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Surgical Intervention For Persistent Periapical Pathology: Apicoectomy Case Report

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ABSRACT
The objective of endodontic therapy is the removal of pulp tissue or microorganisms within the root canal system to promote healing of periapical tissues. However, root canal treatment failure can result from various factors, leading to persistent periapical lesions. This case report describes the management of symptomatic apical periodontitis and periapical cyst in a 40-year-old female patient through apicoectomy after initial root canal retreatment failed to resolve the condition. The patient presented with tenderness and radiographic evidence of periapical radiolucency after conventional retreatment of teeth #24 and #25. A subsequent diagnosis of a periapical cyst necessitated surgical intervention, including apicoectomy and cyst enucleation. A semilunar flap was utilized to access and resect the root apex, and the lesion was managed with retrograde filling using Mineral Trioxide Aggregate (MTA), bone graft, and guided tissue regeneration (GTR) membrane. The patient exhibited significant clinical improvement, and at the 3-month follow-up, radiographic evaluation revealed bone healing with resolution of symptoms. This case underscores the utility of apicoectomy in salvaging teeth with persistent periapical pathology, highlighting the importance of correct diagnosis, flap design, and appropriate use of materials like MTA for successful outcomes in endodontic surgery.
Keywords: Apicoectomy, Root canal treatment, Periapical cyst, Endodontic therapy

I. INTRODUCTION

The purpose of root canal treatment is to clean the pulp tissue or microorganisms contained in the root canal system, ensuring proper root canal filling and allowing for the repair of periapical tissue. There are numerous causes of root canal treatment failure, including incomplete obturation, root perforation, external root resorption, periradicular-periodontal lesions, overfilling, residual root canal material, periapical cysts, broken instruments in the root canal, perforation of the nasal foramen base, and coronal leakage.

Failure of root canal treatment can result in apical lesions. Most periapical lesions (over 90%) are classified as granulomas, radicular cysts, or abscesses. Clinical evidence suggests that larger lesions are more likely to be radicular cysts. However, some extensive lesions may still be granulomas or abscesses, and a definitive diagnosis can only be confirmed through histological analysis. Endodontic surgical treatment is recommended for large periapical lesions because conventional root canal treatment of nonvital teeth with widespread periapical lesions has a high failure rate.

Indications for endodontic surgery include a root canal system with persistent pain that cannot be filled orthogradically. Apicoectomy, or apical resection, is a procedure that involves sectioning the root tip of the tooth along with periapical curettage. This is typically followed by retrograde filling to seal the root canal ends.

The aim of this report is to demonstrate that root canal treatment failures can be managed without extraction, utilizing alternative treatments such as apicoectomy to preserve the tooth and its function in the oral cavity.

II. CASE REPORT

A 40-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, P.S.M. College of Dental Science & Research. The chief complaint of the patient was fractured restoration on the upper left back region since 6 months with history of pain during palpation. The medical history was noncontributory. In the clinical assessment, it was revealed that the upper left first and second premolar had a defective restoration and lacked a proper seal in the crown. Tooth #24 and #25 exhibited slight tendernesson percussion.Preoperativeradiographrevealed the previous root canal treatment with incomplete obturation and periapical radiolucency. A diagnosis of symptomatic apical periodontitis was made and endodontic retreatment was planned for tooth #24 and #25. A surgical endodontic re-treatment

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procedure was planned for the maxillary left premolars.

Under rubber dam isolation, the access cavity was re-entered using a endo access bur and the permanent restorative material was removed. Entire gutta-percha was removed from buccal and palatal canals wrt #24 and #25 with the help of GP solvents and alternatively by Hedstrom (H) files. Root canal spaces were irrigated with saline to flush the gutta-percha and sealer remnants. Entire gutta-percha removal from the canal was confirmed by radiographs. Working length was determined by an apex locator (Root ZX mini, J Morita) and confirmed by files in the radiograph. Cleaning and shaping was performed by protaper rotary instruments using EDTA as a chelating agent and with copious 5.25% sodium hypochlorite solution and saline irrigation in between the instrumentation. Finally the canals were rinsed with 2% Chlorhexidine (CHX). Calcium hydroxide paste (RC cal) was used as an intracanal medicament and the access cavity was closed with Glass Ionomer Cement. Patient was prescribed antibiotics and analgesics to manage pain.

Patient was recalled after two week for further follow up. At the second visit patient was totally asymptomatic. Temporary restorative material was removed, canals were irrigated and dried with paper points. Master cone radiograph was taken to confirm the length. Canals were coated with bioceramic sealer and obturation of both premolars were done with gutta-percha and bioceramic sealer. Patient was reviewed after 2 months on examination #24 and #25 was completely asymptomatic with tender on palpation in the apical area.

The patient was referred to the Department of Periodontology, PSM College of Dental Science and Research with complaints of tenderness on palpation in the gingiva with respect to #24 and #25. On clinical examination, there was 4mm recession and cervical abrasion with respect to #24 and 1mm recession with respect to #25(fig.1). There was also slight tenderness on palpation in the apical region of #24 and #25. Radiographic examination showed root canal-treated #24 and #25 with a periapical radiolucency surrounding #24 and #25 measuring 9.9mm in width and 7.7mm in length, and close to the sinus floor by 0.3mm.(fig.2). The diagnosis was a periapical cyst with respect to #24 and #25. Cyst enucleation and apicoectomy were planned.

After the patient signed the informed consent, the surgical area was disinfected using iodine. Infiltration anesthesia was administered to the posterior superior alveolar nerve and the nasopalatine nerve with 2% Lidocaine. An incision was made using a semilunar flap design located at the apical region of the tooth, employing a #15 scalpel blade pressed firmly against the periosteum of the alveolus bone.(fig.3). The flap was then opened using a periosteal elevator(fig.4).

The cortical bone around the root tip of tooth #24 and #25 was removed using a slow speed Handpiece using round bone bur and irrigated with saline. Next, the reduction was continued with a fissure-shaped bone bur, opening the periapical area and providing a clear view of the apex area of tooth #25. The lesion was curetted and enucleated at the tip of the tooth root, followed by irrigation with saline(fig.5). The apex of tooth #25 was then resected with a horizontal carbide fissure bur in the buccal-palatal direction(fig.6).

The retrograde cavity was prepared with a contra-angle handpiece at a 0 degree angle from the lingual to labial surface of the root. In this case, the retrograde cavity was filled with MTA (Angelus, Brazil)(fig.7). The flap was repositioned and sutured after placing a bone graft (Osseograft) and a GTR membrane(fig.8,9,10). Antibiotics and anti inflammatory medications was prescribed and it was recommended to always maintain oral hygiene. Patients were given control instructions 1 week postoperatively to remove suturing thread. The patient was recalled after 1 week for suture removal. On a 3-month review, the patient was asymptomatic(fig.11).

Fig.1 Preoperative view

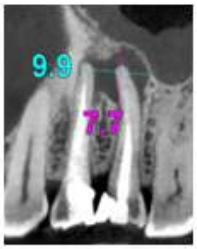

Fig.2 Preoperative radiographs

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Fig.6 Apicocetomy done

Fig. 7 Retrograde cavity prepared and filled using MTA

Fig.8 Xenograft placed in the area of bone loss

Fig.9 GTR membrane placed above the bone graft

Fig.10 Sutures placed

Fig.11Postoperative view after 1

III. DISCUSSION

One of the main objectives of contemporary dentistry is the preservation of natural teeth. Potential pathogens in peri radicular pathosis cases are often removed by non-surgical root canal therapy, followed by obturation and coronal restoration. But occasionally, the peri radicular lesion either doesn't heal or worsens, suggesting that harmful substances are still present inside the actual canal system. The standard endodontic surgical approach for maintaining a tooth with a severe periapical lesion that is not amenable to traditional endodontic therapy is apical surgery. Apical surgery, also known as apicoectomy, is the operation that is typically performed as a retreatment when any non-surgical or traditional endodontic treatment fails.

Indications for apical surgery according to Weine, are as follows:[1]

1. Severe vertical bone loss encompassing only one root of multi-rooted teeth.
2. Through and through furcation involvement.
3. Unfavorable closeness of roots of adjacent teeth.
4. Precluding adequate hygiene maintenance in proximal areas.
5. Severe root exposure due to dehiscence.

Periradicular surgery includes surgical debridement of pathologic periapical tissue, root-end resection, root-end cavity preparation, and the placement of a root-end filling to seal the root canal. Following peri radicular surgery, it is thought that the location, cleaning, and filling of the apical root canal are crucial components in ensuring a predictable result.[2,3]

A comparative case report by Irwandana et al., which demonstrated endodontic treatment failure due to an overfilled root canal on the maxillary right incisor and the presence of a radicular cyst around the tooth. The treatment involved apicoectomy with retrograde filling using Mineral Trioxide Aggregate (MTA). After 6 months, clinical examination showed no lumps on the palatum, and radiographic examination revealed that the lesion had shrunk.

The anatomical features, access, visibility, repositioning, suturing, postoperative care of the surgical site, and postoperative sequelae are all impacted by flap design. The flap design used in this case was semilunar flap design.

Under local anesthesia, periradicular surgery was carried out. A high concentration of vasoconstrictor containing anesthetic, 1:80,000

epinephrine, was used to obtain effective vasoconstriction. The lesion and root end were accessible after elevating a full-thickness mucoperiosteal flap and removing bone from the apical region. A low speed handpiece round bur and a sharp spoon excavator were used for the surgical debridement of cortical and cancellous bone. Throughout the entire surgery, saline solution was used to sporadically rinse the area to prevent bone dehydration. This method prevents bone necrosis and promotes the rapid formation of new bone by improving heat control[4].

Gilheany et al.[6] suggests that at least 2 mm from the root apex be removed to minimize bacterial leakage from the canals. Kim et al[5] anatomical study of the root apex shows that at least 3 mm of the root-end must be removed to reduce 98% of the apical ramifications and 93% of the lateral canals.

The ideal root-end preparation can be defined as a class 1 cavity at least 3 mm into root dentine, with walls parallel to and coincident with the anatomic outline of the root canal space[7].When used in conjunction with apical surgery, root-end filling material mineral trioxide aggregate (MTA) possesses many of the characteristics that make it the perfect filler material for root ends.[2] MTA has many advantages, including excellent biocompatibility and a bactericidal effect with a pH of 12.5. It is non-cytotoxic and non-mutagenic. The ingredients in MTA include calcium silicate, bismuth oxide, calcium carbonate, calcium sulfate, and calcium aluminate. When mixed with water, MTA forms amorphous calcium oxide crystals, composed of 49% phosphate, 33% calcium, 6% silica, 3% chloride, and 2% carbon.

Witasari et al. analyzed the inflammatory reaction of pulp tissue with direct pulp capping agents—calcium hydroxide, MTA, and Portland cement—over periods of 7, 14, 42, and 90 days. On day 42, calcium hydroxide showed an inflammatory reaction, while reactions to MTA and Portland cement were observed as early as day 7. This suggests that MTA and Portland cement induce tissue response faster than calcium hydroxide. This finding is consistent with the statement that MTA has a quicker effect in forming hard tissue compared to calcium hydroxide.

In order to promote the regeneration of both soft and hard tissues, the periapical lesion must be removed and the apical portion of the root canal system sealed.[1] A number of factors, of including surgical techniques utilizing various materials, clinical and radiographic evaluation, systemic conditions, and local factors, affect the outcome of peri-radicular surgery.[1]

The administration of bone grafts in this case aimed to accelerate bone healing. Besides accelerating the healing process, bone grafts also induce host cells to form new bone. The process of bone formation, or osteogenesis, involves osteoblasts or progenitor cells present in the graft material. Osteoinduction is the ability of the bone graft material to stimulate the formation of a scaffold for host stem cells to grow.[8] During osteoinduction, various growth factors influence the transformation of host stem cells into osteoblasts. The growth factors that play a role in this process include platelet-derived growth factors (PDGFs), fibroblast growth factors (FGFs), and transforming growth factor-β (TGF-β). These four materials serve as basic properties in the formation of new bone which occurs in direct parallel with the interconnections between bones.[8]

The use of bone substitution materials, such as bone grafts, is an alternative for regenerating damaged bone tissue. Bone grafts serve as scaffolds that play a crucial role in tissue engineering for bone regeneration. It is essential to design a bone graft as an appropriate scaffold to facilitate new bone growth.[9] Bone tissue regeneration requires a combination of factors, including scaffold design with adequate mechanical strength, porosity, and degradation speed. These factors involve the release of suitable molecular signals and the use of biocompatible materials, which are crucial for regenerating bone tissue and restoring bone defects. Selecting a bone graft material depends on its biocompatibility, bioresistability, sterility, structural integrity, adequate porosity for new blood vessel growth, compressive strength, cost, and ease of manipulation.[9]

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