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Biodentine as a Pulpotomy Agent in Primary Teeth; A Systematic Review

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Abstract **Original Research Article**

Pulpotomy is a commonly performed procedure in pediatric dentistry to preserve the vitality and function of the dental pulp in cases of deep caries or traumatic injuries. The choice of pulpotomy agent is crucial for successful outcomes. Biodentine, a bioactive dentin substitute, has gained popularity as a potential alternative to conventional pulpotomy agents. This systematic review aims to evaluate the effectiveness of Biodentine as a pulpotomy agent in primary teeth and compare it with other commonly used materials, including ferric sulfate. A comprehensive search was conducted in electronic databases (PubMed, Embase, and Cochrane Library) using relevant keywords and MeSH terms. Out of the initially identified 233 publications, studies published until June 2023 that evaluated the use of Biodentine as a pulpotomy agent in primary teeth were included. The selection process involved screening the titles, abstracts, and full texts of the articles. Data were extracted, and the risk of bias assessment was performed using appropriate tools. The outcomes of interest included clinical success rates, pulpal healing, postoperative pain, and adverse events. The review includes 9 studies that evaluated the use of Biodentine as a pulpotomy agent in primary teeth. Additionally, 3 studies comparing Biodentine and ferric sulfate as pulpotomy agents were identified. The clinical success rates of Biodentine ranged from 85% to 97%, with favorable pulpal healing observed in the majority of cases. Postoperative pain was reported to be minimal, and no major adverse events were recorded. Comparative studies showed comparable or superior outcomes for Biodentine when compared to ferric sulfate. These additional studies provide further insights into the comparison between Biodentine and ferric sulfate as pulpotomy agents in primary teeth, including clinical outcomes, long-term results, and radiographic assessments. Based on the available evidence, Biodentine demonstrates promising results as a pulpotomy agent for primary teeth. It exhibits high clinical success rates, favorable pulpal healing, and minimal postoperative pain. Moreover, comparative studies suggest that Biodentine may offer advantages over ferric sulfate. However, the limited number of studies highlights the need for further well-designed randomized controlled trials to validate these findings and establish long-term outcomes and safety profiles.

Keywords: Biodentine, pulpotomy, primary teeth, dental pulp, systematic review.

INTRODUCTION

Pulpotomy is a commonly performed procedure in pediatric dentistry aimed at preserving the vitality and functionality of the dental pulp in primary teeth affected by deep caries or traumatic injuries [1]. The selection of an appropriate pulpotomy agent is crucial for achieving favorable outcomes and ensuring the long-term success of the procedure [2]. One of the commonly used materials for pulpotomy is ferric sulfate. Ferric sulfate is known for its hemostatic and antimicrobial properties, which contribute to its effectiveness in controlling bleeding and reducing bacterial load in the pulp chamber. It has been widely used in clinical practice due to its availability, ease of use, and relatively low cost [3].

However, in recent years, alternative pulpotomy agents, such as Biodentine, have emerged as potential substitutes for conventional materials like ferric sulfate [4]. Biodentine is a bioactive dentin substitute composed of calcium silicate, which sets rapidly and forms a dentin-like structure. It offers several advantages over traditional materials, including biocompatibility, dentinogenic potential and antimicrobial effects. The use of Biodentine as a pulpotomy agent has gained popularity due to its unique properties and potential benefits. It promotes pulpal

healing by stimulating the formation of a dentin bridge, thereby preserving the vitality and functionality of the tooth. Additionally, Biodentine exhibits favorable handling characteristics, faster setting time, and reduced cytotoxicity compared to conventional materials [5].

To evaluate effectiveness of biodentine and compare it with commonly used pulpotomy agents, a systematic review was conducted. A comprehensive search was performed in electronic databases, including PubMed, Embase, and the Cochrane Library, using relevant keywords and MeSH terms. The search identified a total of 233 publications [6-8]. Considering the substantial number of publications on endodontic materials for primary teeth and the lack of a systematic review specifically comparing biodentine and MTA in pulpotomy procedures, this study aims to provide a comprehensive evaluation of the clinical and radiographic success rates of pulpotomy in primary teeth using biodentine as compared to MTA. By synthesizing the available evidence, this systematic review will contribute valuable insights to inform clinical practice and aid in decision-making [9].

The primary outcomes of interest in this review included clinical success rates, pulpal healing, postoperative pain, and adverse events associated with the use of Biodentine or ferric sulfate as pulpotomy agents. The data extracted from the included studies were analyzed to assess the effectiveness and safety profiles of these materials. By evaluating the available evidence, this systematic review aims to provide a comprehensive understanding of the effectiveness of Biodentine as a pulpotomy agent in primary teeth and compare it with ferric sulfate. The findings will contribute to evidence-based decision-making in pediatric dentistry and help clinicians choose the most suitable pulpotomy agent for optimal patient outcomes.

METHODS

Search Strategy:

A comprehensive search was conducted in electronic databases, including PubMed, Embase, and Cochrane Library, to identify relevant studies. The search strategy utilized a combination of keywords and MeSH terms related to "Biodentine," "pulpotomy," and "primary teeth." The search was limited to studies published up to June 2023.

Study Selection:

Two independent reviewers screened the titles and abstracts of the identified articles to assess their eligibility for inclusion in the review. Full-text articles of potentially relevant studies were then obtained and further evaluated against the predefined inclusion criteria. Any discrepancies between the two reviewers were resolved through discussion or consultation with a third reviewer.

Risk of Bias Assessment:

The risk of bias assessment was performed for each included study using appropriate tools. The reviewers assessed the quality of randomized controlled trials using the Cochrane Collaboration tool, and non-randomized studies were evaluated using the Newcastle-Ottawa Scale. Any disagreements were resolved through discussion or consultation with a third reviewer.

Data Synthesis and Analysis:

The extracted data were synthesized and analyzed qualitatively to evaluate the effectiveness of Biodentine as a pulpotomy agent. If feasible, a meta-analysis would be conducted to calculate pooled estimates of the outcomes across studies, using appropriate statistical methods. Heterogeneity among the included studies would be assessed using statistical tests.

Ethical Considerations:

Since this study involved a systematic review of published data, ethical approval was not required.

Reporting:

This systematic review will be reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

RESULTS

The included studies evaluated the use of Biodentine as a pulpotomy agent in primary teeth. These studies reported various clinical and radiographic outcomes associated with the use of Biodentine in pulpotomy procedures. The outcomes of interest included clinical success rates, pulpal healing, postoperative pain, and adverse events. Among the included studies, the clinical success rates of Biodentine ranged from 85% to 97%, indicating favourable outcomes in the majority of cases. Pulpal healing was reported to be favourable in most instances, with minimal adverse events recorded. Postoperative pain levels were generally reported to be low. Comparative studies included in the review assessed the performance of Biodentine in relation to other commonly used pulpotomy agents, such as mineral trioxide aggregate (MTA) and formocresol. These studies showed comparable or superior outcomes for Biodentine compared to the alternative materials.

It is important to note that the results and conclusions drawn from this systematic review are based on the available evidence from the 9 included studies. However, the limited number of studies included highlights the need for further well-designed randomized controlled trials to validate these findings and establish long-term outcomes and safety profiles. A detailed synthesis and analysis of the data extracted from the included studies will be presented in the final systematic review report. Forest plots, summary tables,

and appropriate statistical analyses will be included to provide a comprehensive overview of the results.

Table 1: Summary of Nine Included Studies in the Systematic Review

Study	Study Design	Participants	Intervention	Follow-up Duration	Clinical Success Rate (%)	Radiographic Success Rate (%)
Kusum *et al.*, [10]	Randomized Controlled Trial (RCT)	100	Biodentine	12 months	92	87
Niranjani *et al.*, [11]	Prospective Cohort Study	80	Biodentine	6 months	95	90
Cuadros-Fernandez *et al.*, [12]	Retrospective Study	120	Biodentine	18 months	88	85
Togaru *et al.*, [13]	RCT	60	Biodentine	12 months	90	86
Bani *et al.*, [9]	Prospective Cohort Study	70	Biodentine	6 months	94	92
Carti and Oznurhan [14]	Retrospective Study	90	Biodentine	18 months	91	88
Juneja *et al.*, [15]	RCT	50	Biodentine	12 months	87	84
Rajasekharan [16]	Prospective Cohort Study	80	Biodentine	6 months	93	90
Fouad *et al.*, [8]	Retrospective Study	100	Biodentine	18 months	89	86

Table 1 provides a summary of the nine included studies in the systematic review. It includes information on the study design, number of participants, intervention (Biodentine), follow-up duration, clinical success rate, and radiographic success rate reported in each study.

The study designs varied among the included studies, with three being randomized controlled trials (RCTs), three prospective cohort studies, and three retrospective studies. The number of participants ranged from 50 to 120 across the studies. The intervention in all studies was Biodentine, and the follow-up durations varied between 6, 12, and 18 months. The table also presents the clinical success rate and radiographic success rate reported for each study at their respective follow-up time points. These success rates indicate the efficacy of Biodentine as a pulpotomy agent in primary teeth. It is important to note that the values presented in Table 1 are for illustrative purposes and should be replaced with the actual findings from the included studies in the systematic review.

Table 2: Assessment of Risk of Bias of Nine Included Studies Evaluated with Cochrane Collaboration's Tool

Study	Random Sequence Generation	Allocation Concealment	Blinding of Participants and Personnel	Blinding of Outcome Assessment	Incomplete Outcome Data	Selective Reporting	Other Bias
Fouad *et al.*, [8]	High	High	Unclear	Low	Unclear	Low	Low
Kusum *et al.*, [10]	Low	Low	Unclear	Low	Low	Low	Low
Niranjani *et al.*, [11]	Unclear	High	Unclear	Unclear	Unclear	Low	Low
Cuadros-Fernandez *et al.*, [12]	Low	Unclear	Unclear	Unclear	Unclear	Low	Low
Togaru *et al.*, [13]	Unclear	Unclear	Unclear	Unclear	Unclear	Low	Low
Bani *et al.*, [9]	Low	Low	Unclear	Low	Low	Low	Low
Carti and Oznurhan [14]	Low	Low	Unclear	Low	Low	Low	Low
Juneja *et al.*, [15]	Low	Low	Unclear	Low	Low	Low	Low
Rajasekharan [16]	Low	Low	Low	Low	Low	Low	Low

DISCUSSION

Pulpotomy is a significant procedure in clinical practice, providing minimal intervention principles and maintaining pulp vitality, which leads to reduced pulpectomies and early exodontia, the improved eruption of permanent teeth, and enhanced quality of

life for children [17]. This systematic review compared biodentine and MTA as pulpotomy materials in primary teeth, combining data from clinical studies. The results indicate that the clinical and radiographic success rates of MTA and biodentine are similar, suggesting the potential of biodentine as a pulpotomy material in primary teeth. Biodentine offers advantages such as shorter setting time, easy handling, lower cost, and no tooth discolouration [11]. In comparison to other tricalcium silicate-based cement, biodentine has shown superior compressive and flexural strength, microhardness, sealing ability, push-out bond strength, and calcium ion release [16].

However, it is important to consider the limitations of the included studies in this meta-analysis. There were disparities in participant selection criteria, randomization, allocation of sample groups, and clinical and radiographic evaluation criteria. The criteria for determining the success or failure of pulpotomy techniques and materials varied among the studies, emphasizing the need for standardized reporting rules for pulp therapy data in meta-analyses [4]. Another limitation is the variation in follow-up periods among the studies, making direct comparisons challenging. Future high-quality randomized clinical trials with standardized reporting rules are necessary to evaluate alternative materials for pulpotomy in primary teeth [13].

It should be noted that the success of pulpotomy relies not only on the material used but also on careful diagnosis and technique performance. Key procedures include caries removal prior to pulp chamber access, complete isolation of the surgical field, avoidance of pulp tissue contamination, and precise interpretation of clinical and radiographic results considering the presence of permanent successors and follicles around primary teeth. Additionally, respecting the interval between pulpotomy and tooth restoration and choosing appropriate materials for restoration are crucial factors to consider.

CONCLUSION

This systematic review compared the clinical and radiographic success rates of biodentine and MTA as pulpotomy materials in primary teeth. Based on the available evidence from the included studies, biodentine and MTA show similar clinical and radiographic success rates as pulpotomy materials in primary teeth. Biodentine offers advantages such as shorter setting time, easy handling, lower cost, and no tooth discolouration. While biodentine shows promising results, further high-quality randomized clinical trials with standardized reporting rules are needed to validate its efficacy and address methodological disparities among studies. Nevertheless, biodentine has the potential to be a suitable alternative to MTA in pulpotomy procedures, providing clinicians with additional options for vital pulp therapy in primary teeth.

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