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EVALUATION OF THE CLINICAL AND RADIOGRAPHIC OUTCOMES OF PULPITIS TREATMENT IN PRIMARY MOLARS USING DEVITALIZING PASTES

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ABSTRACT

Pulpitis in primary teeth may cause pain, spread inflammation to the periodontal tissues, and result in premature tooth loss. Therefore, preserving primary molars until physiological exfoliation and evaluating treatment effectiveness using both clinical and radiographic criteria are important. This study aimed to evaluate the 3- and 6-month clinical and radiographic outcomes of pulpitis treatment in primary molars using devitalizing pastes. This retrospective observational study was conducted at the Surkhandarya Regional Pediatric Dental Clinic in 2025–2026. It included 44 primary molars from 38 children aged 4–9 years that had been treated with a devitalizing paste. Treatment outcomes were assessed according to the presence or absence of spontaneous pain, pain during mastication, tenderness to percussion, swelling, sinus tract formation, pathological mobility, furcation or periapical changes, and pathological root resorption. Three months after treatment, the overall clinical success rate was 90.9%, the radiographic success rate was 88.6%, and the combined clinical and radiographic success rate was 86.4%. At the 6-month follow-up, these rates decreased to 86.4%, 81.8%, and 79.5%, respectively. Complicated or unsuccessful cases accounted for 13.6% at 3 months and 20.5% at 6 months. The findings indicate that treatment with devitalizing pastes provides satisfactory short-term outcomes in primary molars with pulpitis. However, the higher proportion of radiographic complications at the longer follow-up indicates the need for regular clinical and radiographic monitoring of treated teeth.

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Keywords: *primary teeth, primary molars, pulpitis, devitalizing paste, devital method, clinical outcome, radiographic outcome, root resorption.*

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INTRODUCTION

The timely treatment of dental caries and its complications in primary teeth is an important clinical responsibility in pediatric dentistry. Primary teeth play essential roles in mastication, speech development, normal craniofacial growth, and maintaining adequate space for the eruption of permanent teeth. Untreated pulpitis in a primary tooth may cause pain, spread inflammation to the periodontal tissues, induce pathological root resorption, and result in premature tooth loss. Therefore, selecting an appropriate treatment method and regularly evaluating post-treatment outcomes are important aspects of pediatric dental practice.

The anatomy and physiology of primary teeth differ considerably from those of permanent teeth. Primary teeth have relatively thin enamel and dentin, large pulp chambers, and pulp horns located close to

the tooth surface. In addition, numerous accessory canals occur between the roots of primary molars, facilitating the rapid spread of inflammation to the furcation area. A child's age, psychological and emotional state, and level of cooperation during dental procedures also influence the choice of treatment. Therefore, the main objective of treating pulpitis in primary teeth is not only to relieve pain but also to preserve the tooth in a functional condition until physiological exfoliation.

The devital method involves devitalizing inflamed pulp tissue with a specialized paste and treating the devitalized tissue at a subsequent visit. This method has traditionally been used when adequate local anesthesia is difficult to achieve, when a child cannot cooperate sufficiently during the procedure, or when treatment must be completed over several visits. However, the composition and quantity of the devitalizing paste, the quality of the hermetic seal, and the duration of contact between the material and the pulp directly affect treatment safety. In particular, leakage of paraformaldehyde-containing preparations into the surrounding soft tissues may cause cytotoxic effects, gingival necrosis, periodontal tissue damage, and inflammatory changes in the alveolar bone [2].

Modern pediatric dentistry places particular emphasis on accurately assessing pulp status through clinical signs and radiographic findings. Evaluating treatment outcomes solely on the basis of pain relief is insufficient. A successful clinical outcome requires the absence of spontaneous pain, pain during mastication, swelling, sinus tract formation, pathological mobility, and tenderness to percussion. Radiographic examination should reveal no pathological changes in the furcation or periapical areas, no pathological internal or external root resorption, and no signs of adverse effects on the underlying permanent tooth germ. The American Academy of Pediatric Dentistry guidelines also state that the overall success of pulp therapy in primary teeth should be determined through a combined assessment of clinical and radiographic outcomes [1].

Although vital pulp therapy with highly biocompatible calcium silicate cements has become increasingly common in contemporary pediatric dentistry, investigating the outcomes of primary teeth treated with devitalizing pastes remains scientifically relevant. Such analysis can identify favorable outcomes, potential complications, and the clinical and radiographic signs that require attention during follow-up. In particular, it is important to assess tooth retention over time, the absence of recurrent pain and inflammation, and changes in the root and furcation areas.

Accordingly, the aim of this study was to evaluate the clinical and radiographic outcomes of pulpitis treatment in primary molars using devitalizing pastes.

LITERATURE REVIEW

Treatment approaches for pulpitis in primary teeth have evolved to include methods that devitalize pulp tissue, partially preserve pulp vitality, or stimulate biological regeneration. The traditional devital method is based on the chemical devitalization of inflamed pulp tissue, followed by the removal or mummification of the coronal pulp. This approach has been used when adequate local anesthesia is difficult to achieve, when a child demonstrates limited cooperation during dental procedures, or when treatment must be completed in several stages. However, its clinical effectiveness depends on the composition and quantity of the preparation, the duration of exposure, the quality of the hermetic seal, and the initial condition of the pulp.

S. Vilella-Pastor et al. investigated the long-term outcomes of pulpotomies performed with mineral trioxide aggregate (MTA) and Biodentine in primary molars in a randomized clinical trial. A total of 84 pulpotomy cases were monitored clinically and radiographically at 6, 12, 18, and 24 months. At the end of the 24-month follow-up, the overall success rate was 99.4% in the Biodentine group and 97.2% in the MTA group, with no statistically significant difference between the groups. The authors identified the absence of pain, swelling, pathological mobility, sinus tract formation, and pathological radiographic changes as the principal criteria for treatment success [3].

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N. Tewari et al. synthesized evidence from systematic reviews of the medicaments and techniques used for pulpotomy in primary teeth and analyzed their clinical and radiographic effectiveness. The findings showed that most pulpotomy medicaments and techniques, except calcium hydroxide, achieved success rates above 80%. In several comparisons, MTA produced better outcomes than calcium hydroxide and formocresol. However, the authors emphasized that differences in follow-up duration, patient-selection criteria, medicaments, and methods of evaluating treatment success limited the generalizability of the conclusions [4].

In a randomized, double-blind clinical trial, A. Eshghi et al. compared pulpotomies performed with MTA and Biodentine in mandibular second primary molars diagnosed with irreversible pulpitis. The treated teeth were examined clinically every three months for 12 months and radiographically at 6 and 12 months. No statistically significant differences in clinical or radiographic success were found between the MTA and Biodentine groups. Kaplan–Meier analysis also demonstrated similar survival rates for teeth treated with the two materials. The study showed that treatment outcomes are influenced not only by the material used but also by the initial condition of the pulp, adequate bleeding control, and high-quality hermetic sealing of the tooth cavity [5].

A network meta-analysis conducted by J. Guo, N. Zhang, and Y. Cheng synthesized the findings of 43 randomized clinical trials of pulpotomy in primary molars. The analysis compared the clinical and radiographic effectiveness of formocresol, ferric sulfate, sodium hypochlorite, calcium hydroxide, MTA, Biodentine, and laser techniques. MTA was associated with higher clinical and radiographic success rates than many other medicaments and techniques and had the highest probability of being the optimal treatment material. Calcium hydroxide produced less favorable outcomes than the other materials. The authors identified the absence of spontaneous pain, swelling, sinus tract formation, pathological mobility, tenderness to percussion, and radiographic pathology as essential criteria for treatment success [6].

The reviewed literature demonstrates that contemporary studies of pulp therapy in primary teeth have focused mainly on vital pulpotomy techniques using biocompatible materials. In contrast, relatively few studies have directly evaluated the clinical and radiographic outcomes of primary molars treated with devitalizing pastes. Therefore, assessing recurrent pain, swelling, sinus tract formation, pathological mobility, furcation changes, pathological root resorption, and tooth retention after treatment with the devital method is of considerable scientific and practical importance.

This line of research can clarify the clinical outcomes of treatment with devitalizing pastes, facilitate the prompt identification of post-treatment complications, and establish clinically relevant criteria for the clinical and radiographic follow-up of treated primary molars.

RESEARCH METHODOLOGY

This retrospective observational study evaluated the clinical and radiographic outcomes of pulpitis treatment in primary molars using devitalizing pastes. The principal recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were considered during study design, participant selection, variable definition, and reporting [7]. The STROBE guidelines promote clear reporting of the study design, participants, variables, data-collection procedures, potential sources of bias, and findings.

The study was conducted at the Surkhandarya Regional Pediatric Dental Clinic. It reviewed the outpatient records and radiographs of children aged 4–9 years who had been treated for pulpitis in primary molars during 2025–2026. Each primary molar treated with a devitalizing paste was considered an individual unit of analysis. When a child had more than one treated tooth, each tooth was recorded as a separate clinical case.

Cases were eligible when they met all of the following criteria: the child was 4–9 years old; a first or second primary molar had been diagnosed with pulpitis; the tooth had been treated with a devitalizing paste; pre-treatment and post-treatment clinical findings were completely documented in the outpatient

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record; baseline and follow-up radiographs were available; and the treated tooth had been followed for at least six months.

Cases were excluded when documentation of the diagnosis, treatment stages, or follow-up findings was incomplete. Additional exclusion criteria were poor-quality radiographs, physiological root resorption exceeding one-third of the total root length, pathological changes affecting the permanent tooth germ, and extensive destructive lesions in the furcation or periapical area before treatment.

The following variables were entered into a specially designed data-collection form: the child's age and sex; the type of tooth treated; its maxillary or mandibular location; the type of devitalizing paste used; the treatment date; and the duration of follow-up. The treated teeth were classified as first or second primary molars and as maxillary or mandibular teeth.

Treatment followed the clinical protocol documented in the outpatient records. First, carious tissue was removed, the pulp chamber was opened, and the devitalizing paste was applied according to the manufacturer's instructions. The cavity was then hermetically sealed with a temporary restorative material. At the subsequent visit, the devitalized pulp tissue was treated according to the documented protocol; the cavity was then filled with an appropriate material, and a permanent restoration was placed. No additional procedures were performed for this study; only records of previously completed treatment were retrospectively analyzed.

Treatment outcomes were evaluated clinically and radiographically at the 3- and 6-month follow-up examinations. Previous studies of pulp therapy outcomes in primary molars have also used 3- and 6-month follow-up periods and combined clinical and radiographic criteria for success [8].

The clinical assessment included spontaneous pain, pain during mastication, tenderness to percussion, swelling of the gingiva and surrounding soft tissues, sinus tract formation, pathological mobility, and retention of the treated tooth in the dental arch. Cases without spontaneous pain, pain during mastication, tenderness to percussion, swelling, sinus tract formation, or pathological mobility were considered clinically successful. A case with at least one of these signs was classified as a clinical failure.

During the radiographic assessment, baseline intraoral radiographs were compared with follow-up radiographs. The assessment covered radiolucent lesions in the furcation area, periapical pathological changes, widening of the periodontal ligament space, internal root resorption, pathological external root resorption, and signs of adverse effects on the permanent tooth germ.

Teeth without furcation or periapical destruction, pathological internal or external root resorption, or adverse periodontal changes were considered radiographically successful. Cases in which pathological changes were detected radiographically, even in the absence of clinical signs, were included in the overall treatment-failure group.

Overall treatment success was determined through a combined assessment of clinical and radiographic criteria. Cases without clinical symptoms or radiographic pathology were classified as successful. Cases with at least one unfavorable clinical or radiographic finding were classified as complicated or unsuccessful.

The data were analyzed using descriptive statistical methods. Categorical variables were expressed as absolute numbers (n) and percentages (%). A 95% confidence interval (95% CI) was calculated for each proportion using the Wilson method, which provides more reliable estimates in small samples. Because multiple teeth could come from the same patient and tooth-level paired follow-up data were unavailable, p-values were not calculated for comparisons between the follow-up periods. The findings were therefore presented as proportions with 95% confidence intervals. All confidence intervals were two-sided.

Patient confidentiality was maintained throughout the study. Data obtained from the outpatient records were coded, and the children's names were not disclosed during the analysis. The study was conducted with appropriate authorization from the administration of the Surkhandarya Regional Pediatric Dental Clinic.

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ANALYSIS AND RESULTS

The outpatient records of patients treated at the Surkhandarya Regional Pediatric Dental Clinic during 2025–2026 were reviewed. Based on the established inclusion and exclusion criteria, 44 primary molars from 38 children aged 4–9 years were included in the study. When a child had more than one treated tooth, each tooth was evaluated as a separate unit of observation.

The participants were divided into two age groups: 4–6 years and 7–9 years. The treated teeth were classified by tooth type (first or second primary molar) and jaw location (maxilla or mandible). The general characteristics of the children and treated teeth are presented in Table 1.

Table 1.

General characteristics of the children and treated primary molars included in the study

Indicator	Group	Number, n	Proportion, %
Children	Total	38	100
Sex	Boys	20	52.6
	Girls	18	47.4
Age	4–6 years	23	60.5
	7–9 years	15	39.5
Treated teeth	Total primary molars	44	100
Tooth type	First primary molar	19	43.2
	Second primary molar	25	56.8
Location by jaw	Maxilla	20	45.5
	Mandible	24	54.5

Of the 38 participants, 20 (52.6%) were boys and 18 (47.4%) were girls. Children aged 4–6 years constituted the majority of the study population, with 23 participants (60.5%).

Of the 44 treated primary molars, 19 (43.2%) were first primary molars and 25 (56.8%) were second primary molars. Regarding jaw location, 24 teeth (54.5%) were mandibular and 20 (45.5%) were maxillary.

The outcomes of primary molars treated with devitalizing pastes were evaluated using clinical and radiographic criteria at 3 and 6 months after treatment. The clinical assessment included spontaneous pain, pain during mastication, tenderness to percussion, swelling, sinus tract formation, and pathological mobility. The radiographic assessment included pathological changes in the furcation and periapical areas and pathological root resorption.

Previous studies of pulp therapy in primary molars have defined clinical success by the absence of pain, swelling, sinus tract formation, pathological mobility, and tenderness to percussion. Furcation changes and pathological root resorption have been identified as signs of radiographic failure [9].

Table 2.

Clinical and radiographic outcomes of primary molars treated with devitalizing pastes at the 3- and 6-month follow-ups

Assessment indicator	After 3 months, n (%) [95% CI]	After 6 months, n (%) [95% CI]
No spontaneous pain	42 (95.5) [84.9–98.7]	40 (90.9) [78.8–96.4]
No pain during mastication	41 (93.2) [81.8–97.7]	39 (88.6) [76.0–95.0]
No tenderness to percussion	42 (95.5) [84.9–98.7]	40 (90.9) [78.8–96.4]

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No swelling or sinus tract	43 (97.7) [88.2–99.6]	41 (93.2) [81.8–97.7]
No pathological mobility	43 (97.7) [88.2–99.6]	41 (93.2) [81.8–97.7]
No furcation or periapical changes	40 (90.9) [78.8–96.4]	37 (84.1) [70.6–92.1]
No pathological root resorption	41 (93.2) [81.8–97.7]	38 (86.4) [73.3–93.6]
Overall clinical success	40 (90.9) [78.8–96.4]	38 (86.4) [73.3–93.6]
Overall radiographic success	39 (88.6) [76.0–95.0]	36 (81.8) [68.0–90.5]
Overall combined clinical and radiographic success	38 (86.4) [73.3–93.6]	35 (79.5) [65.5–88.8]
Unsuccessful or complicated cases	6 (13.6) [6.4–26.7]	9 (20.5) [11.2–34.5]

At the 3-month follow-up, spontaneous pain was absent in 42 teeth (95.5%), pain during mastication was absent in 41 teeth (93.2%), and tenderness to percussion was absent in 42 teeth (95.5%). Swelling or sinus tract formation and pathological mobility were each absent in 43 teeth (97.7%).

At the 3-month follow-up, overall clinical success was recorded in 40 teeth (90.9%). Radiographic examination revealed no pathological furcation or periapical changes in 40 teeth, while pathological root resorption was absent in 41 teeth. Overall radiographic success was recorded in 39 teeth (88.6%).

When the clinical and radiographic findings were evaluated together, 38 teeth (86.4%) were classified as successful at the 3-month follow-up. Clinical or radiographic complications were identified in six teeth (13.6%).

At the 6-month follow-up, several outcome indicators had declined. Spontaneous pain was absent in 40 teeth (90.9%), pain during mastication was absent in 39 teeth (88.6%), and tenderness to percussion was absent in 40 teeth (90.9%). Swelling or sinus tract formation and pathological mobility were each absent in 41 teeth (93.2%).

At the 6-month follow-up, overall clinical success was observed in 38 teeth (86.4%). No pathological furcation or periapical changes were detected in 37 teeth, while seven teeth showed radiographic changes of varying severity in these areas. Pathological root resorption was absent in 38 teeth (86.4%).

Overall radiographic success was recorded in 36 teeth (81.8%). Some teeth were included in the overall treatment-failure group because pathological radiographic changes were detected despite the absence of clinical symptoms. Previous studies have likewise reported that clinical success rates may exceed radiographic success rates [10]. Therefore, radiographic monitoring of treated primary teeth is important even when patients have no clinical complaints.

At the 6-month follow-up, overall combined clinical and radiographic success was recorded in 35 teeth (79.5%). Unfavorable clinical or radiographic findings were identified in nine teeth (20.5%). Because multiple clinical and radiographic findings could occur simultaneously in a single tooth, the total number of individual complications did not necessarily equal the total number of unsuccessful cases.

Contemporary clinical studies have shown that, even when clinical outcomes are favorable after the use of certain pulpotomy materials, internal root resorption, furcation radiolucency, or other pathological signs may still be detected during radiographic follow-up [11]. Systematic reviews and meta-analyses have likewise emphasized the importance of considering clinical and radiographic outcomes together when evaluating the effectiveness of pulp therapy in primary teeth [12].

The overall combined clinical and radiographic success rate for primary molars treated with devitalizing pastes was 86.4% at three months (95% CI: 73.3–93.6) and 79.5% at six months (95% CI: 65.5–88.8). The proportion of complicated cases was 13.6% (95% CI: 6.4–26.7) and 20.5% (95% CI: 11.2–34.5), respectively. Because no paired inferential comparison was performed and no control group was

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included, the observed reduction cannot be interpreted as a statistically confirmed effect of time or as evidence of superiority over another treatment method. These findings describe the outcomes of the devital method within the present sample.

This retrospective, single-center observational study did not include a control group treated with vital pulpotomy or another method. Therefore, the findings represent only the clinical and radiographic outcomes observed in this sample and do not demonstrate the comparative effectiveness of devitalizing pastes relative to other treatment approaches.

The sample was limited to 38 children and 44 primary molars. In addition, more than one tooth from some children was included as a unit of observation, which may have reduced the independence of the observations and limited the generalizability of the findings. Wilson 95% confidence intervals were provided for all principal proportions to indicate statistical uncertainty. However, because tooth-level paired outcome data at 3 and 6 months were unavailable, McNemar's test and regression analyses appropriate for clustered data were not performed. Future studies should include a larger sample with a prospectively determined sample size, an independent control group, individual paired data, and a statistical model that accounts for patient-level clustering.

CONCLUSIONS AND RECOMMENDATIONS

This retrospective observational study described the short-term clinical and radiographic outcomes of primary molars treated with devitalizing pastes. Three months after treatment, the overall clinical success rate was 90.9% (95% CI: 78.8–96.4), the radiographic success rate was 88.6% (95% CI: 76.0–95.0), and the combined clinical and radiographic success rate was 86.4% (95% CI: 73.3–93.6).

At the 6-month follow-up, the overall clinical success rate was 86.4% (95% CI: 73.3–93.6), the radiographic success rate was 81.8% (95% CI: 68.0–90.5), and the combined clinical and radiographic success rate was 79.5% (95% CI: 65.5–88.8). Because the study did not include a control group, these findings should not be interpreted as evidence that the devital method is superior to other treatment methods.

Clinical success rates were higher than radiographic success rates. In some teeth, clinical signs such as pain, swelling, sinus tract formation, and pathological mobility were absent, whereas radiographic examinations revealed furcation or periapical changes and pathological root resorption. Therefore, clinical symptoms alone are insufficient for evaluating primary molars treated with the devital method.

The findings indicate that treatment with devitalizing pastes may keep primary molars functional in the dental arch for a limited period. However, treatment effectiveness depends on correct application of the preparation, a high-quality hermetic seal, and regular clinical and radiographic monitoring.

Practical Recommendations

1. Before a devitalizing paste is applied, the clinical condition of the pulp, the degree of physiological root resorption, and the radiographic condition of the furcation area should be thoroughly evaluated.
2. Only the minimum amount required under the manufacturer's instructions should be applied. The tooth cavity should be hermetically sealed during both the temporary and permanent restoration stages.
3. Treated primary molars should undergo clinical and radiographic follow-up examinations at 3 and 6 months. If pathological changes are detected, the treatment strategy should be reconsidered.

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