ORIGINAL ARTICLE

Effectiveness of Mineral Trioxide Aggregate (MTA) as Direct Pulp Capping Agent in Mandibular Molars

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ABSTRACT

Background: Direct pulp-capping technique has been in use as a treatment to maintain the vital pulp. Root canal treatment and extraction of tooth can be ruled out if direct pulp capping reveals better rate of success. Mineral trioxide aggregate (MTA) is a new advancement in the science of dental materials which is used as direct pulp capping agent as it has good biocompatibility and superior sealing capacity. It is also easy and simple to use.
Aim: To evaluate rate of success when MTA is used as a direct pulp capping agent.
Methods: This study was done in Multan Dental College, Multan. Sample size was 60 cases with pin-point pulpal exposure. Patients having vital pulp exposed by Trauma / caries in permanent mandibular molars clinically were chosen.
Results: MTA was used on the exposure site in width of 2mm and damped cotton engaged on MTA. Postoperative x-rays and follow up was monitored. 35 were male (58.33%) and 25 were female (41.67%). Overall rate of success is 90% which means fifty-four patients treated with MTA show effectiveness, but six patients had failure of pulp capping.
Conclusion: MTA is a better choice for direct pulp capping. Whenever an exposure site is sealed by means of mineral trioxide aggregate, the chances of failure decrease and the prognosis is usually good.
Keywords: Mineral trioxide aggregate (MTA), direct pulp capping, Postoperative x-rays**,** follow up

INTRODUCTION

One of the vital aims of endodontists is to preserve the pulpal vitality. Pulp can be traumatically or accidently exposed during cavity formation. Exposed pulp can be covered by biocompatible material. The procedure of engagement of a material or medicament against a directly exposed pulp throughout excavation of caries is called direct pulp capping. Direct pulp-capping technique has been in use as a treatment to maintain the vital pulp[1]. This procedure can help in formation of dentinal bridge which offers pulpal protection[2]. Root canal treatment and extraction of tooth can be ruled out if direct pulp capping reveals better rate of success[3].

Rate of success with direct pulp capping may varies and is dependent on the materials as well as the technique used. In human beings, rates of success fluctuated from thirty to eighty five percent in some retrospective studies[4,5].

Gold standard pulp capping agent is calcium hydroxide. Antibacterial properties of calcium hydroxide can reduce the contamination of pulp from bacteria. Reduced penetration of bacteria can enhance the survival of pulpal tissues. Dentin matrix, including Transforming Growth Factor-Beta One (TBF-β1) and Bone-Morphogenetic Protein (BMP) can repair the pulpal tissues and form dentinal bridge. Calcium hydroxide stimulate these growth factor. But evidence is not clear about this mechanism of repair. But calcium hydroxide (CaOH) has certain shortcomings like degradation with time, higher solubility, calcification of pulp chamber and tunnel formation. Tunnel defects inside dentin bridges may give a path to the entrance of microorganisms[6-8].

Mineral trioxide aggregate (MTA) is a new advancement in the science of dental materials which is used as direct pulp capping agent. Mineral trioxide aggregate (MTA) consists of calcium oxide in the shape of tricalcium aluminate, dicalcium silicate, tricalcium silicate and bismuth oxide for radiopacity. MTA forms CaOH and water on setting[9,10]. By product calcium hydroxide provides biocompatibility and pulpal repair property to MTA. MTA has better marginal seal than conventional calcium hydroxide[11]. Setting time of MTA is 265 minutes and MTA is highly soluble. These two are great disadvantages of MTA[12,13]. MTA has performed better than CaOH as a direct pulp capping histologically and clinically. MTA maintains the pulp vitality better than calcium hydroxide[14].

Histologically MTA make thicker dentinal bridge than calcium hydroxide. Clinical success is not definitely related with thickness of bridge. Clinical success should measure through pulp vitality test and absence of symptoms of pulpal pain[15]. Previous publications are evident that MTA is a better agent for direct pulp capping[16,17]. Histological findings show that MTA forms thicker dentinal bridge and cause less inflammation of pulp[2].

The objective of study is to evaluate rate of success when MTA is used as a direct pulp capping agent.

MATERIAL & METHODS

Patients were in the Operative Dentistry department, Multan Medical and Dental College Multan. Sample size

Received on 23-09-2010
Accepted on 03-01-2021

was 60 cases. Patients were recruited having age fifteen-forty years with vital pulp being exposed by Trauma / caries in permanent mandibular molars clinically. Cases with pin-point pulpal exposure were selected. Bleeding from exposure site should be stopped within 2 to 3 minutes after application of moist cotton pallet with saline. Rubber dam should be used to isolate the tooth before procedure. MTA had been in use on the exposure place in width of 2mm and damped cotton engaged on MTA. Zinc phosphate cement was used to seal the cavity. After twenty four hours this cement was detached, and then the amalgam was used to fill the cavity.

Post operative x-ray was done promptly after the method so as to compare base line x-ray with the follow-up x-rays. Follow up should be taken at 3 months, 6 months and one year. Pain on percussion was the indication of failure of pulp capping. Thermal tests were done to assess the Vitality. Lack of symptoms and signs of irreversible pulpal inflammation was indication of the success of the treatment. Periapical radiolucency of tooth was evaluated on the x-ray taken at each visit.

Material or agent for direct pulp capping was believed successful if there is no pain subjectively and objectively on history and percussion respectively and tooth was vital by thermal test with no periapical radiolucency. All this facts will be documented in pre-designed performa. All procedure was done by a single person. The variables were age of the patient's, effectiveness and gender. The quantitative facts that was age will be presented as mean with standard deviation. The qualitative variables in data that were gender, and outcome variable effectiveness which included pain, response to hot and cold stimulus, periapical radiolucency and periodontal status of the tooth will be presented as frequency and percentages.

RESULTS

Sixty teeth were treated in 60 patients. 35 were male (58.33%) and 25 were female (41.67%). The age of the patients was between fifteen to forty years. Overall rate of success is 90% which means fifty-four patients treated with MTA show effectiveness, but six patients had failure of pulp capping.

Table 1: Gender distribution

Gender	No. of patients
Female	25
Male	35
Total	60

Table 2: Effectiveness of MTA

Effectiveness	n	%age
Yes	54	90
No	6	10
Total	60	100

DISCUSSION

In this study the rate of success is 90%, which is similar to that reported in another two studies by Daniele L (92.5%) & Emara R et al (>95%)[18,19]. Mostafa NM also stated the higher success rate for MTA[20]. Results of this study are almost in accordance with the results reported by Bogen G et al & Cosme-Silva L et al (100%)[21,22]. In the procedure of direct pulp capping, dental material or medicament was used to dress the exposed pulp with the precise aim to preserve the health and vitality of pulp. Many endodontists have been using the technique of direct pulp capping for more than 200 years[23].

MTA is a biomaterial used in endodontics with good biocompatibility and bigger sealing capacity. It is not as much cytotoxic than the other conservative materials which are currently in use for the technique of direct pulp capping. That's why it has been known as a high ranked agent for dental pulp capping[24].

The findings submitted by Inami C also showed that MTA is highly effective and biocompatible when used for direct pulp capping[25]. Similar findings were also confirmed by Matsuura T et al that MTA is extra predictable and effective material for Direct pulp capping than others[26].

It has been documented that pulp of a tooth may form a dentine bridge (hard tissue barrier) after pulpotomy or direct capping of pulp[27]. MTA was more effective when compared with CH at the formation of hard-tissue barrier, it also had much better effects in capping mechanical pulp exposures[28]. MTA provided better protection to pulp, showed an outstanding sealing ability in vitro high capability in repairing of perforations[29].

Arafa A et al reported a higher rate of success for MTA while using in the direct pulp capping procedure[30].

A key feature of pulpal treatment is matter of selection of biological pulp capping agent that can influence the residual vital pulp. Present-day clinical practice flourishes with studies indicating great rate of success of MTA when directed as a pulp capping agent. MTA has been known to prompt a lesser amount of pulpal inflammation and greater formation of dentine bridge when matched with CaOH cement[31]. The administration of the capping material at the site of exposure is significant for the clinicians. Besides its histologic superiority as a pulp capping material, the MTA is also easy and simple to practice. A formerly published literature affirmed this simpler clinical application[17]. MTA has been thought as an acceptable mash topping agent in ongoing years[32].

Many in vivo and in vitro investigations have demonstrated that MTA averts microleakage, is non-resorbable and biocompatible, has higher comprehensive strength and low solubility, and advances regeneration of tissue when it is put in contact with peri-radicular tissues or dental pulp. This might be the reason that few studies indicated better effectiveness for MTA when compared with other materials specially Calcium Hydroxide.

Suhag K reported 69% success rate for CH while 93% for ProRoot MTA which is identical to our study. There is a proof from the randomised controlled trials that MTA offer better outcomes than CaOH for direct pulp capping of permanent teeth. There are signs that the preeminence of MTA over CaOH for direct pulp capping becomes more noticeable over time. MTA stimulated the appearance of transcription factors like Runx2 and genes like dentin sialoprotein, alkaline phosphatase and osteocalcin, which are vital odontoblastic genes, in this manner demonstrating the capacity to advance differentiation of the cells of pulp into odontoblast-like cells, which, in deed, are responsible for the formation of dentin bridge. MTA roughly prompted a 1.7-fold rise in the secretion of angiogenic factors like

vascular endothelial development factor, which is significant in the course of tissue regeneration and healing.

CONCLUSION

MTA is a better choice for direct pulp capping. Whenever an exposure site is sealed by means of mineral trioxide aggregate, the chances of failure decrease and the prognosis is usually good.

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