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RESEARCH ARTICLE OPEN ACCESS

Clinical and Radiographic Outcomes of Pulpectomy in Primary Second Molars with a History of Abscess or Facial Cellulitis: A Comparative Clinical Study

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Abstract:

Introduction: Odontogenic infections originating from primary teeth remain a frequent cause of pain, facial swelling, and systemic complications in children. Although pulpectomy is the treatment of choice for necrotic primary teeth, the influence of a previous history of abscess or facial cellulitis on treatment prognosis remains controversial. This study aimed to compare the clinical and radiographic success of pulpectomy in primary second molars with a history of abscess or facial cellulitis and those with irreversible pulpitis without prior infection.

Materials and Methods: This clinical study included 58 primary second molars in children aged 3–9 years (n=58). Teeth were allocated into a case group (necrotic teeth with a history of acute or chronic abscess or facial cellulitis, treated with two-visit pulpectomy) and a control group (vital teeth with irreversible pulpitis, treated with single-visit pulpectomy). All canals were instrumented manually, obturated with zinc oxide–eugenol, and restored with stainless steel crowns. Clinical and radiographic outcomes were evaluated after 6 months. Fisher's exact test was used for statistical analysis. Fisher's exact test was used for statistical analysis, and Relative Risk (RR) and Absolute Risk Reduction (ARR) were calculated. A *p*-value less than 0.05 was considered significant.

Results: Radiographic success was 89.7% in the case group and 88.9% in the control group (p = 1.00). Clinical success was 96.6% and 96.3%, respectively (p = 1.00). No statistically significant differences were observed between groups in any radiographic or clinical subgroup outcomes.

Discussion: Pulpectomy in necrotic primary second molars with a history of abscess or facial cellulitis demonstrates clinical and radiographic outcomes comparable to those of vital teeth.

Conclusion: When infection is properly managed and standard endodontic and restorative protocols are followed, prior odontogenic infection does not negatively affect prognosis.

Keywords: Pulpectomy, Primary teeth, Dental abscess, Facial cellulitis, Pediatric dentistry, Odontogenic infection.

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1. INTRODUCTION

Dental caries remains one of the most prevalent chronic diseases in childhood and frequently progresses to pulpal involvement due to the structural characteristics of primary teeth. Untreated pulpal disease may result in pain, impaired mastication, sleep disturbances, and reduced quality of life [1]. In advanced stages, odontogenic infections such as dentoalveolar abscesses and facial cellulitis may develop, which can progress rapidly in children and be associated with serious systemic complications [2].

Primary teeth play a critical role in maintaining arch length, guiding eruption of permanent successors, preserving oral function, and supporting speech and facial esthetics. Premature loss of primary molars, particularly second molars, may lead to malocclusion and functional problems [3]. Therefore, preserving primary teeth until their natural exfoliation is a fundamental principle in pediatric dentistry [4].

Pulpectomy is recommended by the American Academy of Pediatric Dentistry (AAPD) as the treatment of choice for necrotic primary teeth when adequate root structure remains [5, 6]. Despite this recommendation, clinicians often hesitate to perform pulpectomy in teeth with a history of abscess or facial cellulitis due to concerns about persistent infection, compromised healing, and potential effects on the permanent successor [7].

In a study by Mendoza *et al*., pulpectomized teeth with necrosis were studied, and complete resolution of pain, swelling, and fistula was observed within 6 months, as well as progressive healing of the radiolucent lesion on radiographs [8]. In a study by Shenkin, 308 pulpectomized teeth with irreversible pulpitis were treated with zinc oxide eugenol root filling material, and 100% clinical success and 93.5% radiological success were observed [9]. In a study by Gupta *et al*., 42 necrotic teeth were randomly assigned to two groups, and two root filling materials, zinc oxide eugenol and Metapex, were compared, and the results were almost similar for them [10].

According to AAPD, untreated dental caries and infections affect the ability to eat, resulting in poor nutritional intake and stunted or reduced growth in children, especially in low-income families [9]. Treatment of dental caries and infections increases growth rates and improves the quality of life of millions of children [11]. Odontogenic infections differ in children and adults. The course of facial infection in children is dynamic and more acute, associated with faster spread to deeper spaces, and leads to more systemic symptoms such as fever, dehydration, and impaired respiratory function in children; therefore, prompt treatment is necessary [12].

On the other hand, premature tooth loss due to necrosis and dental infection leads to malocclusion and functional, aesthetic, and phonetic problems, which can be prevented by preserving the tooth with timely pulpectomy [13]. Therefore, the primary objective of this study was to compare the clinical and radiographic success rates of pulpectomy in primary second molars with a history of dentoalveolar abscess or facial cellulitis (treated with a two-visit protocol) against vital teeth with irreversible pulpitis (treated with a single-visit protocol) over a 6-month follow-up period. The secondary objective was to evaluate specific failure criteria, including periapical/furcation radiolucencies, pathological resorption, recurrent pain, mobility, and sinus tract formation. We hypothesized that necrotic primary second molars with a prior history of acute or chronic abscess or facial cellulitis would demonstrate clinical and radiographic success rates comparable to those of vital teeth when proper disinfection and coronal sealing protocols are applied (null hypothesis).

2. MATERIALS AND METHODS

2.1. Sample Size

The sample size was calculated based on expecting a clinical/radiographic success rate of approximately 90% in primary molar pulpectomies according to previous literature. To detect a clinically relevant difference of 25% in success rates between the two groups with a statistical power of 80% ($\beta=0.20$) and a two-tailed significance level of 5% ($\alpha=0.05$), a minimum of 26 teeth per group was required. Anticipating a potential drop-out rate of approximately 10% during follow-up, 29 teeth were initially enrolled in each group (total N=58).

2.2. The Population and the Study Design

A total of 58 children aged 3–9 years requiring pulpectomy of a primary second molar were recruited. A total of 58 teeth were included and allocated into two groups. The case group consisted of 29 necrotic primary second molars with a documented history of acute or chronic abscess or facial cellulitis. The control group consisted of 29 vital primary second molars diagnosed with irreversible pulpitis.

2.3. Inclusion Criteria

Inclusion criteria were restorable teeth with more than two-thirds of root length remaining and absence of extensive internal or external root resorption. Teeth with lesions extending to the permanent tooth germ, advanced physiologic resorption, pathological mobility, or previous pulp therapy were excluded.

2.4. Procedures

All procedures were performed under local anesthesia and rubber dam isolation. Access cavities were prepared, and working length was determined radiographically. Canals were instrumented manually using K-files up to size 30 with copious saline irrigation. In the case group, treatment was completed in two visits, and children presenting with facial cellulitis received systemic antibiotics prior to endodontic treatment. In the control group, pulpectomy was completed in a single visit using the same protocol. In both groups, canals were obturated with zinc oxide–eugenol paste and restored with stainless steel crowns cemented with glass ionomer cement.

Given the anatomical complexity of primary molar root canal systems, including accessory canals and physiological resorption patterns, particular attention was paid to conservative instrumentation to prevent over-preparation and extrusion of obturation material beyond the apex. This approach was especially critical in teeth with previous infection, where periapical tissues may already be compromised. The two-visit protocol selected for teeth with a history of abscess or facial cellulitis was designed to allow additional microbial reduction and periapical tissue recovery prior to obturation. The use of an interim intracanal medicament and delayed obturation was intended to enhance bacterial suppression and reduce the risk of persistent infection. Antibiotic Therapy (AT) in cases presenting with facial cellulitis was prescribed strictly according to clinical indications and current pediatric guidelines, emphasizing that systemic antibiotics were used as an adjunct to, rather than a substitute for, definitive endodontic treatment.

To enhance methodological consistency and minimize operator-related bias, all clinical procedures in both study groups were performed according to a standardized and uniform protocol. The same instrumentation sequence, irrigation regimen, obturation material (zinc oxide–eugenol), and restorative approach were applied to all treated teeth to control for potential confounding variables. Manual instrumentation was selected to ensure precise canal debridement in primary teeth with complex root morphology. Repeated irrigation with normal saline and sodium hypochlorite was employed to reduce microbial load and remove necrotic debris, particularly in teeth with a previous history of infection.

All treated teeth were definitively restored with stainless steel crowns to ensure optimal coronal sealing and to minimize microleakage, which has been identified as a critical determinant of pulpectomy success in primary teeth. This standardized coronal restoration protocol was implemented to eliminate restoration-related variability between groups. Clinical and radiographic evaluations were independently performed by two experienced pediatric dentists who were blinded to the pulp status and group allocation of the teeth. This blinding process was designed to reduce assessment bias and improve the internal validity of the study.

2.5. Statistical Analysis

Clinical and radiographic evaluations were performed after 6 months by two independent pediatric dentists blinded to group allocation. Fisher's exact test was used for statistical analysis, and Relative Risk (RR) and Absolute Risk Reduction (ARR) were calculated. A *p*-value less than 0.05 was considered significant.

3. RESULTS

At the 6-month follow-up, complete data were available for 56 teeth (27 control, 29 case). The median age of participants was 5 years (interquartile range: 5–6), with a mean age of 5.59 ± 1.14 years. Sex distribution was identical between groups (Table 1).

Table 1. Demographic characteristics.

Variable	Total (n=58)	Control (n=29)	Case (n=29)
Age, mean ± SD	5.59 ± 1.14	5.79 ± 1.01	5.38 ± 1.24
Age, median (IQR)	5 (5–6)	6 (5–6.5)	5 (5–6)
Male, n (%)	32 (55.2)	16 (55.2)	16 (55.2)
Female, n (%)	26 (44.8)	13 (44.8)	13 (44.8)

Radiographic success was observed in 26 of 29 teeth (89.7%) in the case group and 24 of 27 teeth (88.9%) in the control group, with no statistically significant difference (p = 1.00; RR = 1.008). Table 2 shows the overall radiographic success.

Table 2. Overall radiographic success.

Outcome	Control (n=27)	Case (n=29)	*p*-value
Success	24 (88.9%)	26 (89.7%)	1.00
Failure	3 (11.1%)	3 (10.3%)	—

Clinical success was achieved in 28 of 29 teeth (96.6%) in the case group and 26 of 27 teeth (96.3%) in the control group (p = 1.00; RR = 1.002). Table 3 shows the overall clinical success.

Table 3. Overall clinical success.

Outcome	Control (n=27)	Case (n=29)	*p*-value
Success	26 (96.3%)	28 (96.6%)	1.00
Failure	1 (3.7%)	1 (3.4%)	—

Osseous radiolucency improvement was observed in 41.4% of the case group and 18.5% of the control group (p = 0.08). Periodontal ligament widening was detected in 10.3% of the case group and 11.1% of the control group (p = 1.00). Crypt involvement was observed in 6.9% of the case group and 3.7% of the control group (p = 1.00). Root resorption occurred in 10.3% of the case group and 11.1% of the control group (p = 1.00). Table 4 shows radiographic subgroup outcomes.

Clinically, pain and mobility were each observed in one tooth (3.7%) in the control group and none in the case group (p = 0.48). Gingival enlargement was detected in one tooth (3.4%) in the case group (p = 0.48). Erythema was present in one tooth in each group (p = 1.00). No teeth in either group exhibited percussion sensitivity (Table 5).

Table 4. Radiographic subgroup outcomes.

Parameter	Control n (%)	Case n (%)	*p*-value
Osseous radiolucency	5 (18.5)	12 (41.4)	0.08
PDL widening	3 (11.1)	3 (10.3)	1.00
Crypt involvement	1 (3.7)	2 (6.9)	1.00
Root resorption	3 (11.1)	3 (10.3)	1.00

Table 5. Clinical subgroup outcomes.

Parameter	Control n (%)	Case n (%)	*p*-value
Pain	1 (3.7)	0 (0)	0.48
Mobility	1 (3.7)	0 (0)	0.48
Percussion sensitivity	0 (0)	0 (0)	—
Gingival enlargement	0 (0)	1 (3.4)	0.48
Erythema	1 (3.7)	1 (3.4)	1.00

4. DISCUSSION

The primary aim of the present study was to evaluate whether a previous history of odontogenic infection, including dental abscess or facial cellulitis, influences the clinical and radiographic outcomes of pulpectomy in primary second molars. The results demonstrated that pulpectomy performed in necrotic primary teeth with prior infection achieved success rates comparable to those of vital teeth diagnosed with irreversible pulpitis. The present study demonstrated that pulpectomy in necrotic primary second molars with a history of abscess or facial cellulitis resulted in clinical and radiographic success rates comparable to those of vital primary second molars with irreversible pulpitis. Both groups exhibited high success rates, and no statistically significant differences were identified in overall outcomes or in any evaluated clinical or radiographic subgroups.

The radiographic success rates observed in this study are consistent with those reported in previous systematic reviews, which describe success rates ranging from 70% to 94% for pulpectomy in primary teeth [14]. Importantly, the similarity between groups suggests that preoperative infection status does not inherently compromise radiographic healing when proper canal debridement and coronal sealing are achieved. This finding is in agreement with studies by Holland *et al*. [15] and Khan *et al*., who reported that the presence of necrosis or previous infection did not adversely affect pulpectomy outcomes [16].

In contrast, some studies have reported lower success rates in infected primary teeth. Differences between those findings and the present results may be explained by variations in treatment protocols, particularly irrigation methods [17], obturation materials, and the quality of coronal restorations [17]. In the present study, all teeth were restored with stainless steel crowns, which likely minimized microleakage and contributed to the favorable outcomes [17]. Some studies have also shown that children have the highest rates of bone repair [18, 19].

Although osseous radiolucency improvement was numerically higher in the case group, this difference was not statistically significant. From a biological perspective, removal of necrotic tissue and microbial load may activate reparative pathways and osteoblastic activity, leading to radiographic evidence of healing [20, 21]. The comparable radiographic healing patterns observed in both groups may be explained by the high regenerative capacity of pediatric periapical tissues. Children exhibit accelerated bone turnover and enhanced inflammatory resolution, which may compensate for the initial severity of infection once the source of microbial irritation is eliminated [5, 22, 23].

In a study, Abanto *et al*. reported that after pulpectomy, clinical symptoms resolved in more than 94% of children within the first months [5]. Samir *et al*. also stated that the type of pulp diagnosis did not significantly affect the appearance of pain [24]. This result is consistent with our data.

However, there are studies with inconsistent results. A study by Mendoza *et al*. on pulpectomy treatment of necrotic primary teeth with a history of abscesses showed that treatment of these teeth is less successful than for healthy teeth. In this study, the success rate of treatment in primary teeth with a history of abscess was reported to be only 70%, while this rate was 90% in healthy teeth [8]. In a study by Shenkin *et al*., it was shown that primary teeth with a history of abscess or facial cellulitis are generally more difficult to treat and their success rate is significantly lower than in healthy teeth or teeth with a viable pulp. This study also concluded that additional treatments and continuous follow-up are necessary for primary teeth with a history of infection [9]. A study by Gupta *et al*. conducted on primary teeth with irreversible pulpitis and necrotic primary teeth states that pulpectomy treatment is less successful in primary teeth with a history of infection than in healthy teeth. Also, in necrotic teeth, the rate of infection recurrence and the need for follow-up treatments were observed to be higher [10]. In the study of Bawazir *et al*., they investigated the success of pulpectomy treatment in necrotic primary teeth using zinc oxide eugenol and showed that the success rate of treatment in primary teeth with a history of infection was significantly reduced compared to healthy teeth [25].

These findings of the current study support the hypothesis that when adequate infection control, thorough canal debridement, and appropriate coronal restoration are achieved, a history of odontogenic infection does not adversely affect pulpectomy prognosis. This is particularly relevant in pediatric patients, where bone healing capacity and regenerative potential are generally higher than in adults. The absence of statistically significant differences in radiographic subgroups, including osseous radiolucency, periodontal ligament widening, crypt involvement, and root resorption, suggests that periapical healing is more closely associated with treatment quality rather than the initial vitality status of the pulp [26]. Proper elimination of necrotic tissue and microbial contamination appears to promote favorable periapical repair even in previously infected teeth [27, 28]. From a clinical perspective, the high success rates observed in both groups indicate effective resolution of inflammatory signs such as pain, mobility, gingival changes, and percussion sensitivity. These outcomes reinforce the role of pulpectomy as a reliable and conservative treatment option for maintaining infected primary molars until their natural exfoliation.

Variability among previously published studies may also be attributed to differences in follow-up duration, operator experience, obturation techniques, and coronal restoration quality [29, 30]. In the present study, the uniform use of stainless steel crowns likely contributed to the high overall success rates by preventing coronal leakage and reinfection.

5. STUDY LIMITATIONS

Limitations of this study include the 6-month follow-up period, absence of Cone Beam Computed Tomography (CBCT) imaging, and small sample sizes in some subgroups. Longer follow-up and advanced imaging may provide additional insight into long-term outcomes.

CONCLUSION

Based on the findings of this study, a previous history of dental abscess or facial cellulitis should not be considered a contraindication for pulpectomy in primary second molars. When infection is appropriately managed and standard endodontic and restorative principles are strictly followed, favorable clinical and radiographic outcomes can be achieved. The results of this study support a more conservative treatment approach and may assist pediatric dentists in avoiding unnecessary extraction of infected primary molars, thereby preventing subsequent orthodontic, functional, and psychosocial complications associated with premature tooth loss. From a broader clinical perspective, preserving infected primary molars may reduce the need for space maintainers, decrease the risk of malocclusion, and support normal oral development, reinforcing the importance of conservative pulp therapy in pediatric dentistry.

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows: Z.E.A., M.K.: Conceptualization; A.V., N.T., M.D.: Data curation; M.K.: Formal analysis; Z.E.A.: Investigation; Z.E.A.: Methodology; Z.E.A.: Project administration; M.K.: Resources; Z.E.A.: Supervision; A.V., Z.E.A.: Validation; M.K., M.D.: Writing-original draft; Z.E.A., A.V.: Writing-review & editing.

LIST OF ABBREVIATIONS

AAPD = American Academy of Pediatric Dentistry

AT = Antibiotic therapy

CBCT = Cone Beam Computed Tomography

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This clinical study was conducted at the Faculty of Dentistry, Tabriz University of Medical Sciences, Iran following approval by the institutional ethics committee (IR.TBZMED.REC.1404.538).

HUMAN AND ANIMAL RIGHTS

All procedures involving human participants were conducted in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Written informed consent was obtained from parents or legal guardians.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supporting information is available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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