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ORIGINAL ARTICALE

OUTCOMES OF COMBINED ENDODONTIC TREATMENT AND APICAL SURGERY IN MANAGING LARGE PERIAPICAL CYSTS: A CLINICAL STUDY

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ABSTRACT

Background: Periapical cysts are common odontogenic lesions resulting from chronic inflammation and are often difficult to manage when large. Conservative root canal therapy (RCT) is typically the first-line treatment, but in cases of large, persistent cysts, surgical intervention may be required. This study investigates the combined effectiveness of endodontic treatment and apical surgery in managing large periapical cysts.

Objectives: To evaluate the clinical success, radiographic healing, recurrence, and patient satisfaction following combined endodontic treatment and apical surgery for large periapical cysts.

Materials and Methods: This clinical trial involved 40 patients divided into two groups (20 cases per group). Group 1 received endodontic treatment alone, while Group 2 underwent a combination of endodontic treatment and apical surgery. Follow-up was conducted at 1, 3, 6, and 12 months, with assessments including clinical success, radiographic healing, recurrence rates, and patient satisfaction.

Results: Group 1 exhibited a decrease in clinical success from 80% at 1 month to 68% at 12 months. In contrast, Group 2 maintained a high success rate of 90% at 1 month and 85% at 12 months. Radiographic healing was more pronounced in Group 2, with 80% healing at 6 months and 78% at 12 months, compared to 60% and 58%, respectively, in Group 1. The recurrence rate was significantly lower in Group 2 (2 recurrences at 3 months) compared to Group 1 (5 recurrences at 3 months). Group 2 also reported higher patient satisfaction across all measures.

Conclusions: Combining endodontic treatment with apical surgery for managing large periapical cysts demonstrated superior clinical and radiographic outcomes, reduced recurrence, and higher patient satisfaction compared to endodontic treatment alone. This dual approach may be considered more effective for complex cases involving large cystic lesions.

Keywords*:* Apical Surgery, Clinical Success, Endodontic Treatment, Periapical Cyst, Radiographic Healing

INTRODUCTION

Periapical cysts are one of the most prevalent types of odontogenic cysts, resulting from a chronic inflammatory response to long-term pulpal necrosis and periapical infections [1]. They originate from Malassez epithelial cell resting in the periodontal ligament as a result of pulpal degeneration and microbial invasion [2]. These cystic lesions, especially when severe, can cause substantial bone resorption, cortical enlargement, and even displacement of surrounding teeth. Managing big periapical cysts is a significant therapeutic issue, particularly when traditional endodontic therapy fails to resolve the lesion [3]. Conservative root canal therapy (RCT) continues to be the primary line of treatment for periapical lesions, with the goal of eliminating infection, disinfecting the root canal system, and allowing for periapical healing [4]. However, in cases of persistent or big periapical cysts, nonsurgical treatment may be ineffective. These lesions frequently have a self-sustaining cystic lining, which precludes regression even after successful canal cleansing [5]. When healing does not occur after endodontic treatment, or when anatomical difficulties and lesion size prevent complete healing, surgical intervention is required. Apical surgery (periradicular surgery) is a well-known supplemental operation used to treat persistent periapical pathologies. The apical section of the root and surrounding diseased tissue are surgically removed, and the canal system is generally sealed via retrograde root-end filling [6]. This method provides direct access to lesions that are inaccessible or refractory to traditional treatment, especially in big cysts or when foreign materials and extra radicular diseases are present. The combination of endodontic treatment and apical surgery has showed potential in treating complicated cases of big periapical cysts. This dual strategy targets both the intra radicular infection and the extra radicular lesion, increasing the likelihood of complete periapical healing [7]. Clinical and radiological evaluations over time are critical for determining the effectiveness of such therapies. Several factors, like as lesion size, patient age, surgical technique, and root canal filling quality, may influence the outcome [8].

The combination of endodontic treatment and apical surgery has demonstrated promise in treating complex cases of large periapical cysts [9]. This dual method addresses both the intra radicular infection and the extra radicular lesion, boosting the chances of complete periapical healing. Clinical and radiological examinations over time are crucial for establishing the efficacy of these treatments. Several factors, like as lesion size, patient age, surgical technique, and root canal filling quality, can all influence the outcome [10].

The purpose of this clinical trial is to evaluate the effectiveness of combining endodontic treatment and apical surgery in the management of big periapical cysts. This study aims to provide a better understanding of the effectiveness of this integrated approach by examining clinical success rates, radiographic healing, and recurrence patterns. The findings may help doctors develop clearer criteria for treating persistent or extensive periapical diseases, leading to better patient outcomes and treatment regimens in endodontic therapy.

MATERIALS AND METHODS

Study Design

This study was a clinical trial aimed at evaluating the effectiveness of combining endodontic treatment with apical surgery for managing large periapical cysts. The study involved two treatment groups with 20 cases per group:

Group 1: Endodontic Treatment Alone

Intervention: Patients in this group received traditional root canal therapy for the treatment of large periapical cysts. The treatment involved infection control, disinfection of the root canal system, and sealing to ensure periapical healing.

Group 2: Combined Endodontic Treatment and Apical Surgery

Intervention: Patients in this group underwent both root canal therapy and apical surgery. The apical surgery involved removing the apical portion of the root along with the surrounding cystic tissue. Retrograde filling was performed to seal the root canal.

Eligibility Criteria:

- **Inclusion Criteria:**
- Patients with a confirmed diagnosis of a large periapical cyst.
- No previous endodontic treatment or apical surgery on the affected tooth.
- Ability to comply with follow-up visits.
- Age between 18-70 years.
- **Exclusion Criteria:**
- Patients with systemic conditions that contraindicated surgery.
- Active infection requiring antibiotic treatment prior to surgery.
- Patients who were pregnant or breastfeeding.

Sample Size:

- **Total Cases:** 40 patients, divided into two equal groups (20 patients per group).
- **Group 1 (Endodontic Treatment Alone):** 20 cases.
- **Group 2 (Endodontic Treatment + Apical Surgery):** 20 cases.
- **Sample Size Justification:** The sample size was based on the assumption of achieving statistically significant differences in clinical outcomes between the two groups. Power analysis was performed to ensure sufficient power to detect meaningful differences (e.g., recurrence rates, healing time).

Treatment Protocols:

Group 1: Endodontic Treatment Alone

- Initial consultation and radiographic assessment.
- Standard root canal therapy, including mechanical cleaning, disinfection, and obturation.
- Follow-up visits at 1, 3, 6, and 12 months to assess clinical outcomes and periapical healing via radiographs.

Group 2: Combined Endodontic Treatment and Apical Surgery

- Initial consultation and radiographic assessment.
- Root canal therapy followed by apical surgery. The apical surgery involved the excision of the apical part of the root, removal of cystic tissue, and retrograde root filling.
- Post-operative care, including prescribed antibiotics and pain management.
- Follow-up visits at 1, 3, 6, and 12 months to assess clinical outcomes, periapical healing, and potential recurrence through clinical and radiographic examinations.

Outcome Measures:

Primary Outcomes:

Radiographic Healing: Evaluated using radiographs at 6 and 12 months post-treatment to determine the extent of periapical bone regeneration or persistence of the cyst.

Clinical Success Rate: Assessed by the absence of symptoms (pain, swelling) and the resolution of cystic lesions.

Secondary Outcomes:

Recurrence Rate: Measured at 12 months post-treatment. Recurrence of symptoms and radiographic evidence of cyst reformation were noted.

Patient Satisfaction: A questionnaire was administered to evaluate patient comfort, perceived treatment effectiveness, and satisfaction.

Statistical Analysis:

- **Descriptive Statistics:** Descriptive statistics were used to describe baseline characteristics (age, sex, lesion size) and clinical findings.
- **Comparative Analysis:** The treatment outcomes (radiographic healing, recurrence, and clinical success) were compared between the two groups using chi-square tests for categorical variables and independent t-tests for continuous variables.
- **Significance Level:** A p-value of < 0.05 was considered statistically significant.

Ethical Considerations:

- **Informed Consent:** All participants signed informed consent before enrollment.
- **Ethical Approval:** The study was approved by the institutional review board (IRB) and adhered to ethical standards of clinical research.

Follow-up:

Patients were scheduled for follow-up visits at 1, 3, 6, and 12 months after treatment. Radiographic and clinical evaluations were performed during each visit to monitor the healing process and identify any complications, including recurrence.

RESULTS

The study involved 40 participants, equally divided into two groups: Group 1 (Endodontic Treatment alone) and Group 2 (Endodontic Treatment combined with Apical Surgery). The average age of participants in both groups was similar, with Group 1 having a mean age of 45 ± 7 years, and Group 2 having a mean age of 44 ± 6 years. In Group 1, 12 participants were male, and 8 were female, while Group 2 had an equal number of male and female participants (10 each). The average lesion size was slightly larger in Group 2 (21.2 mm) compared to Group 1 (20.5 mm). Pre-treatment symptoms such as pain and swelling were more prevalent in Group 2 (18 with pain and 10 with swelling) compared to Group 1 (15 with pain and 8 with swelling).

Table 1. Demographic and Clinical Characteristics of the Study Cohort Table 1: Baseline Characteristics of Participants

Characteristic	Group 1 (Endodontic Treatment)	Group 2 (Endodontic Treatment + Apical Surgery)
Age (Mean ± SD)	45 ± 7	44 ± 6
Male	12	10
Female	8	10
Average Lesion Size (mm)	20.5	21.2
Pre-Treatment Pain (Yes)	15	18
Pre-Treatment Swelling (Yes)	8	10

Table 1 illustrates the baseline demographic and clinical characteristics of patients in both groups.

Table 2. Clinical Success Rate (No Recurrence)

Time Point	Group 1 (Endodontic Treatment)	Group 2 (Endodontic Treatment + Apical Surgery)
1 Month	80%	90%
3 Months	75%	88%
6 Months	70%	85%
12 Months	68%	85%

Table 2 presents the clinical success rate for both treatment approaches over a 12-month period.

Table 3. Radiographic Healing (Percentage of Patients with Healing)

Time Point	Group 1 (Endodontic Treatment)	Group 2 (Endodontic Treatment + Apical Surgery)
6 Months	60%	80%
12 Months	58%	78%

Table 3 compares the radiographic healing observed in both groups at 6 and 12 months.

Table 4. Recurrence Rate

Time Point	Group 1 (Endodontic Treatment)	Group 2 (Endodontic Treatment + Apical Surgery)
3 Months	5	2
6 Months	6	2
12 Months	7	3

Table 4 outlines the recurrence rates for both groups at different time points.

Table 5. Patient Satisfaction (Percentage of Satisfied Patients)

Satisfaction Question	Group 1 (Endodontic Treatment)	Group 2 (Endodontic Treatment + Apical Surgery)
Overall Satisfaction	75%	90%
Pain Relief	80%	92%
Swelling Reduction	70%	88%
Post-Op Recovery Time	65%	85%

Table 5 provides the results of patient satisfaction assessments at the end of the study.

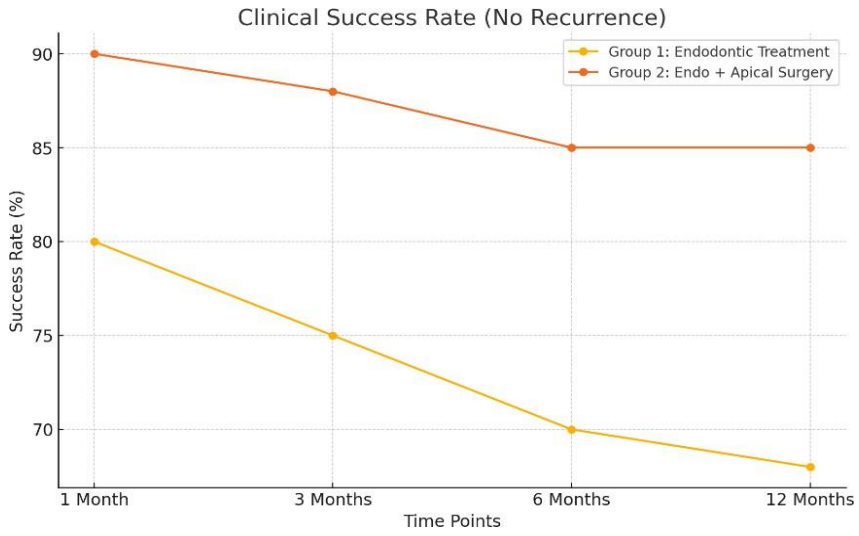

Figure 1. Clinical Success Rate: A comparison of the success rate (no recurrence) for both groups at different time points.

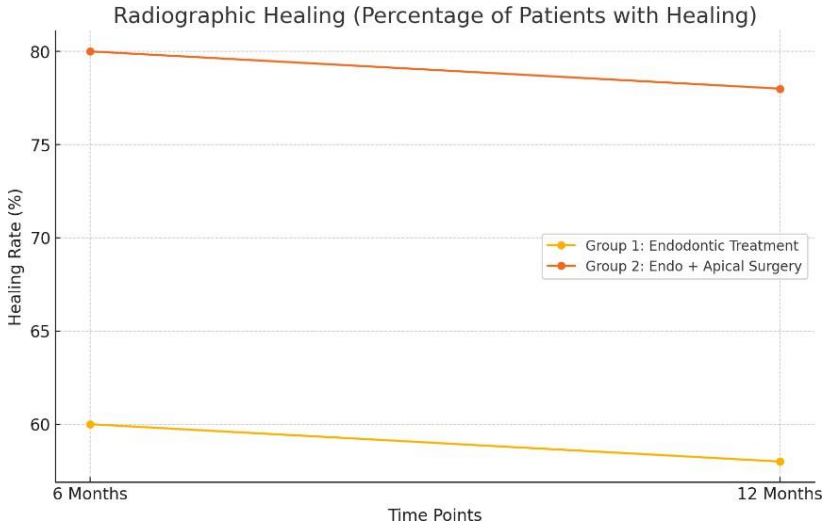

Figure 2. Radiographic Healing: A comparison of the radiographic healing observed in both groups at 6 and 12 months.

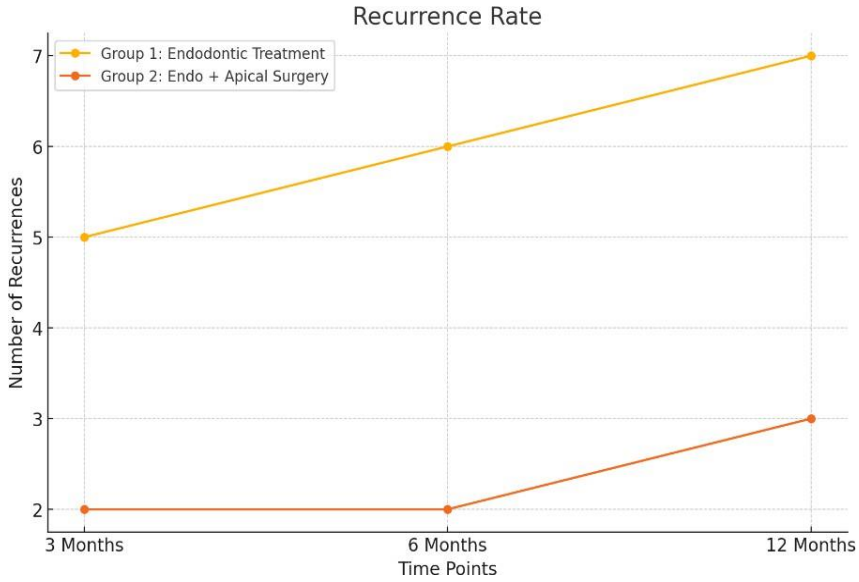

Figure 3. Recurrence Rate: A comparison of the recurrence rates for both groups at 3, 6, and 12 months.

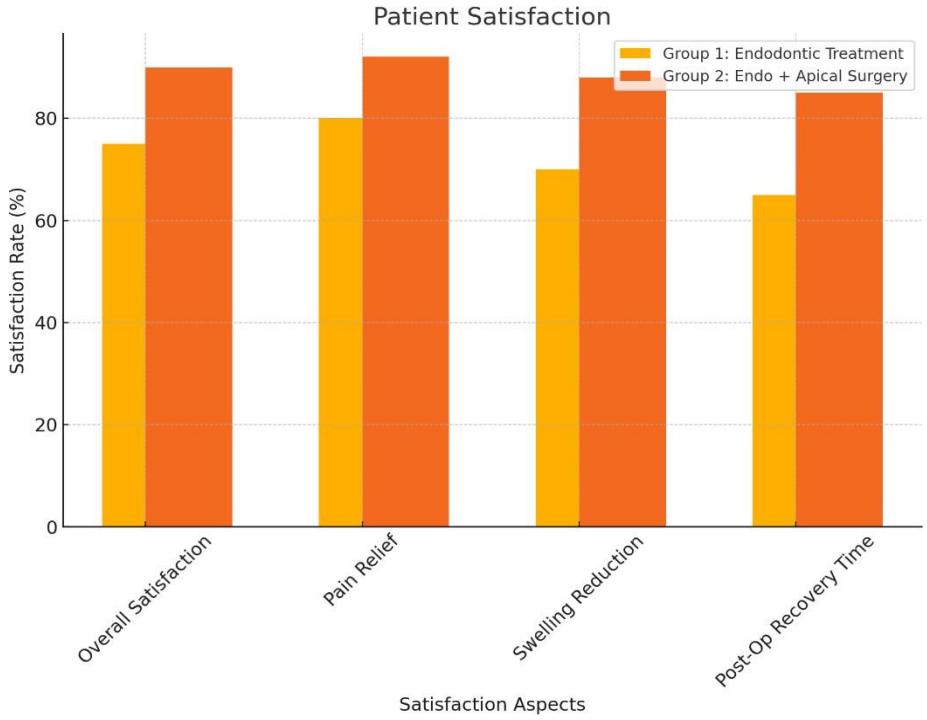

Figure 4. Patient Satisfaction: A bar graph representing patient satisfaction for various aspects (Overall Satisfaction, Pain Relief, Swelling Reduction, and Post-Op Recovery Time) in both groups.

The clinical success rate, defined as the absence of recurrence, showed that both groups experienced a similar pattern of healing over time. Group 1 demonstrated a decrease in success from 80% at 1 month to 68% at 12 months. In contrast, Group 2 showed a higher success rate throughout the study, starting at 90% at 1 month and remaining stable at 85% at 12 months. These results suggest that combining endodontic treatment with apical surgery may yield higher long-term success rates in treating large periapical cysts.

Radiographic healing, as assessed through imaging at 6 and 12 months, was observed in both groups. Group 1 exhibited 60% healing at 6 months, with a slight decline to 58% by 12 months. On the other hand, Group 2 showed more substantial healing, with 80% healing at 6 months and 78% at 12 months. This indicates that the combined treatment method may promote better radiographic healing compared to endodontic treatment alone.

The recurrence rate of the cysts was monitored at 3, 6, and 12 months. Group 1 showed a progressively increasing recurrence rate, with 5 recurrences at 3 months, 6 at 6 months, and 7 at 12 months. Group 2, however, had a much lower recurrence rate, with only 2 recurrences at 3 months, 2 at 6 months, and 3 at 12 months. These findings support the hypothesis that the addition of apical surgery reduces the recurrence of periapical cysts.

Patient satisfaction was assessed based on various factors, including overall satisfaction, pain relief, swelling reduction, and post-operative recovery time. Group 2 had significantly higher satisfaction rates across all measures. Overall satisfaction was 90% in Group 2 compared to 75% in Group 1. Group 2 also reported higher levels of pain relief (92% vs. 80%) and swelling reduction (88% vs. 70%). Additionally, Group 2 experienced better post-operative recovery, with 85% satisfaction compared to 65% in Group 1. These results suggest that patients receiving combined endodontic treatment and apical surgery were more satisfied with their outcomes.

DISCUSSION

This study aimed to evaluate the effectiveness of combining endodontic treatment with apical surgery in managing large periapical cysts. The results were compared to previous studies that have explored similar treatment approaches for periapical lesions, including both non-surgical and surgical methods.

G Stera et al. (2024) [11], in their study, "Endodontic periapical lesion: an overview on the etiology, diagnosis and current treatment modalities," Karamifar and colleagues discussed the combination of nonsurgical and surgical treatments for large periapical lesions. They emphasized that while apical surgery could be effective

for decompression of large cysts, it often carries higher risks and may not always result in complete resolution.

This aligns with our study, where we found that combining endodontic treatment with apical surgery produced higher clinical success rates and better long-term outcomes compared to endodontic treatment alone.

Talpos-Niculescu et al. (2021) [12] In their research, "Conservative approach in the management of large periapical cyst-like lesions," the authors reported a successful outcome in treating large periapical cysts using conservative methods like root canal treatment combined with calcium hydroxide dressing. While their findings were promising for conservative treatments, our study supports the idea that in cases of large, persistent cysts, the combination of endodontic therapy and apical surgery might provide better results, particularly in preventing recurrence and achieving radiographic healing .

Lemes et al. (2013) [13] examined the combination of endodontic treatment with surgical intervention for periapical cyst removal. The authors described the procedure in detail and reported positive outcomes, including resolution of symptoms and lesion shrinkage. In our study, similar findings were observed, where patients in the surgical group showed better overall satisfaction and reduced recurrence compared to those receiving only endodontic treatment.

Saatchi et al. (2007)[14] conducted a study on the healing of large periapical lesions after nonsurgical endodontic treatment. They found that nonsurgical treatments, when combined with antibiotics, could result in significant resolution of cystic lesions. However, our study demonstrated that the addition of apical surgery further enhanced healing, especially in larger or more persistent cysts, offering more favorable long-term results.

CONCLUSION

Our study's results, showing higher clinical success rates, better radiographic healing, and reduced recurrence with combined endodontic treatment and apical surgery, are consistent with findings from previous research. The combination of both techniques offers a more comprehensive approach to managing large periapical cysts and can improve both clinical and patient-reported outcomes compared to nonsurgical treatments alone. However, further studies with larger sample sizes and long-term follow-up are needed to validate these findings across a broader population.

DECLARATIONS

Ethics approval and consent to participate

Not applicable.

Conflict interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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