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Surgical Treatment of Odontogenic Periapical Lesions

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1. Introduction

Periradicular surgical practise is done for the treatment or prevention of periradicular pathologies. Abscess drainage, periapical surgery, corrective surgery, intentional replantation, and root removal are the most commonly performed types of periradicular surgery. Conventional endodontic treatment is generally a successful procedure; however, in 10% to 15% of cases the symptoms can persist or spontaneously recur. Findings such as a draining fistula, pain on mastication, or the incidental noting of a radiolucency increasing in size indicate problems with the initial endodontic procedure. Surgery then becomes a an important part of treatment in such cases. A decision on whether to approach the case surgically or to consider orthograde (through the coronal portion of the tooth) endodontic retreatment is dictated by various clinical and anatomic situations. Apicoectomy, apical surgery, endodontic surgery, root resection, root amputation are the terms which are used for surgery involving the root apex to treat the apical infection. It is the cutting off of the apical portion of the root and curettage of periapical necrotic, granulomatous, inflammatory or cystic lesions. In spite of adequate endodontic treatment, if periapical lesions are not resolved, then apical surgery is taken to consideration.

2. Indications

- Apical anomaly of root that blocks appropriate root canal therapy
- Presence of lateral/accessory canal/apical region perforations
- Roots with broken instruments/overfillings

- Fracture of apical third of the root
- Formation of periapical granuloma or odontogenic cyst related with apex
- Draining sinus tract/nonresponsive to RCT
- Extension of root canal sealant cement/filling beyond the apex

3. Contraindications

- Presence of systemic diseases—leukaemia, uncontrolled diabetes, anaemia, thyrotoxicosis, etc.
- Teeth damaged beyond restoration
- Teeth with deep periodontal pockets and grade III mobility
- Traumatic occlusion
- Poor root crown ratio
- Acute infection which is nonresponsive to the treatment
- Anatomic structures (e.g., adjacent nerves and vessels)
- Structures interfere with access and visibility

4. Assessment for surgical procedures

The basic purpose of periapical surgery can be determined as follows:

- Elimination of disease
- Prevention of disease
- Removal of damaged or redundant tissue
- Improvement of function and esthetics.

In order to achieve these goals, following principles have to be estimated:

Preoperatively;

- Developing a surgical diagnosis

Intraoperatively;

- Aseptic technique
- Flap design
- Tissue handling

- Haemostasis
- Dead space management
- Decontamination and debridement
- Suturing

Post operatively;

- Oedema control
- Infection control
- Patient's general health and nutrition
- Follow-up.

5. Incision and flap design

Surgical access is a compromise between the need for visibility of the surgical site and the potential damage to adjacent structures. A properly designed and carefully reflected flap results in good access and uncomplicated healing. Although several possibilities exist, the three most common incisions are

- Submarginal curved (i.e., semilunar) (fig:1)
- Submarginal, and full mucoperiosteal (i. e., sulcular) (fig:2)
- Submarginal and full mucoperiosteal incision has a three-corner (i.e., triangular, trapezoidal, rectangular).(fig:3)

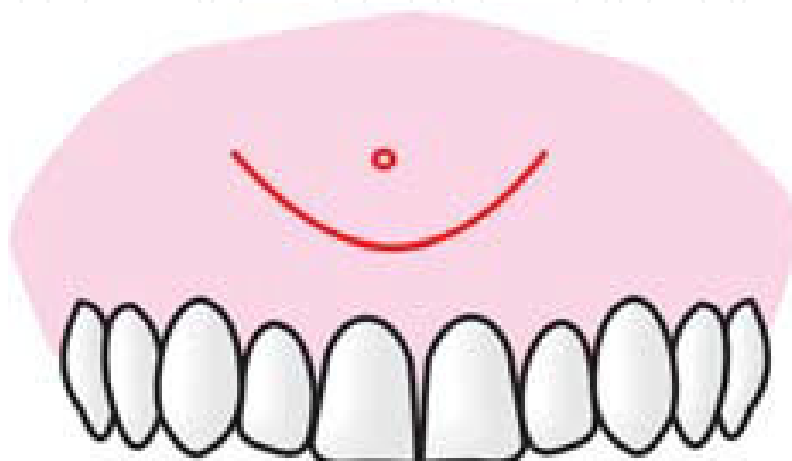


Figure 1. Semilunar incision

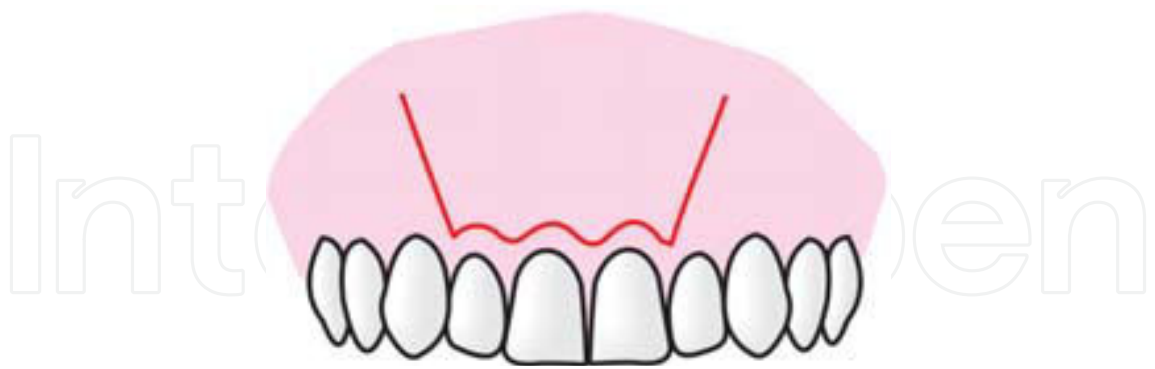


Figure 2. Submarginal incision

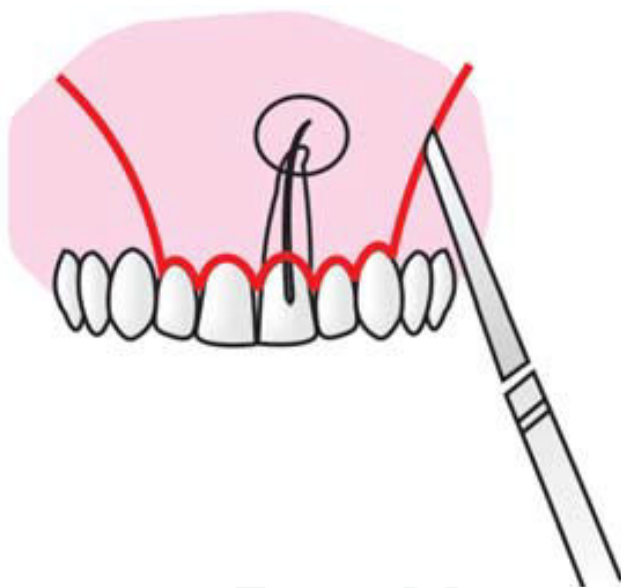


Figure 3. Full mucoperiosteal incision

6. Semilunar incision

Despite the commonly use of semilunar incision among practitioners, it's limitations and potential complications should be considered deply before surgery. Semilunar incision

is a slightly curved half-moon horizontal incision in the alveolar mucosa. Although the location allows easy reflection and quick access to the periradicular structures, it limits the clinician in providing full evaluation of the root surface. The incision is based primarily in the unattached or alveolar mucosa, which heal more slowly with a greater chance of dehiscence than a flap based primarily in attached or keratinized tissue. In addition, the flap design carries the flap

over the inflamed surgical site, and this inflamed mucosa is at a high risk of breakdown. Other disadvantages to this incision include excessive hemorrhage, delayed healing, and scarring; this design is therefore contraindicated for most endodontic surgery.

7. Submarginal incision

The horizontal component of the submarginal incision is in attached gingiva with one or two accompanying vertical incisions. Generally, the incision is scalloped in the horizontal line, with obtuse angles at the corners. The incision is used most successfully in the maxillary anterior region or, occasionally, with maxillary premolars with crowns. Because of the design, prerequisites are at least 4 mm of attached gingiva and good periodontal health. The major advantage is esthetics. Leaving the gingiva intact around the margins of crowns is less likely to result in bone resorption with tissue recession and crown margin exposure. Compared with the semilunar incision, the submarginal provides less risk of incising over a bony defect and provides better access and visibility. Disadvantages include hemorrhage along the cut margins into the surgical site and occasional healing by scarring, compared with the full mucoperiosteal sulcular incision.

8. Full mucoperiosteal incision

The full mucoperiosteal incision is made into the gingival sulcus, extending to the gingival crest. This procedure includes elevation of interdental papilla, free gingival margin, attached gingiva, and alveolar mucosa. One or two vertical relaxing incisions may be used, creating a triangular or rectangular design.

The full mucoperiosteal design is preferred over the other two techniques. The advantages include maximum access and visibility, not incising over the lesion or bony defect, fewer tendencies for hemorrhage, complete visibility of the root, allowance of root planing and bone contouring, and reduced likelihood of healing with scar formation. The disadvantages are that the flap is more difficult to replace and to suture; also, gingival recession can develop if the flap is not reapproximated well, exposing crown margins or cervical root surfaces.

9. Periapical exposure

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. With a limited bony opening, radiographs are used in conjunction with root and bone topography to locate the apex. Regardless of the handpiece used, there should be copious irrigation with a syringe or through the

handpiece with sterile saline solution. Enough overlying bone should be removed to expose the area around the apex and at least half the length of the root. Good access and visibility are important; the bony window must be adequate. The clinician should not be concerned about the bone removal because once the infection resolves, the bone will reform. The exposure of the root is done before resecting the root to avoid the potential of blending the root in with the bone and losing surgical orientation. This is especially critical in the mandible where the bone is dense. Lower incisor roots are carefully exposed because the proximity with adjacent teeth could lead to treatment of the wrong apex. Fig:4



Figure 4. Periapical exposure

10. Curettage

Granulomatous, inflamed tissue around the periradicular area should be removed to gain access and visibility of the apex, to obtain a biopsy for histologic examination (when indicated), and to minimize hemorrhage. If possible, the tissue should be enucleated with a suitably sized sharp curette. Fig:5

11. Root end resection/preperition/restoration

Apical third of the root is most likely the most difficult part to obturate properly. Presence of accessory canals increases at the apex as well, which may have not been initially cleaned and

debrided, thereby leaving a source of continued infection. In general, approximately 2 to 3 mm of the root is resected more if necessary for apical access or if an instrument is lodged in the apical region; less if too much removal would further compromise stability of an already short root. Fig:5



Figure 5. Root resection

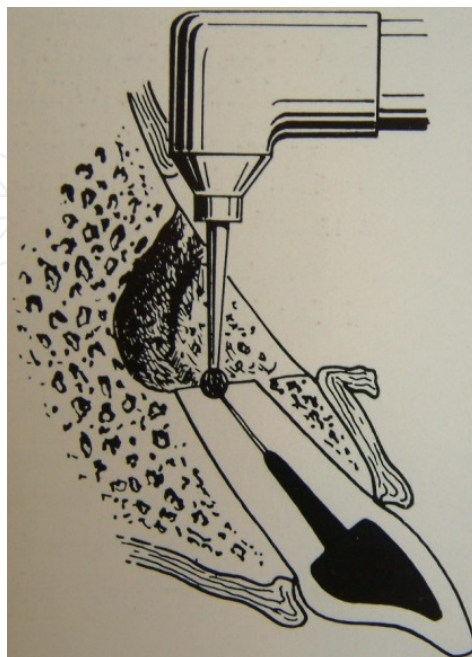


Figure 6. Root preparation for retrograd filling**Figure 7.** Suturing after retrograd filling

An angled micro handpiece and micro round bur or ultrasonic tip can be used for retropreparation. The bur or tip is placed at the apical opening of the canal and guided gently deeper into the canal as it cuts. Once the retropreparation is completed the prepared cavity is inspected. The gutta-percha at the base is recondensed with small 0.5 mm microplugger (Fig:6). After that root end filling material can be applied. The aim of placing root end filling material is to establish an apical seal that inhibits the leakage of residual irritants from the root canal into the surrounding tissues (Fig:7).

12. Flap replacement and suturing

After finishing surgical procedures the flap is returned to its original position and is held with moderate digital pressure and moistened gauze. Primary closure of the elevated flap is gained by basic or interrupted sutures. Absorbable monofilament or sling suture material is commonly used. After suturing, the flap should again be compressed digitally with moistened gauze for several minutes to express more hemorrhage. This limits postoperative swelling and promotes more rapid healing and adequate positioning of the flap.

13. Postoperative care

Oral and written information should be supplied in simple, straightforward language. Patient should be informed about the procedure and what is coming next. A chart like the one below can be prepared and given to patient.

- Do not raise the lip to look at the suture.
- Place an icepack on the outside of the face 20 min. out of every 1½ hour for the first day of surgery
- Instruct to do salt water or chlorhexidine rinsing 3 times daily preferably after meal.
- Do not chew any hard food with the tooth for 1 week.
- Do not brush in the area of surgery for 1 week.
- Maintain good oral hygiene.
- Soft diet is suggested for the first 4 days.

14. Complications

Damage to the anatomic structures, bleeding, splattering of retrograd filling material at the operation site, incomplete root resection and curettage process, inadequate flap closure, healing problems of soft tissue, scar formation are the most common complications that may occur should be considered during and after the surgical procedure.

15. Prognosis

Healing capacity of involved tissues after periapical surgery is considered as good. Under the conditions that the diagnosis and treatment planning is held carefully and the intraoperative procedures achieved successfully most of the cases reveals long term uneventful follow up.

16. Sample cases

16.1. Case 1

The patient applied to our clinic with the complaint of swelling at right maxillary buccal area. Via radiographic and clinical examination, an intrabony lesion was observed between right maxillary lateral and first molar tooth apices about 5x2 cm in size. All teeth related to lesion were devital. An aspiration biopsy performed and characteristic yellowish fluid which

has cholesterol crystals in it was gained which lead us to define the lesion as a radicular cyst due to necrotic pulp tissues.

Treatment plan was to have endodontic treatment after that to enucleate the cyst totally, achieve apicoectomies to all related teeth apices and reconstruct the intrabony defect by cancellous-bone grafts and membranes. We received postoperative antibiotic therapy per os (amoxicillin 875 mg+clavulanate 125 mg 2x1) for ten days. Defect area started to fill with healing tissue from the base of the cavity and the complaints of the patient disappeared considerably.

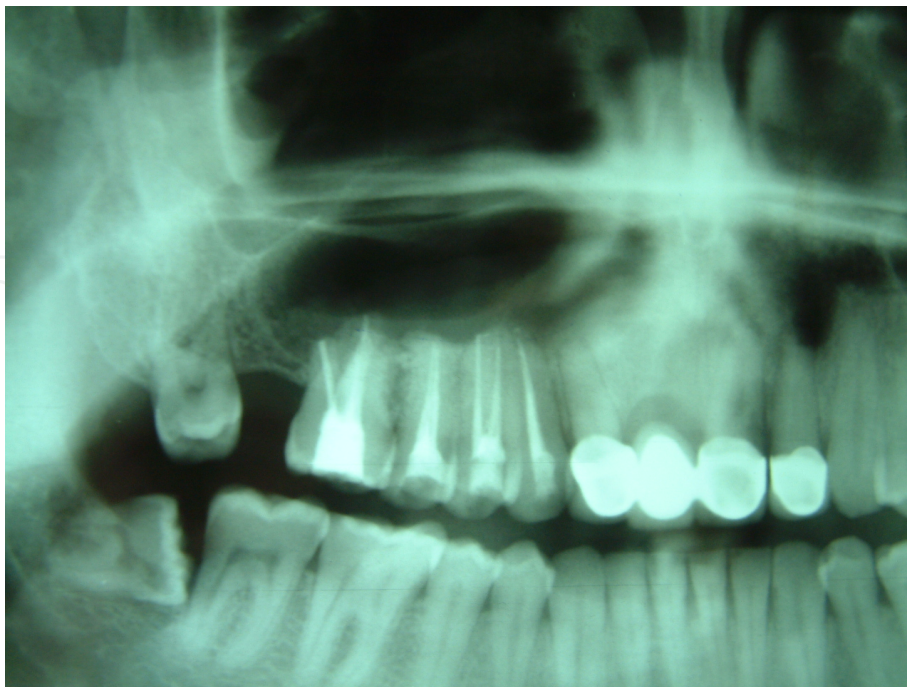


Figure 8. OPTG view before surgery



Figure 9. Incision

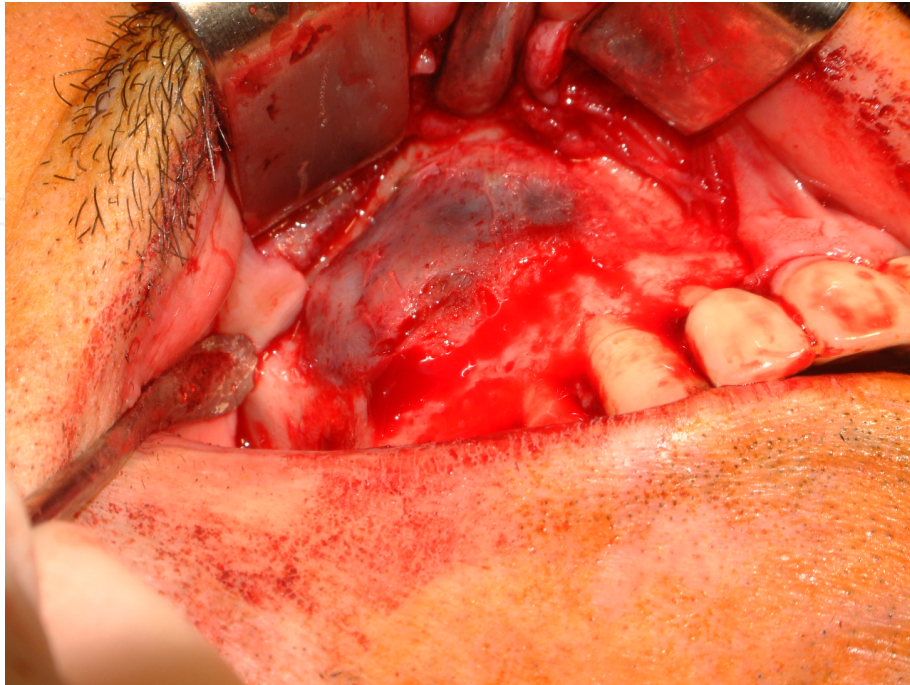


Figure 10. Exposure of Cystic Lesion

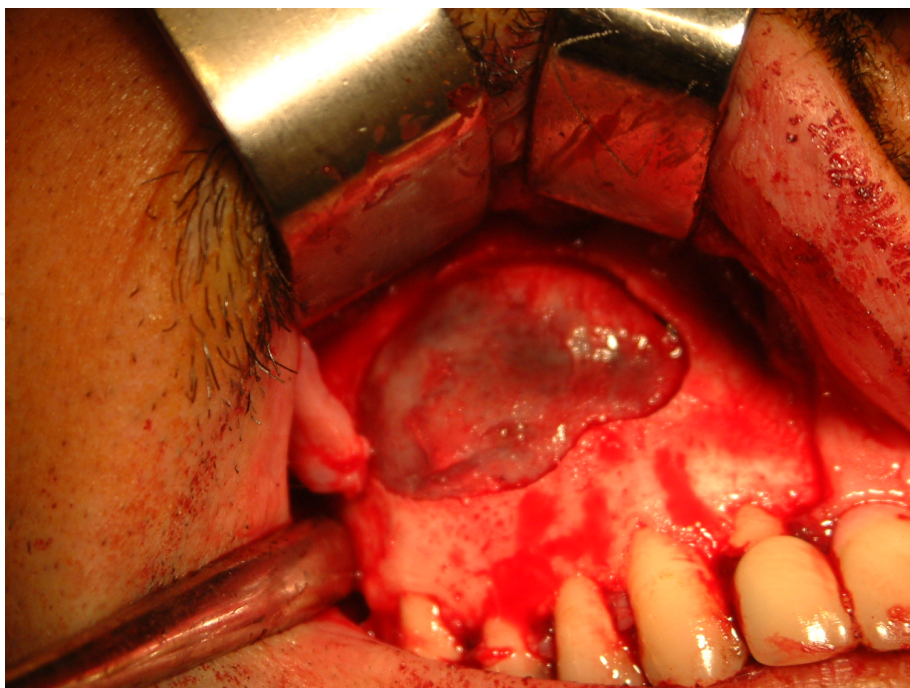


Figure 11. Elevation of Cyst Epithelium

16.2. Case 2

A 43-year-old female patient referred to our clinic with incidental OPTG examination finding of a homogenous radiolucent, sharply lined lesion located between canine teeth in anterior maxilla. On clinical examination, oral mucosa was intact and there was no evidence of bony expansion on both buccal and palatal sides. Pulp vitality testing was performed for all maxillary anterior teeth, 12 and 22 were found to be non-vital. With an initial diagnosis of inflammatory dentigerous cyst, enucleation of the lesion was planned. Prior to surgery, endodontic treatment of all involved teeth were completed. On surgical exploration, there was no expanded buccal bone was observed. After reaching the cyst capsule and performing resection of the involved roots, two separate cystic cavities extending palatally behind the roots that have been separated on the midline with a bony septa were encountered. Lesions were totally enucleated and submitted to histopathological examination. Result of histopathological examination was fibrotic capsule with medium degree of mononuclear cell infiltration, hyperplastic stratified squamous epithelium. In the postoperative period, healing was uneventful.



Figure 12. Cystic cavity



Figure 13. Graft material



Figure 14. Application of collagen membrane



Figure 15. Adaptation of flap



Figure 16. Primary closure of area



Figure 17. OPTG view



Figure 18. CT image

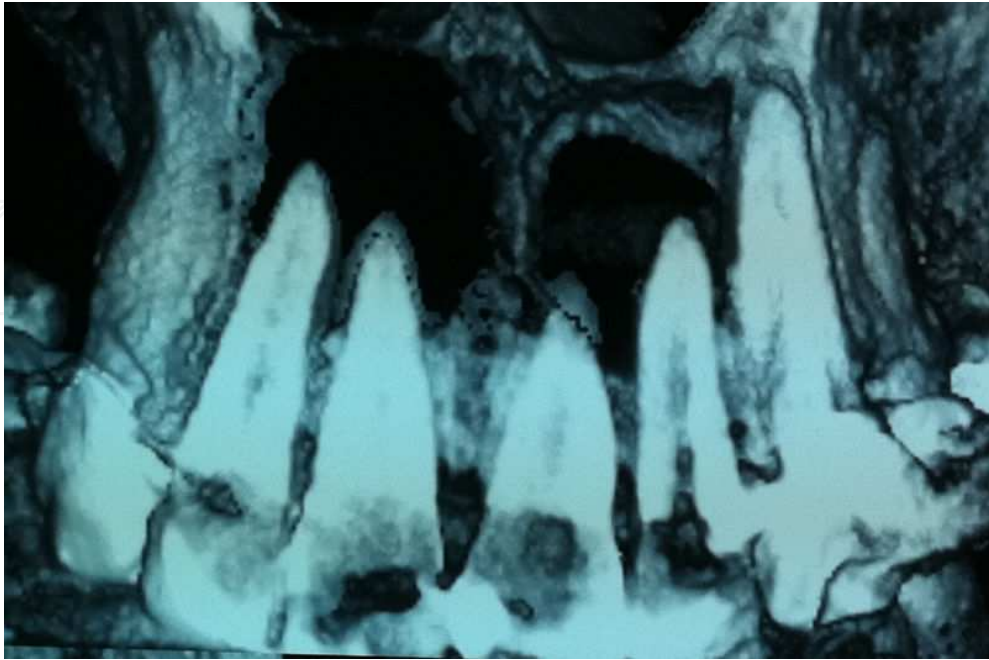


Figure 19. CT image

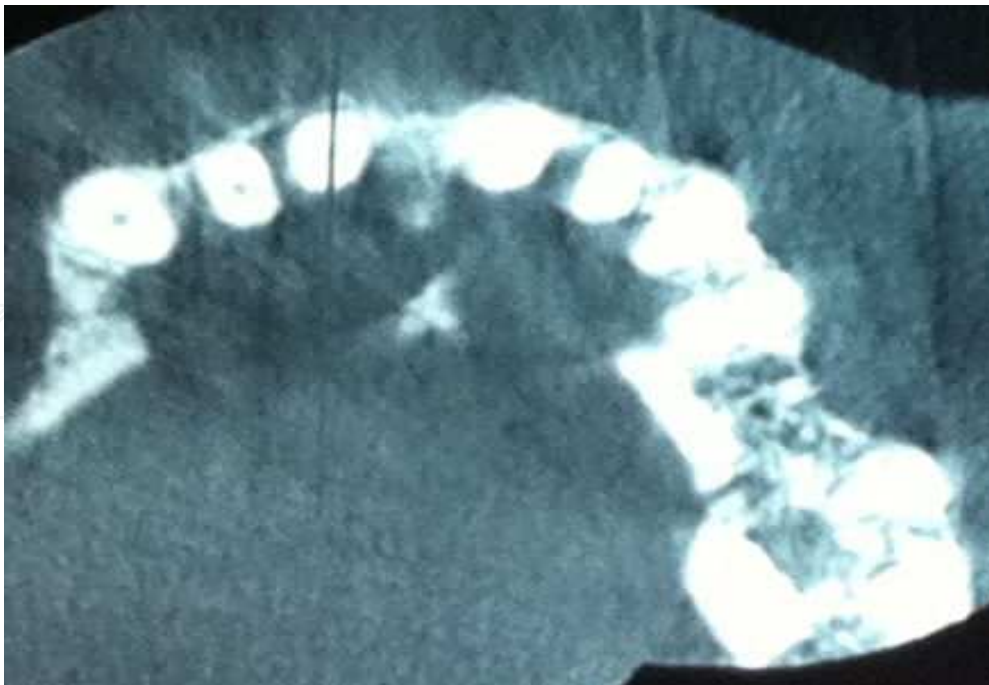


Figure 20. CT image

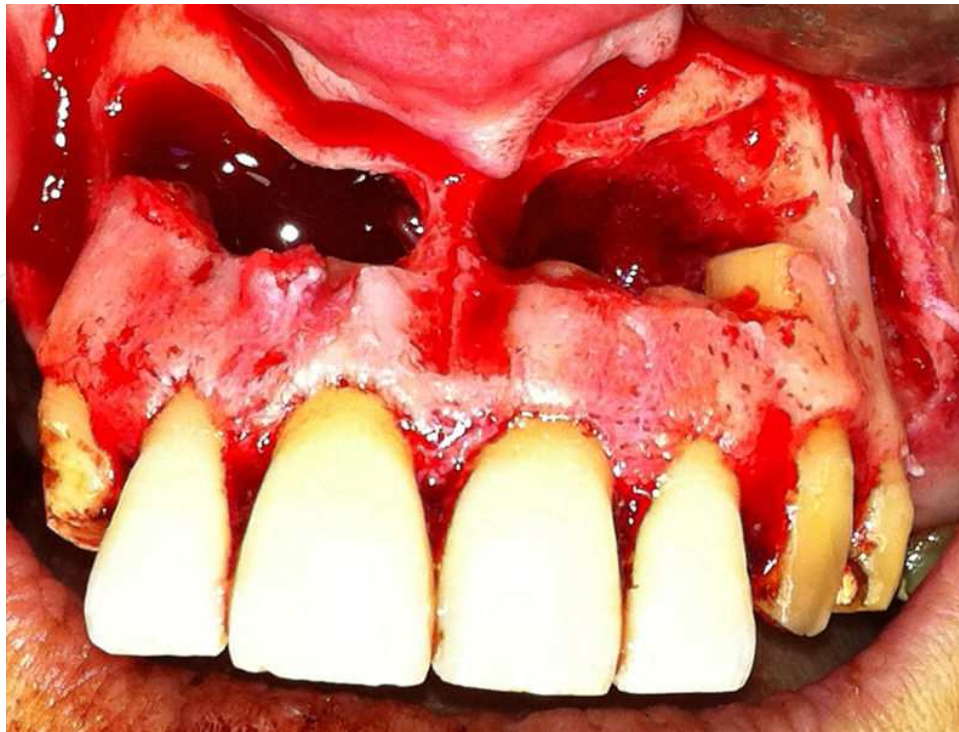


Figure 21. Cystic cavity

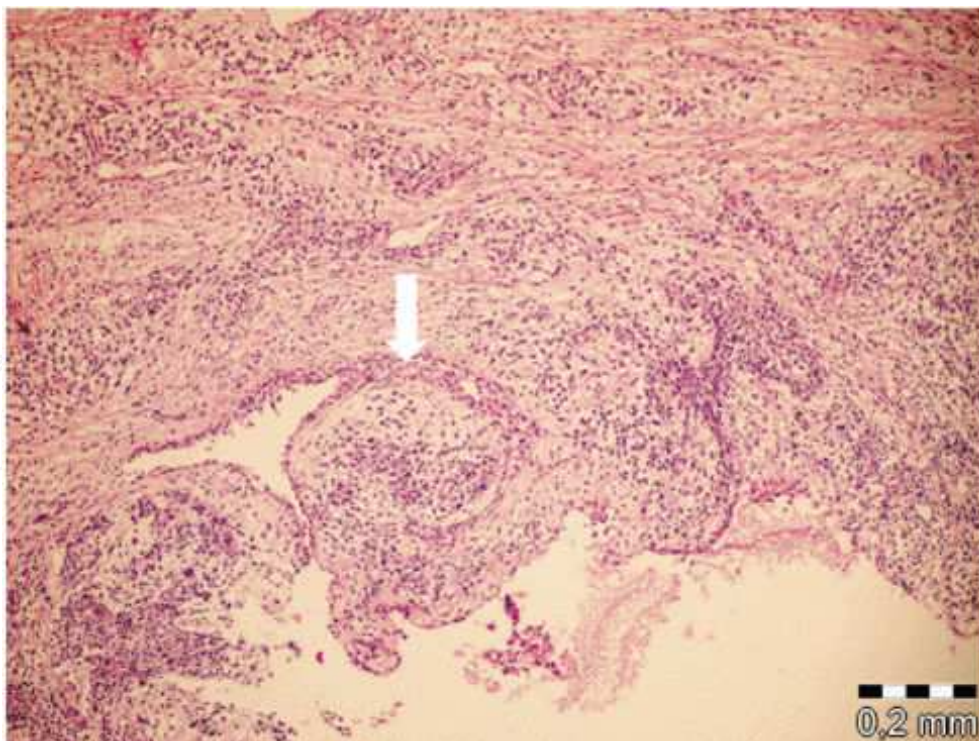


Figure 22. Histopathologic evaluation

16.3. Case 3

36-year-old female patient admitted to our clinic with complaints of pain. Clinical and radiographic examination revealed a demarcated radiolucent lesion at the apexes of the teeth no: 25, 26, 27. An electrical vitality test examination related to the teeth 24, 25 and 27 was performed which found that teeth are non-vital, and these findings suggest that lesion was caused by non vital pulp tissues of related teeth. CT results showed that maxillary sinus bone compact and buccal cortex were perforated elevated and sinus floor was elevated by the lesion. After completion of endodontic treatment of related teeth patient have been operated under intravenous conscious sedation. During the operation, primarily by aspiration of cyst fluid pressure is reduced and the 2,3x2x1 cm sized radicular cyst was enucleated. Apical resections of relevant teeth were performed an operation region was primarily closed by 3.0 silk suture. Enucleated lesion was sent to histopathologic examination for definitive diagnosis sent for and diagnosis was confirmed as periradicular cyst epithelium.



Figure 23. OPTG view

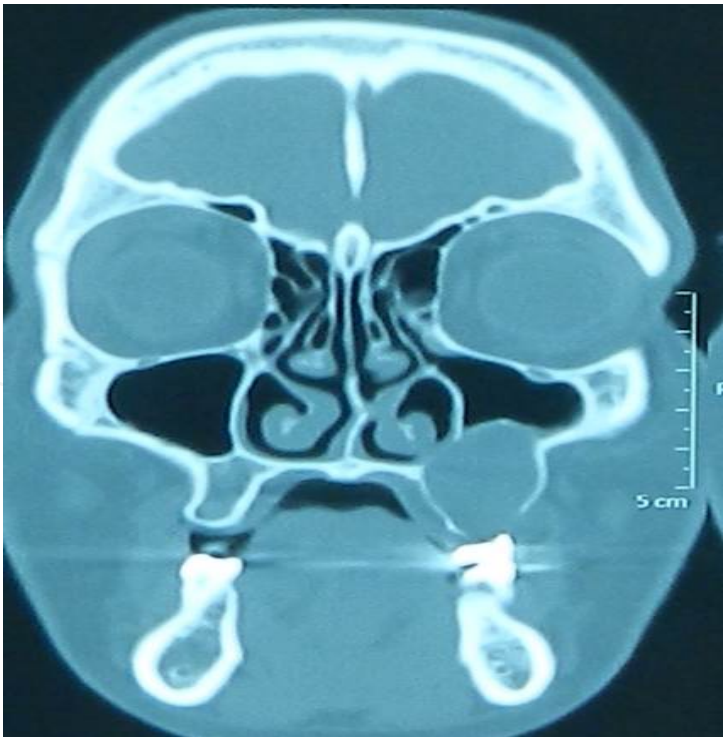


Figure 24. CT image



Figure 25. CT image



Figure 26. Exposure of lesion area

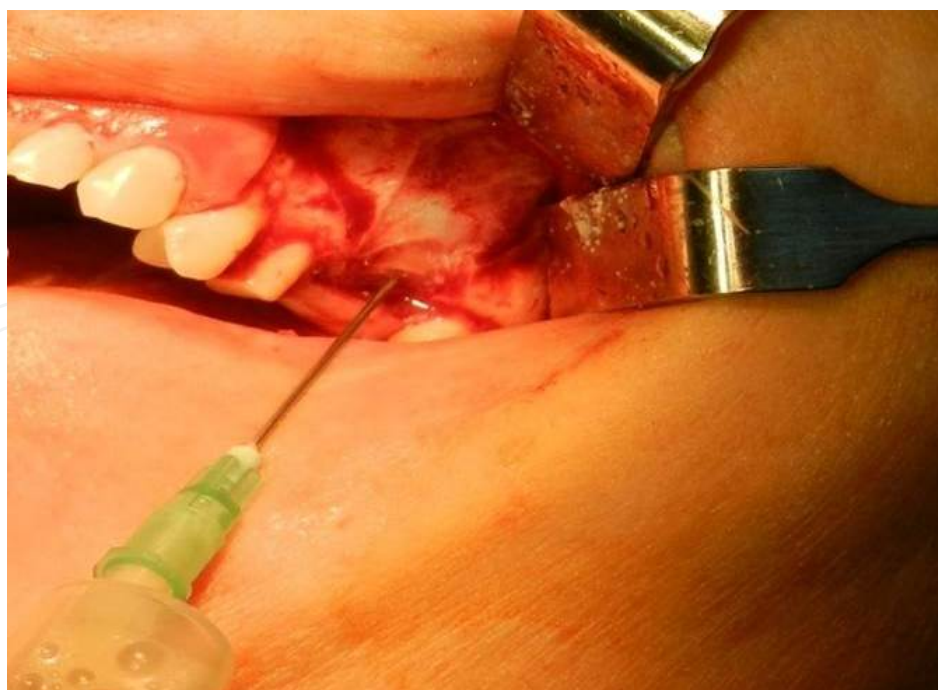


Figure 27. Aspiration of cystic liquid



Figure 28. Enucleation of cyst epithelium



Figure 29. Cyst epithelium



Figure 30. Cystic cavity



Figure 31. Primary closure of lesion area

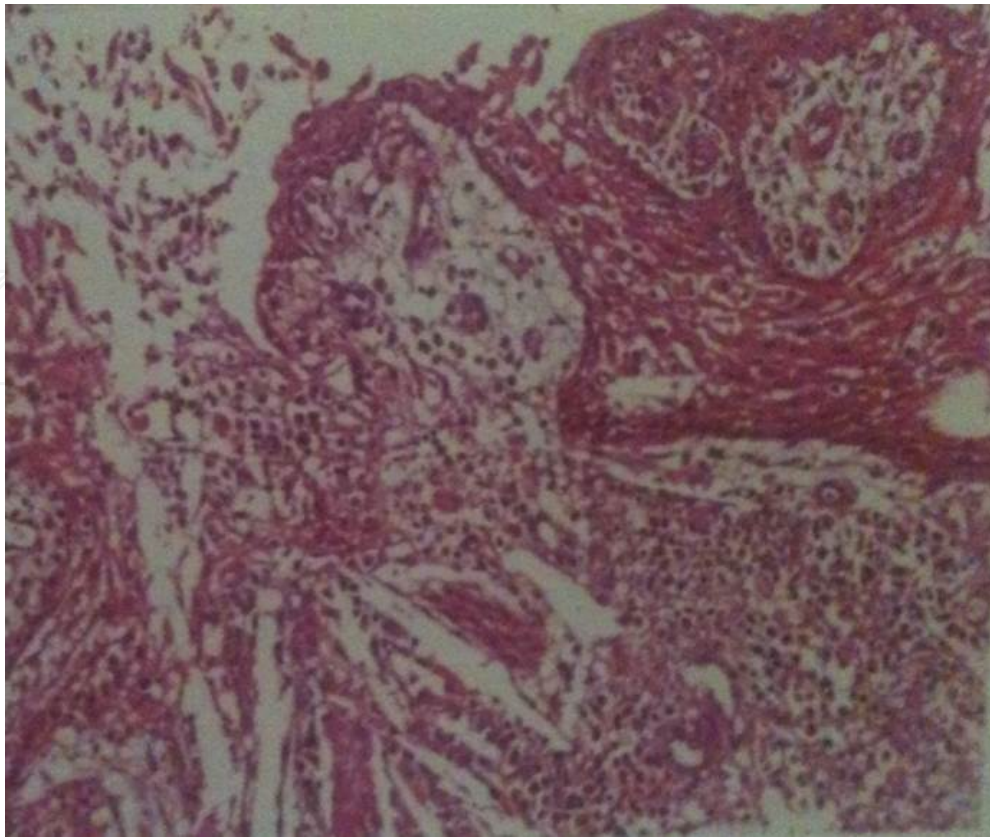


Figure 32. Histopathologic evaluation

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