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Comparison of Post-Operative Pain in Mandibular and Maxillary 1st and 2nd Molars after Pulp Capping with Biodentine and Endosequence Root Repair Material as Pulp Capping Agent

Muzammil Jamil Ahmed Rana, Mehmood Ahmed Rana, Sadaf Islam, Ajmal Yousaf Bangash, Sara Bano, Sara Hamdani

Armed Forces Institute of Dentistry/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To analyze and compare the response of human pulpal pain with Bio-dentine and Endo-sequence root repair material as pulp capping agents.

Study Design: Quasi-experimental study.

Place and Duration of Study: Operative Dentistry Department, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Feb 2019 to Aug 2020.

Methodology: This study was performed on 100 maxillary and mandibular vital permanent molars with symptoms of reversible pulpitis. Patients were divided into two groups, with 50 patients in each group. In Group-A, Bio-dentine was used as a pulp capping agent whereas Endo-sequence root repair material was used for pulp capping in Group-B. Patients of both groups were then recalled after one week, one month and three months. A visual analogue scale was used to record the intensity of pain.

Results: In a sample size of 100 patients, 16% were maxillary first molars, 4% were maxillary second molars, 26% were mandibular second molars, and 54% were mandibular first molars. Between Groups A and B, four patients from Group-A (8%) and three patients from Group-B (6%) complained of pain of mild category (1-3), according to VAS. The rest of the patients remained asymptomatic at 1 and 3-months follow-up (*p*-value=0.695). Hence no significant difference was found in the post-operative pain following pulp capping with Bio-dentine and Endo-sequence root repair material.

Conclusion: Bio-dentine and Endo-sequence root repair material has comparable effectiveness. Hence, they can be used as suitable pulp capping agents.

Keywords: Bio-ceramic material, Bio-dentine, Endo-sequence, Pulp capping, Pulp capping agent.

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INTRODUCTION

Pulp capping is defined as treating an exposed vital pulp by sealing the pulpal wound with a biocompatible material to facilitate reparative dentin formation and maintenance of vital pulp.[1] Selecting pulp capping material is an important factor for successful vital pulp therapy. White Mineral trioxide (MTA) has recently been introduced as a potential pulp-capping agent with higher biocompatibility and superior sealing ability than calcium hydroxide.[2] However, MTA has some disadvantages of difficult handling, tooth discolouration and long setting time.[3]

Biodentine is a calcium silicate cement that resembles MTA. It is used as a substitute for dentin and stimulates tertiary dentin formation as a pulp-capping agent [4]. Endosequence root repair material is a newly developed calcium silicate-based bioactive ceramic.[5] It is available as premixed condensable putty or white paste. It surpasses the limitations of MTA and has excellent biological and mechanical properties, easy manipulation, and is highly biocompatible, hydrophilic, radiopacity, osteogenic and insoluble.[6,7] It is moisture sensitive and sets in two hours. Dentin provides sufficient moisture for the setting of the material, which reaches the root canal through dentinal tubules, eliminating the need to add moisture before placing the material. It has satisfactory biocompatibility, sealing ability and antibacterial activity. ERRM can be used as a potential pulp capping material as it upregulates the expressions of mineralization-related genes.[8,9]

Successful pulp capping in an immature tooth will allow the roots to continue to mature in thickness and length.[10] Similarly, in a mature tooth, root canal therapy may be avoided in the future by giving the tooth a chance to repair. Therefore, our study was conducted to compare the post-operative pain followed by pulp capping of a tooth with deep carious lesion while using two different pulp capping agents, Biodentine and Endosequence BC RRM.

Correspondence: Dr Sadaf Islam, Representative Operative Dentistry, AFID, Rawalpindi, Pakistan

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METHODOLOGY

This quasi-experimental study was conducted at the Department of Operative Dentistry at the Armed Forces Institute of Dentistry, Rawalpindi Pakistan, after approval from the Ethical Committee (IRB number 90/ Trg–ABP1K2). This study was carried out from February 2019 to August 2020. The sample size was calculated using OpenEpi sample size calculator with a 9% margin of error, 50% anticipated frequency and a confidence level of 95%.[9]

Inclusion Criteria: Patients with asymptomatic maxillary/mandibular vital first or second permanent molars with deep carious lesions in proximity to the pulp chamber identified on radiographic and clinical examination were included through the non-probability convenience sampling technique.

Exclusion Criteria: Patients with symptoms of irreversible pulpitis, pregnant females and nursing mothers were excluded from the study.

Patients were explained about the clinical procedure and its possible complications. Informed consent was taken from every patient on the consent form. All patients were divided into two groups according to the lottery method for simple random sampling.

Patients in both groups were first given local anaesthesia (Lignocaine HCl 2%). Next, a rubber dam was applied, and the carious lesion was removed with a round sterile diamond using a high-speed handpiece under air-distilled water cooling. The deeper caries in the proximity of the pulp were removed using slow-speed carbide round burs (1.4mm) until the pulp was encountered. New burs were used on each patient. Hemostasis at the site of pulpal exposure was achieved with saline irrigation, and a sterile cotton pellet was placed onto the pulpal exposure site. In Group-A,Biodentin was used as a pulpal agent according to the manufacturer's recommendations, and the tooth was temporarily restored with Glass Ionomer Cement (GIC). Premixed ERRM was used for pulp capping in Group-B per manufacturer recom-mendations. Sterile plastic instruments should be used to place the material onto the exposed site. The cavity was then filled with GIC. Patients were recalled after one week for evaluation and permanent restoration. Teeth were then permanently restored with a resin composite Visual Analogue Scale (VAS) used to record the post-operative pain. Patient with pain score 1-3 was categorized as mild pain, 4-7 as moderate pain and 8-10 was referred to the severe pain category.

Follow-up was done at one-month and three months intervals. The post-operative radiograph was taken on each visit to detect any apical radiolucency. Any periapical radiolucency, post-operative pain or sensitivity to cold on air water syringe was recorded as a failure. The procedure was successful if the patient had no periapical radiolucency, pain and sensitivity at subsequent visits.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were summarized as mean±SD and qualitative variables were summarized as frequency and percentages. The Chi-square test was applied to find out the association. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

One hundred subjects were included in this study, with the age ranging between 19 to 50 years, and mean age of 26.3±7.3 years. Among them, 49 patients were females, and 51 were males. 80% of patients were in the age group of 19-34 years, and 20% patients were in the age range of 35-50 years (Table-I).

Table-I: Gender and Age Group Wise Distribution of post-operative pain (n=100)

Variables	Post-Operative Pain n(%)		*p*-value
	Ye	No	
Gender			
Male	4(7.8%)	47(92.2%)	0.736
Female	3(6.1%)	46(93.9%)	
Age Groups			
19-34 years	5(6.3%)	75(93.8%)	0.557
35-50 years	2(10.0%)	18(90.0%)	

On the first day of pulp capping, four patients from Group-A (8%) and three patients from Group-B (6%) complained of pain in the mild category (1-3), according to VAS. The rest of the patients remained asymptomatic at 1 and 3 months follow-up. No periapical changes or pathology was seen on radiographs after the experimental period. Biodentine and Endosequence BC RRM did not have any significant difference as pulp capping agent while considering post-operative pain in patients (p=0.695) (Table-II).

Table-II: Comparative analysis of Biodentine and Endosequence Root Repair Material on occurrence of post-operative pain (n=100)

Materials	Post-Operative Pain n%		*p*-value
	Yes	No	
Biodentine	4(8.0%)	46(92.0%)	0.695
Endosequence	3(6.0%)	47(94.0%)	

16% patients had maxillary first molars, 4% had maxillary second molars, 26% mandibular second molars, and 54% had mandibular first molars (Table-III).

Table-III: Tooth wise Distribution of the Cases Considered in the Study (n=100)

Restored Tooth	Occurrence of Post-Operative Pain n(%)	
	Yes	No
Mandibular 1st Molar	3(5.6%)	51(94.4%)
Mandibular 2nd Molar	4(15.4%)	22(84.6%)
Maxillary 1st Molar	0(0%)	16(100.0%)
Maxillary 2nd Molar	0(0%)	4(100.0%)

DISCUSSION

This study aimed to determine the effectiveness of Biodentine and end sequence BC RRM when used as a pulp capping agent. Both these materials have different compositions but contain Tricalcium Silicate as the main constituent.[9] In young patients, there is comparatively larger pulp space, an increased number of cells, an abundant blood supply, a rapid response to inflammation, and poor localization of infection. With advancing age, there is a reduction in pulp chamber volume due to secondary and reparative dentin formation. Therefore, there is decreased risk of pulpal exposure and subsequent pain with the increasing age of the patient.[10]

Multiple factors affect the success rate of pulp cappings, such as correct diagnosis, case selection, hemostatic agent, pulp capping agent and coronal seal.[11] Biodentin is a relatively new bioactive calcium silicate cement and is considered suitable for pulp-dentin complex regeneration such as DPC. A study recently published by Nowicka *et al.* compared the differences between the dental pulp responses between MTA and Biodentine.[12] The study involved 41 patients ranging from 19 to 28 years. Maxillary and mandibular third molars, pre-planned for extraction for orthodontic considerations, were mechanically exposed and capped with either one of the two materials. At six weeks, on examination and vitality testing, all teeth were vital. This study showed that Biodentine had similar efficacy in the clinical setting, there was no significant difference between the two materials, and the pulp well tolerated both materials.[12]

A study by Gupta *et al.* concluded that biodentin could maintain pulp vitality in patients judiciously selected for pulp capping. Single-stage pulp capping can be done, followed by composite restoration.[13]

ERRM is ready-to-use material that does not require mixing. It has a pH of more than 12 and has antimicrobial activity.[14] When placed in the cavity, the material comes in contact with moisture in dentinal tubules, and calcium silicates react with water to produce calcium silicate hydrogel and Ca(OH). In addition, calcium Hydroxide reacts with Calcium Phosphate and forms hydroxyapatite. Due to the high level of calcium and silicones, the end sequence has good biocompatibility.[15]

In a previous study, forty-one patients aged 7-58 years were selected for pulp capping. The success rate of vital pulp therapy in this study was 87.8%, with an average of 730 days follow-up. In addition, patients receiving ERRM materials had over twice the odds of failure compared to those receiving MTA and Biodentine.[16]

In a systemic review by Emara *et al.* the clinical and histological effects of calcium silicate cement were studied when used as a pulp-capping agent. In addition, MTA, Biodentine and ERRM were evaluated. It was concluded that all commercially available calcium silicate cement are biocompatible, exhibit comparable and favourable effects clinically and histologically, and can efficiently enhance high-quality dentin bridge formation with minimal inflammation.[17]

A study by Elshamy *et al.* showed that MTA and ERRM have similar clinical effectiveness. The antibacterial activity of ERRM is comparable to MTA against mutans streptococci (MS) but is superior to MTA against Lactobacillus.[18]

In this study, the successful treatment was identified based on the presence or absence of symptoms of pulpitis, such as no post-operative pain. However, the histological aspect was not known for the true interpretation of the success of the pulp capping agent.

CONCLUSIONS

In conclusion, Biodentin is as effective as ERRM. These materials can be viable pulp-capping agents in asymptomatic vital teeth.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MJAR & MAR: Conception, drafting the manuscript, approval of the final version to be published.

SI & AYB: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

SB & SH: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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