

Periapical Surgeries in Paediatric Dental Patients: A Case Series.

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ABSTRACT

Background: Periapical lesions are sequelae of microbial pulpal invasion, which can occur through trauma or dental caries. These periapical radiolucent areas may be diagnosed on routine dental examination or following acute dental pain. These lesions may manifest as sinus discharge, pain, swelling, fever, mobility, and even possible loss of the tooth. In such instances, antibiotic therapy may not be effective in restricting the infective process, but when combined with re-treatment and periapical surgery, complete resolution of the symptoms occurs.

Objective: To report cases of periapical surgeries on Paediatric Dental Patients

Method: A retrospective case series study design and a single-centre data collation of four Periapical surgeries carried out at the Paediatric Dental Clinic of the Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria. LUTH, a leading tertiary Hospital in Nigeria, with referral cases from different centres in the country.

Result: Four cases of periapical surgery done on the anterior teeth of four patients with periapical lesions were seen. Two cases had periapical cysts, while the other two had iatrogenic displacements of gutta-percha beyond the apex of the teeth. Retrograde apical seal was achieved using Mineral Trioxide Aggregate as an adjunct to periapical surgery, resulting in satisfactory healing outcomes post-surgery, with radiographic and clinical signs of healing in all cases.

Conclusion: Periapical surgery as part of endodontic treatment remains a tool for the complete and satisfactory healing outcome in the management of periapical lesions.

Keywords: periapical surgery, paediatric, dental, cases

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INTRODUCTION

The enamel, dentine, and cementum serve as protective barriers of the dental pulp. The pulp is a sterile connective tissue. Injury to the pulp may lead to inflammation, which, if left untreated, can degenerate into pulp necrosis.¹ After the pulp loses its blood supply, microorganisms colonize the pulp tissue, resulting in periapical pathology.²

Periapical radiolucency can be a sequelae of dental trauma, dental caries or tooth wear lesions. These lesions are a group of pathological conditions found in the apical surrounding area of a tooth. These periapical radiolucent areas may be diagnosed on routine dental examination or following acute dental pain or orofacial swelling.¹ Periapical lesions are manifestations of the host defence response to microbial assault on the dentino-pulpal complex, which leads to local inflammation, hard tissue resorption, and destruction of surrounding periapical tissues.²

The various aetiological factors associated with periapical lesions include dental trauma, caries, or tooth wear lesions. Traumatic dental injury to the anterior teeth is a common cause of large periapical lesions. It is mostly associated with maxillary anterior teeth.³⁻⁵ Periapical lesions are groups of pathological conditions found in the periapical region. These lesions can be a dental granuloma, radicular cyst, or an abscess. Their incidence varies between 9.3 and 87.1%,⁶ and 55%, 28.7 and 70%, respectively.²

There are various treatment options for the management of periapical lesions. They range from non-surgical endodontic treatments, surgical endodontic treatments, to extraction as the last resort when surgical endodontic treatment fails or is contraindicated.⁷⁻⁹ Periapical surgery is an endodontic therapy where a surgical flap is raised. It includes debridement of the periapical pathologic tissues, root end resection, and retrograde restoration to optimize healing of the periapical tissue and regeneration of the attachment apparatus^{3,4,10}

Periapical surgeries are, however, contraindicated when apical lesions are associated with canals that cannot be cleansed or shaped, or a tooth that cannot be restored to function. Furthermore, it is contraindicated where there is an infected neighbouring tooth that has not been treated, when there is an acute inflammation in the operative field, and when patients have underlying systemic medical conditions that contraindicate surgery.¹¹

There are a few case reports in the existing literature on successful surgical endodontic management in the paediatric population. To the best of our knowledge, this is the first study presenting the success rate of periapical surgery in our environment. Knowledge of successful outcomes of periapical surgery is needed to help the paediatric endodontist make good clinical decisions when faced with similar clinical conditions. We hereby report four cases of periapical surgeries performed on four paediatric patients who attended Lagos University Teaching Hospital, Lagos, Nigeria.

METHODS

Ethical approval was obtained from the Lagos University Teaching Hospital Ethical Review Committee before the commencement of the study (ADM/DCST/HREC/APP/7447). Informed written consent and assent were obtained from the parents and subjects, respectively.

The study was a retrospective case series. Medical records of all periapical surgery cases over a period of 2 years were recalled.

Periapical surgery was done for all four cases, under 2% Lidocaine (BS&C) 1:100000 local anaesthesia. Pain was managed with analgesics (ibuprofen and paracetamol), and patients were placed on antibiotics (metronidazole and amoxicillin). All patients were reviewed at 1 week and 1 month post-treatment.

Preoperative periapical radiographies were taken. The incision technique and flap design was a 3-sided mucoperiosteal flap, comprising an envelope incision and two relieving incisions. The location, site and size were chosen according to clinical and radiographical parameters of the index tooth and the healthy tooth adjacent to it. Once the mucoperiosteal flap was raised, the cortical bone over the root end was removed, and the root end was located. The periapical pathological tissue was curetted out to enhance access and visibility of the surgical field. The root end was then resected, residual pathological tissue was removed and haemostasis was later achieved.

A retro-cavity was prepared under copious irrigation with 0.9% normal saline, with a small round bur mounted on a fast handpiece. Root end filling was done with white mineral trioxide aggregate (MTA) PYRAX MTA+. The surgical field was carefully checked and rinsed with 0.9% normal saline before wound closure. Adaptation of the wound margins was done with single interrupted stitches using Vicryl

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3.0 and the stitches were removed a week after surgery. There were no complications recorded in the cases presented, apart from slight facial swelling in some of the subjects which was a sequelae of the surgical procedure.

Flow of participant's procedure.

Detailed history and intra oral examination (soft and hard tissue examination – condition of the oral mucosa, tongue, soft palate, floor of the mouth, gingivae, teeth present with carious teeth) were taken and carried out, respectively.

Preoperative periapical radiographs (Dental X-ray film Dx-54 size D, Henry Schein, USA) were taken for all traumatized teeth selected for treatment.

The incision and flap design included an envelope incision and two relieving incisions. The three-sided mucoperiosteal flap designs were chosen according to clinical and radiographic parameters, including condition, biotype and width of gingival tissues, presence of a restoration margin, location and extent of the periapical lesion, and patient's aesthetic demands. A small osteotomy was produced to locate the root-end that was resected by about 3 mm. The resection plane was perpendicular to the long axis of the tooth. All pathological tissue was removed, and adequate haemorrhage was established. Root-end cavity preparation was performed with ultrasonic driven microtips. The retro-cavity was about 3-5mm in depth, which followed the original path of the root canal. The root-end was filled with mineral trioxide aggregate (MTA). All the cases followed the clinical steps as stated above.

Clinical and radiographic evaluation.

Evidence of bone healing was radiographically assessed using standardized radiographs taken at similar angulations for comparison with pre-operative and 1-week post-operative radiographs. Clinical observations were recorded as present or absent: pain, sensitivity to percussion, evidence of fistula, swelling and tooth mobility.

Radiographic evaluations were done using the classification of Rud et al²² as follows:

1. Complete healing (successful): Complete bone regeneration around the apex with or without a recognizable periodontal ligament space.
2. Incomplete healing (scar tissue): A peri-radicular rarefaction (in comparison with a postoperative or previous follow-up radiograph), either decreased or stationary, the rarefaction is irregular and often has

an asymmetrical outline and an angular connection to the periodontal ligament.

3. Uncertain healing: A rarefaction located symmetrically around the apex, with a funnel-shaped connection to the periodontal ligament space; the size of the rarefaction is less than it appears to be on the postoperative radiograph.

4. Unsatisfactory healing (failure): the same radiographic signs as those of uncertain healing, except that the area of the rarefaction is either enlarged or unchanged in comparison to the immediate postoperative condition.

Overall treatment results were classified²³ as:

Successful: Criteria for successful healing included the absence of clinical signs/symptoms and a radiographic classification of complete or incomplete healing.

Doubtful: Criteria for doubtful cases included absence of clinical signs/symptoms and a radiographic classification of uncertain healing.

Unsuccessful\Failure: Criteria for failure included the presence of any clinical signs/symptoms and/or a radiographic classification of unsatisfactory healing.

CASE 1

A 15-year-old female presented with complaints of pain and swelling on her gum, a salty taste in her mouth of 1week duration and fractured tooth 21. There was a positive history of trauma to her anterior teeth 2 years earlier.

Clinical examination revealed a swelling of about 2cm located at the mucogingival junction labially in relation to tooth 21, with associated pus discharge. About one-third of the coronal tooth substance on 21 was missing. There was grade 1 mobility on teeth 21 and 22, and Ellis Class II fracture on tooth 21. An assessment of dentoalveolar abscess secondary to trauma was made.

Periapical radiograph revealed a well-circumscribed periapical radiolucency involving the 21 and 22, with the base of the radiolucency in close proximity to the floor of the nasal cavity. No root resorption seen internally or externally.

A diagnosis of infected periapical cyst was made. A treatment plan drawn as: counselling of the patient and parents, Root Canal Therapy on the 21 and 22, periapical surgery along with cystic enucleation, composite build up and routine follow-up appointments.

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Figure 1.1: Clinical picture at presentation showing a swelling on 21 and fractured 21

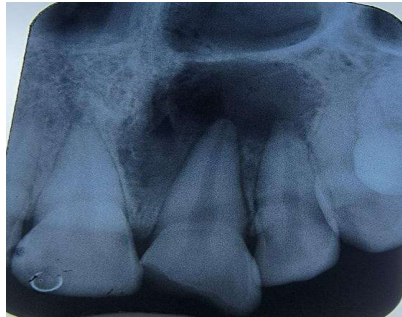


Figure 1.2: Diagnostic radiograph of teeth 21 and 22 showing well-circumscribed cystic lesion.



Figure 1.3: RCT commenced on teeth 21 and 22, with files in canals

Figures 1.4 -1.6 Exposure and curettage of the diseased periapical region



Figure 1.4



Figure 1.5



Figure 1.6



Figure 1.7: Enucleated cyst



Figure 1.8: operative picture



Figure 1.10: Extra-oral photograph of patient 24 hours post-surgery



Figure 1.11: Radiograph showing root canal treatment completed on teeth 21 and 22

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Figure 1: 12: Resin-bonded coronal restoration



Figure 1:13: 1-week post-surgery

CASE 2

A 16-year-old boy who had iatrogenic displacement of gutta-percha (GP) beyond the apex on tooth 21 following a root canal therapy. All efforts to retrieve

the GP through orthograde means yielded no result. Patient was then booked for apical surgery, and thereafter, RCT of tooth 21 was done.



Figure 2:1: Pre-operative periapical radiograph of tooth 21 showing overshooting gutta-percha



Figure 2:2: Intra-operative clinical picture showing exposure and debridement of bone



Figure 2:3: Intra-operative clinical Picture showing removal of the gutta-percha (GP)



Figure 2:4: GP removed



Figure 2:5: Radiograph showing apex sealed with MTA



Figure 2:6: Post-operative clinical picture

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CASE 3

A 12-year-old boy who presented at the clinic with a history of persistent pain and occasional sinus discharge of 2 weeks duration associated with tooth 11. He gave a positive history of a previous root canal therapy on the affected tooth.

Preoperative periapical radiograph showed defective root filling with the gutta-percha overshooting the apex of the tooth into the periapical space. There was associated periapical radiolucency. Periapical surgery to remove the over-shooting gutta-percha, and re-RCT were done.



Figure 3.1: Pre-operative clinical picture



Figure 3.2: Pre-operative radiograph showing over shooting gutta-percha on tooth 11



Figure 3.3: Intra-operative clinical picture



Figure 3.4): Immediate post-operative Photograph showing flap repositioning



Figure 3.5: Complete root canal therapy on tooth 11

CASE 4

A 9-year-old male, with recurrent pain and pus discharge from tooth 11 following an incomplete RCT of 9 months duration secondary to Ellis Class III fracture prior to presentation. Alveolar mucosa overlying teeth 11 and 12 was erythematous and

swollen. Periapical radiograph showed a well-circumscribed radiolucent lesion with open apex of tooth 11. Diagnosis of periapical cyst secondary to incomplete RCT in a young permanent tooth 11 and 12 was made. Periapical surgery was done with cystic enucleation.

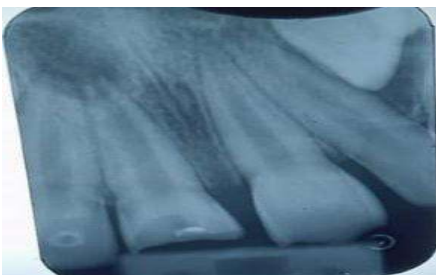


Figure 4.1 preoperative radiograph



Figure 4.2 Pre-operative clinical picture

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Figure 4.3: Intra operative clinical picture showing file on tooth 11 after cystic enucleation and apical resection



Figure: 4.4 radiograph showing MTA plug on tooth 11



Figure 4.5: 1-week post-surgery.



Figure 4.6: Post RCT radiograph of tooth 11



Figure 4.7 photograph after resin-bonded restoration on tooth 11

DISCUSSION

Over the decades, non-surgical endodontic treatment has been the primary treatment option for periapical pathologies as the majority of periapical lesions heal following the conventional root canal treatment.^{3,4-10} However, in the presence of factors such as consistent or worsening of periapical lesions, or the reappearance of signs and symptoms, the surgical endodontic treatments become a suitable option.¹⁴

This study showed the effectiveness of periapical surgeries in selected cases. All the cases showed good clinical and radiographic outcomes during the reviewed period.

Periapical surgery aims at the treatment of apical periodontitis as a last resort after exhaustion of the possibilities of orthograde endodontics.⁸ The subjects in this study benefited from periapical surgery, which culminated in the cessation of their presenting symptoms.

Reasons for periapical surgery can be grouped into Biological and technical factors. Biological causes for periapical pathology include trauma, periapical infection/abscess, and periapical cyst.^{15,16} Technical causes for periapical pathology include overfilling, underfilling or non-homogeneous filling of root canal filling material, empty root canal, fractured instrument, perforation or deviation, insufficient coronal restoration, multiple errors, and recurrence

after apical surgery.¹⁵ Studies have shown that most of the periapical surgeries are due to biologic causes, with periapical cyst being the most common.¹⁵⁻¹⁷ The cases presented in this study fell under both biological and technical factors as reported in the literature cited above.

Surgical endodontics is done when access for retrograde preparation or obturation is required, presence of persistent periapical infection and foreign body reaction caused by a root-obturing material. Periapical surgery is also indicated in the accumulation of endogenous cholesterol crystals and true cystic lesion anatomical abnormalities, leading to the inability to perform the nonsurgical treatment.¹¹ All four cases presented had failed root canal procedures before the commencement of periapical surgery

This study reported 100% clinical and radiographic success outcomes for the reported cases during the reviewed period. The rate of successful healing of periapical surgery is reported to range from 60%-91%.¹⁸ Some factors influence the outcome of the success of periapical surgery, one of which is regression in the size of the periapical lesion.¹⁶ It has been reported that there is a higher healing rate in teeth with smaller (<5mm) preoperative periapical lesion.^{14,19} Therefore, children and adolescents with periapical infections that are not amenable to anterograde root filing should be considered for

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retrograde root filling because of the good clinical outcomes. This treatment option will allow some children and adolescents to keep their teeth for life and prevent the associated burden that comes with dental extractions, especially of the anterior teeth.

The treatment outcome of periapical surgery is always assessed clinically and radiographically. Post-operative factors associated with healing include: asymptomatic tooth, soft tissue healing of reflected flap, absence of oroantral perforation or a sinus tract, radiographic evidence of periapical healing, formation of new periodontal apparatus, preserved tooth function and decreased mobility present.^{20,21} The location and quality of the bone around the root are also closely tied to the success of the treatment.²² In cases involving large labial and palatal perforations of endodontic origin, guided tissue regeneration procedures following the periapical surgery have been shown to lead to better success of treatment.²³ The good clinical and radiographical outcomes recorded in this study could be attributed to the following: meticulous surgical flap management, complete removal of periapical infected tissues (using curettage and copious irrigation with 9% normal saline), meticulous alignment to surgical guidelines/steps, the use of surgical loop which magnified the surgical field, the type of root-end filling material, and the clinical experience of the paediatric dentist that carried out the procedures. The success rate recorded in this study was in line with a Nigerian study that recorded 92% success rate.²⁴

Modern endodontic surgery, also known as endodontic microsurgery, evolved from the traditional apicectomy.²⁰ It makes use of dental operating microscopes, Cone Beam Computed Tomography (CBCT), more biologically acceptable materials and involves ultrasonic root end preparation.^{8,20} Endodontic microsurgery achieves smaller osteotomy sizes of about 3-4mm, a smaller bevel angle of 0-10 degrees, root end preparations that are always within the canal compared to traditional surgical endodontics, thereby giving a higher treatment success of 85-96.8%.²¹ The present study achieved good clinical and radiographical outcomes even with the use of the traditional apicectomy procedure. This success rate could be attributable to the meticulous alignment with the surgical guideline/steps and the use of surgical loop, which magnifies the surgical field.

The requirements of an ideal root-end filling are reviewed before the demise of amalgam is

considered. The focus of root end filling is on good biologic tissue response. Zinc oxide-eugenol cements, Mineral Trioxide Aggregate, glass ionomer cements, composite resins, compomers and Diaket have been reported in the literature as root end filling materials.²⁴ This present study used MTA as root end filling material because of its superior clinical outcomes as reported in the literature.²⁵ Its use could also be attributed to the good clinical outcome.

CONCLUSION

This study validates the fact that good clinical and radiographical outcomes can be achieved following periapical surgery in a resource-challenged environment where access to endodontic microsurgery could be elusive. The limitation of this study is the limited follow-up period.

Conflict Of Interest

None

Source of Funding

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Data Availability

All the data are available on request

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