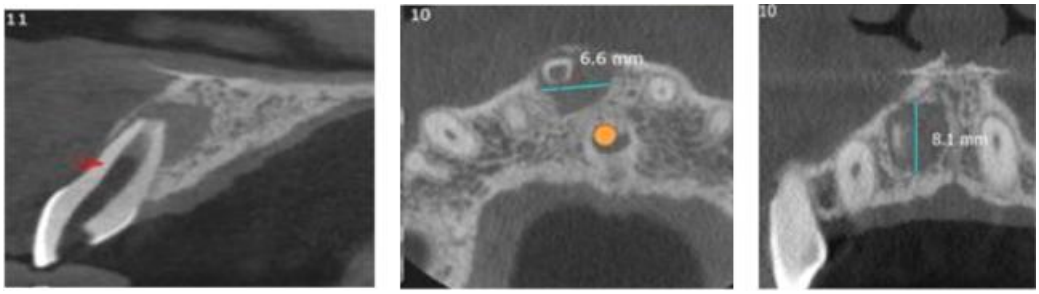

Figure 3: CT scan images of lesion at: (a) sagittal (b) axial and (c) coronal sections

An endodontic Treatment plan was formulated and after explaining it to the patient, his informed consent was taken. Surgical Treatment plan was decided upon considering that there was a breach in the buccal cortical plate as per assessment on CBCT. Root canal opening with 11 was done under rubber dam application. Pus discharge was seen with 11 after access opening. After determination of working length and biomechanical preparation was done and multiple calcium hydroxide dressings were given, however the patient complained of pain even after one month after which a surgical intervention was planned and Mineral Trioxide Aggregate (MTA) Apexification was done. A wet cotton pellet was placed in the chamber and then, in next appointment, obturation was completed. Tooth 11 with open apex was managed by using lateral condensation technique.

In the present case, endodontic treatment was carried out in multiple visits with Mineral Trioxide Aggregate. The use of root canal dressings between sessions in root canal treatment of teeth with chronic periapical lesions is important for reducing levels of bacteria better than that obtained with mechanical preparation, particularly by penetration of areas that are unreachable by instruments or irrigation solutions, such as dentinal tubules and ramifications. MTA has also shown clinical efficiency in reducing exudate due to its hygroscopic properties. Calcium Hydroxide intracanal medicament created a more favourable environment leading to healing of periapical lesion in the right central incisor which was obturated by lateral condensation using resin based sealer and gutta percha before the surgery **as shown in figure 4 (a) – (g).**

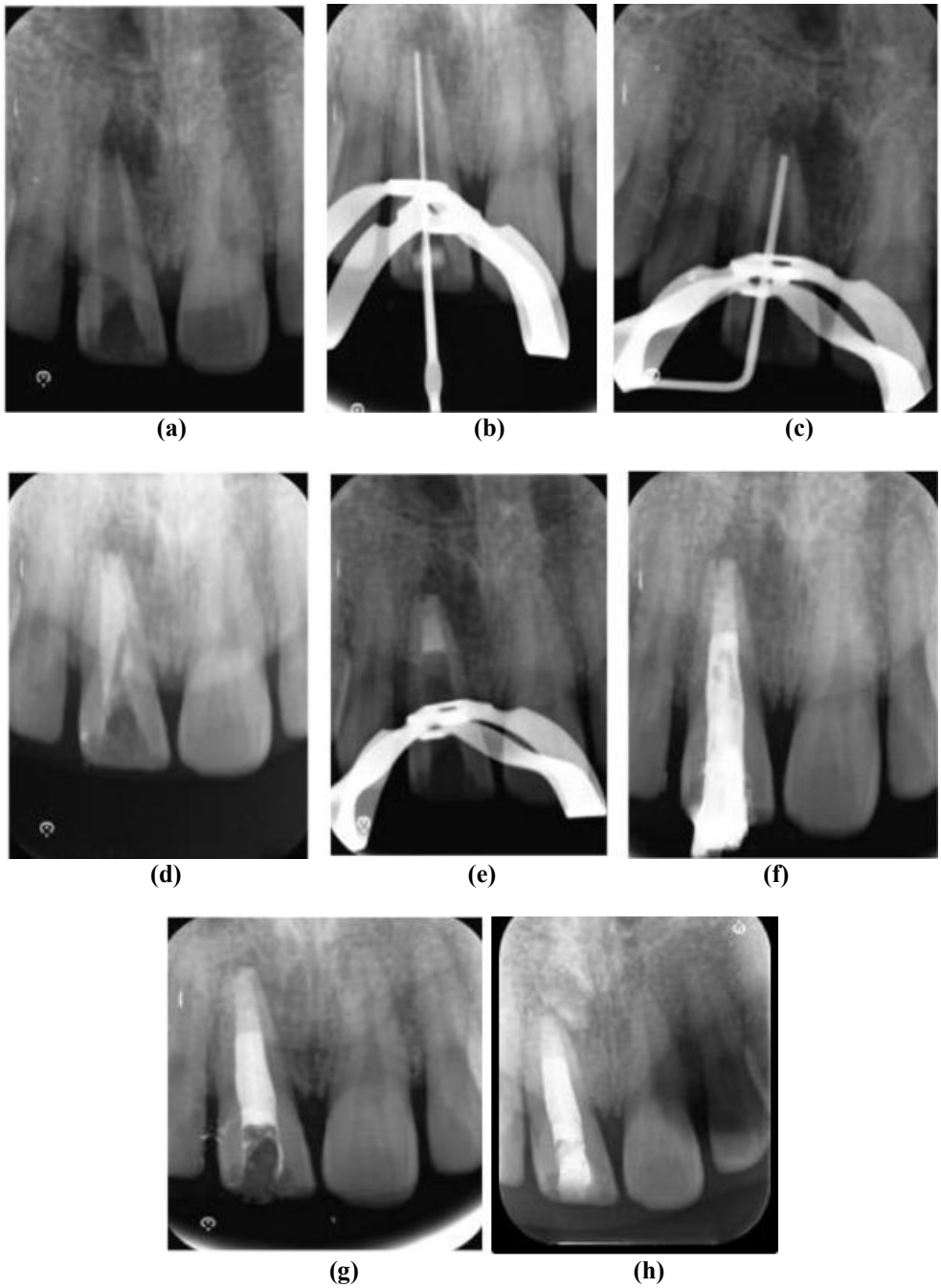

Figure 4: Endodontic treatment stages: a) preoperative status, b) working length determination, c) plugger fit, d) incremental placement of MTA, e) 4 mm apical plug of MTA with clean borders and minimal extrusion, f) Pre-shearing radiograph to check for any lateral space in canal, g) post-operative status (h) 1 year follow up

Patient was prepared for surgery **as shown in figure 5 (a) – (g)** in next visit, bilateral infraorbital and nasopalatine nerve block was given with lignocaine with 1:80,000 adrenaline. After administration of local anaesthesia, crevicular incision was made in labial region **as shown in figure 5. (a)** and a full thickness mucoperiosteal flap was raised from 11 (Upper Maxillary right Central Incisor) to 12 (Upper Maxillary right lateral Incisor **figure 5. (b)**. On flap reflection the cystic lesion was evident **figure 5. (c)** at the apical end of 11 along with dehiscence along the length of the root. Cystic enucleation was done ablated by laser **figure 5. (d)** and the cystic cavity was then filled with plasma rich fibrin (PRF) **figure 5. (e)** and the area was sutured. With our best surgical technique and experience cyst was completely removed. Post-operative instructions were given to the patient and patient was kept on antibiotics and analgesics. Patient was kept under observation for the healing of the cystic space for 1 month **figure 5. (f) and (g).**

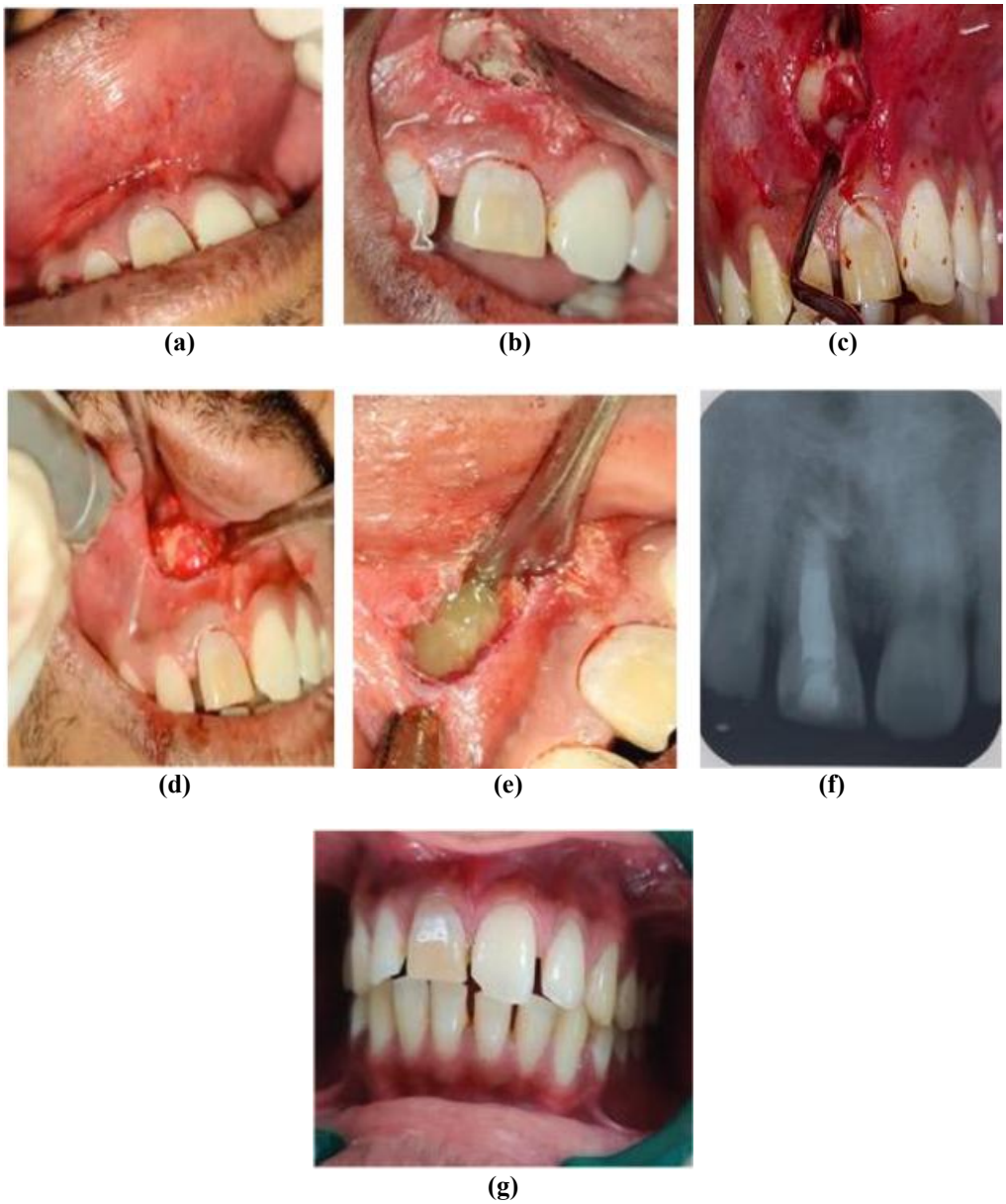

Figure 5: Surgical treatment phases: a) crevicular incision was made in labial region, b) raising of mucoperiosteal flap, c) evidence of cystic lesion, d) cystic enucleation ablated by laser, e) PRF placement in cystic cavity, f) post-operative IOPA at follow up, g) post-operative extraoral appearance

3. Discussion

The term, 'cyst' is derived from the Greek word, 'Kystis', meaning, 'sac or bladder'.[1] Cyst is defined as a pathological cavity that is usually lined by epithelium and which has a centrifugal, expansive mode of growth.[2] The periapical cyst is the most common odontogenic cyst (52.3-70.7 percent) followed by the dentigerous cyst (16.6-21.3 percent) and odontogenic keratocyst (5.4 - 17.4 percent).[3] The choice of treatment may be determined by factors such as the extension of the lesion, relation with noble structures, evolution, origin, clinical characteristic of the lesion systemic condition and cooperation of the patient.[4]

The treatment of these cysts is still under discussion and many professionals opt for a conservative treatment by means of an endodontic technique.[5] However, in large lesions the endodontic treatment alone is not sufficient and it should be associated with decompression or marsupialisation or enucleation.[6]

In the present case, endodontic treatment was carried out in multiple visits with mineral trioxide aggregate (MTA) dressings[7]. The use of root canal dressings between sessions in root canal treatment of teeth with chronic periapical lesions is important for reducing levels of bacteria better than that obtained with mechanical preparation, particularly by penetration of areas that are unreachable by instruments or irrigation solutions, such as dentinal tubules and ramifications. MTA has also shown clinical efficiency in reducing exudate due to its hygroscopic properties.[8]

MTA medicaments created a more favourable environment leading to healing of periapical lesion in the affected region which was obturated by lateral condensation using zinc oxide eugenol sealer and gutta percha before the surgery. The periapical lesion, however, did not respond to the intracanal medicament because of the causative factor being located beyond the root canal system, viz., within the inflamed periapical tissue, thus requiring surgical intervention. After the surgery a plan for long term treatment of 11 with

intracanal medicament was made. At the end of follow-up, patient was free from all symptoms and signs with optimum tissue healing. Radiographic examination revealed a decrease in the size of periapical radiolucency bilaterally. Tooth 11 was obturated using inverted cone technique and lateral condensation of gutta percha with zinc oxide eugenol sealer. A definite apical stop could be felt at the end of canal during obturation.

By filling the canal with MTA, a physical barrier was created that prevents migration of multipotent undifferentiated mesenchymal cells into the canal and regeneration of tissues at the lateral dentinal walls.[9] Moreover, use of MTA medicaments for apexification is cost effective when compared to other materials like calcium hydroxide.[10]

Radicular cysts are inflammatory lesions leading to bone resorption and can reach great dimensions and become symptomatic when infected or with great size due to nerve compression[10,11] enucleation whereas most of others go for conservative endodontic technique.[12] However case selection for endodontic technique is limited to smaller cysts only and for bigger size cyst decompression, marsupialisation or even enucleation is advocated.[13,14] The advantage of enucleation is the immediate rehabilitation resulting in fewer control appointments, which makes it a good choice for patients with poor compliance.[15] 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.[16,17]

4. Conclusion

The clinical case reported was managed successfully by endodontic therapy with emphasis on thorough debridement and disinfection of the root canal system which was followed by surgery. The authors recommend non-surgical management of large periapical lesions in view of clinical evidence present followed by surgical approach. However, in specific situations where the size and extent of the lesion is of critical importance, surgery is a viable option with good prognosis. An endodontist and an oral surgeon should have thorough knowledge about materials and various treatment options involved in management of such a case.

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