



Comparison of four different pulp capping material used for indirect pulp capping in permanent teeth in private clinic in Benghazi-Libya: An in vivo study.

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I. INTRODUCTION

In conservative dentistry maintaining the pulp vitality is important, the vital pulp protects the tooth structure, integrity, and physiological function, the pulp vitality may lose, and exposure happens by long-standing caries left untreated, dental trauma(such as fracture crown or cracks), and mechanical injury. In addition, Deep caries lesions could be challenging to manage, and complete caries removal with the conservative approach.^{1,2} the predictability of vital pulp therapy has improved with the introduction of newer bio ceramic materials.²

Vital pulp therapy techniques are ways to preserve the vitality of the tooth by placing a specific material that helps to reduce inflammation and aid in pulpal regeneration to maintain vitality and neural innervation of the tooth.² Vital pulp therapy is divided into two types direct pulp capping, means placing the pulp capping material directly on the exposed pulp, unlike the indirect pulp capping procedure the hard affected dentine can be left in the cavity,³ and the capping material is placed over it. In both techniques, the main reason for such treatment is to maintain tooth vitality and avoid as much as possible any other invasive treatments.⁴

Different types and varieties of Pulpal capping materials are used in dental practices, but not all material is the same when it comes to their efficiency in the preservation of vital pulp and resolution of inflammation. Researchers work to find out the most effective and ideal capping materials, investigations are still going with the known materials, such as calcium hydroxide and mineral trioxide aggregate (MTA), calcium hydroxide Ca(OH), zinc phosphate, bio glass, and glass ionomer cement.⁵

For many years, calcium hydroxide [Ca (OH)₂] is used as a capping material, its effectiveness comes from promoting the formation of reactive dentine and induced mineralization and

also helps the cells of the dental pulp to continue regeneration, with all the benefits of Ca(OH)₂ it still has impairments, such as the formation of defects in dentine and the creation of micro leakage. Newer materials like MTA can replace Ca (OH)₂, effective with fewer unwanted side effects. On the other hand, its widely used and has better properties that can help in repairing and aiding pulp healing, MTA's main components are tri-calcium silicate, di-calcium silicate, and tri-calcium aluminate, in addition to bismuth oxide for radiopacity, the most favorable properties is low solubility inhibition of bacterial growth, formation of reparative dentine, and also can reduce inflammation by stabilizing the proses of tooth repair, MTA presents some disadvantages it considered to be expansive, longer sitting time and in some cases, it may cause discoloration, MTA promotes cells like fibroblast to migration into the exposed pulp in which aid in tissue and wound regeneration, MTA recent studies have high clinical success.⁶

Bio-C Repair is a new silicate-based hydraulic cement material used as a pulp capping material with a better texture, making it very easy to handle. Do not cause discoloration, but it can help to heal and repair pulpal tissue by creating a barrier against microorganisms and promoting regeneration by releasing calcium ions. Bio-C Repair is considered new material further studies and investigation are needed to fully understand its effect on human pulp regeneration and healing,⁷

Aim

Aimed to evaluate the success rate of different pulp capping materials: MTA, BIO Ceramic, Thecal and Dycal as pulp capping materials for indirect pulp capping in carious permanent teeth.



II. MATERIALS AND METHODS

A randomized clinical trial was obtained in a clinical setting for one year; sixty adult patients were selected for this study, with an age group between 18 and 50 years old. The types of teeth in this study were molars and premolars with deep caries lesions. Patients were informed about all other treatment options and the advantages and disadvantages of each one before participating in this study. Informed consent was obtained from the patient.

Inclusion criterion

Age: between 18 and 50 years old. Teeth selection was molar and premolar with healthy pulp and a deep caries lesion. The pain characteristic is mild to moderate pain or pain on biting diagnosed with hypersensitivity and reversible pulpitis. The selected teeth must have no mobility, no fracture or tenderness on precaution.

Exclusion criterion

Patients younger than 18. Any teeth were other than molars or premolars. Teeth with necrotic pulp or showing signs of irreversible pulpitis, mobility, fracture, and no tenderness on precaution

Clinical procedure

After the selection of the correct patient criteria, local anesthesia administered to the offending tooth, and conservatively, all caries and debris excavated using a high-speed hand piece and manually using a sharp spoon excavator to ensure

complete removal of caries and cavity preparation. After that, the tooth was ready for capping using one of the materials chosen in this study: MTA, Dycal, TherCal, or BioC repair. Using a sterile disposable plastic tip to place capping material only on the floor of the affected tooth, the sitting and polymerization of the capping material are according to the manufacturer's instructions. Next, the tooth is restored with composite restorative material or glass-ionomer cement (GIC), polishing the final restoration and checking the occlusion. Patient recall took place at the 1-month follow-up to check restoration integrity and overall successes of the chosen treatment and assess pulpal status. Patients recalled again in 3 or 6 months and one year for another evaluation.

III. RESULT

In this study, the total number of patients included was 60, 33 female and 27 male, with an age range of 16-45 years old. According to the type of pain, the patients were divided into three categories: hypersensitivity (58.3%), reversible pulpitis (23.3%), and mild pain (8.3%). For each study group, the capping materials used were MTA with a total of 17 patients, 17 patients with Dycal, 15 with Bio-C repair, and 11 using TherCal. The teeth included in this study were molars (75% and premolars 25%).

Four types of pulp capping material used for each patient: MTA, Dycal, TherCal, and Bio-C Repair, as shown in the table 1 below:

Table 1: Distribution of four types of pulp capping material, in molar and premolar

Table with 10 columns: variables, Class, (empty), Type material (MTA, BIO C, THERCAL, DYCAL), Total, (empty), (empty). Rows include Molar and Premolar data with counts and percentages.

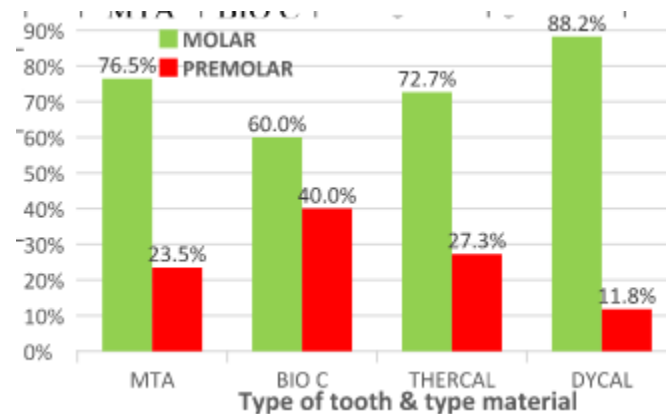


FIG. 1: Distribution of four types of pulp capping material, in molar and premolar

The success rate of different material types showed in the table below and it showed that Thercal has the highest success rate 22.4% and with no negative results in 3, 6 months and 1 year follow up in compare to Dycal it has success rate of

30.6% but it shows 18.2% negative results, MTA and Bio C Repair have similar results MTA has 24.5% Bio C Repair has 22.4% positive results all material at 3, 6 month and 1 year follow up. Shown in Table 2 below.

Table 2: response of different pulp capping material, 3, 6 months

Type material		month		Total		
		negative	positive			
MTA	N	5	12	17	5.049	0.168
	%	45.5	24.5	28.3		
BIO C	N	4	11	15		
	%	36.4	22.4	25		
THERCAL	N	0	11	11		
	%	0.0%	22.4%	18.3%		
DYCAL	N	2	15	17		
	%	18.2%	30.6%	28.3%		
Total	N	11	49	60		
	%	100%	100%	100%		

IV. DISCUSSION

The goal of conservative treatment is to maintain the vitality of the pulp and its normal function. Promoting the formation of reparative dentin, and eliminating inflammation, only a vital and functional pulp can heal naturally. Our attempt focused on a conservative approach to carious molars and premolars covered with new materials. The purpose of this study was to compare the effectiveness of calcium hydroxide (dycal), MTA, Bio C repair, and Bio dentine for indirect pulp

capping of permanent molars using clinical and pulp vitality measurements during a 6-month follow-up. Calcium hydroxide is the gold standard material that was used for pulp capping techniques for a century; hence was included in the trial. Calcium hydroxide is known to have several drawbacks, including poor dentin adhesion, disintegration, and flaws that resemble tunnels in the created dentin bridge.¹

In actual clinical practice in pulp capping therapy in permanent teeth, MTA showed a less or



equal result and outcome in comparison to calcium hydroxide 8, another study done by Aeinehchi et. al., showed that less inflammation, hyperemia, and necrosis plus thicker dentinal bridge and more frequent odontoblastic layer formation with MTA than calcium hydroxide.⁹ In comparison between Bio C Repair and MTA in this clinical trial, Bio C Repair showed better outcomes as a pulpal response was more verbal even after a one-year follow-up. Because the Bio Ceramic is less soluble, has bactericidal activity, and hermetically covers the site owing to its setting, BIO-C® REPAIR encourages the establishment of a dentin barrier for pulp capping and pulpotomy, which produces better outcomes than pure calcium hydroxide expansion. 10 Thera Cal and Dycal used in this study, articles showed that Thera Cal is better capping material than Dycal and MTAM because Thera Cal demonstrated reduced solubility compared to MTA or Dycal and increased calcium-releasing capacity. Thera Cal capacity to cure to a depth of 1.7 mm might decrease the danger of premature dissolution. These characteristics provide significant benefits for direct pulp-capping treatments.¹¹ In our experimental study Thera Cal results were better, and the highest positive response was 100% than Dycal, MTA, and Bio rapier, comes to the most important factor is that Thera Cal releases more calcium ions which potentially stimulatory activity for bone-forming cells and promotes pulp healing by forming a protective barrier.¹²

In this investigation, we tried to evaluate the effectiveness of four different pulp capping materials is more difficult to set where the results were unexpected due to variations in the bacterial load, virulence, and variety, Despite the study's main drawbacks, which include a small sample size and, carried out on permanent molars and premolars that was clinically determined to have extensive dental caries. According to our findings, there was a statistically significant difference between the four materials evaluated at the 6-month and 1-year follow-up times.

V. CONCLUSIONS

THERCAL and Dycal have higher clinical success and efficacy for pulp capping operations than MTA and Bio C Repair, Further research should look into whether Thera Cal has less effective calcium ion release and cytotoxic impact from the resin monomers that are unpolymerized affect its biological and clinical effectiveness.

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