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Clinical Evaluation of Pulp Capping By Various Pulp Capping Agents: An In-Vivo Study

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Abstract
Aim: *To evaluate the clinical and radiographic response of pulp –dentin complex after pulp capping with various materials.****Methods:****Informed consent was obtained after explaining the experimental rationale, clinical procedures and possible complications of the procedure. All teeth exhibiting initial deep dental caries and no prior restorations was considered. The involved tooth was isolated with a rubber dam under local anesthesia and disinfected with 0.2% chlorhexidine solution. Gross carious enamel and dentin was removed using high speed round diamond or carbide bur.Haemostasis was achieved with a cotton pellet wet with Sodium hypochlorite and hydrogen peroxide placed on the exposure site. After haemostasis, the teeth were divided into two experimental groups. Group 1- MTA Angelus, Group 2 – Endocem ZrAfter application of the experimental material, the cavity was temporarily sealed with IRM cement. The patient was recalled after three weeks and permanent restoration was placed after evaluating the prognosis.Results obtained after follow-up will be evaluated statistically and conclusion will be drawn.****Results:****The clinical and radiographic parameters selected for the study were evaluated at 3 weeks, 3 months, 6 months & 12 months for all the two groups.Group 1 was comparatively better than group 2 for all clinical and radiographic parameters but differences were not statistically significant.* ***Conclusion:****The current research has successfully compared and evaluated the clinical success of MTA Angelus and Endocem ZR as Direct pulp capping agents. The patients were divided into two groups, i.e. (Group1) MTA Angelus, (Group 2) Endocem ZR.*
Key words: Pulp capping, MTA, Endocem Zr, Clinical evaluation
Clinical significance: MTA Angelus and Endocem Zr can be used successfully as pulp capping agents.

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I. Introduction

Dental caries is one of the most common chronic diseases in the world. The consequences of pulp exposure from caries, trauma or tooth preparation misadventure can be severe, with pain and infection. An alternative procedure to extraction or endodontic therapy is pulp capping, in which a medicament is placed directly over the exposed pulp (direct pulp cap), or a cavity liner or sealer is placed over residual caries (indirect pulp cap) in an attempt to maintain pulp vitality and avoid the more extensive treatment dictated by extraction or endodontic therapy.

Preservation and maintenance of pulpal vitality is an important objective in endodontics.[1] Pulp capping is the simplest form of pulp therapy that helps achieve the above goal. Calcium hydroxide in its various forms is used widely for pulp capping because of its potential to induce dental hard tissue repair and dentinal bridge formation. But due to certain disadvantages that the material poses, other alternatives have been suggested. One such Alternative is Mineral Trioxide Aggregate [MTA]; originally developed as a root perforation repair material. It has been used for pulp capping as an eligible replacement for the Calcium hydroxide-based materials, as it has demonstrated a promising clinical outcome.

But MTA is also plagued with problems like long initial setting time and poor physical properties.[2] One among the recently developed biomaterials is Endocem zr. Based on a Calcium silicate system, this material can

be a comparable replacement for MTA as it is said to overcome its disadvantages. It is touted to be "Dentine in a Capsule"

II. Methods

All patients for management of deep dental caries irrespective of age and gender were considered for this study.

Informed consent was obtained after explaining the experimental rationale, clinical procedures and possible complications of the procedure.

Teeth with completed intraoral periapical radiographs (IOPA), periodontal probing, percussion testing, vitality assessment with cold testing and electric pulp testing were included and response was noted.

All teeth exhibiting initial deep dental caries and no prior restorations were considered. Such teeth showed no evidence of thickened periodontal ligament (PDL), furcation radiolucencies, internal resorption or periradicular pathosis. Clinically, all teeth showed mobility and periodontal probing measurements within normal range with no evidence of sinus tracts or swelling were considered.

History of pain of the involved tooth, reaction to cold or hot stimuli, reaction to percussion, numerical value obtained on an electric pulp tester, diameter of the pulpal exposure, and degree of bleeding on pulp exposure was examined and noted. If exposure site was not round, then the long axis was measured and noted.

Eligibility Criteria

INCLUSION CRITERIA:

CLINICALLY

1. The tooth responded positively to cold test, leading to a preoperative diagnosis of reversible pulpitis.
2. Tooth had no associated swelling, pus exudate, fistula or abnormal mobility
3. Pin point exposure
4. Bleeding controlled under pressure

RADIOGRAPHICALLY

1. No prominent radiolucency in the furcation or periapical region.
2. No evidence of widening of the periodontal ligament space.
3. Absence of internal or external root resorption, calcification or pulp canal obliteration.

EXCLUSION CRITERIA:

CLINICALLY

1) Severe tooth- aches at night.
2) Spontaneous pain
3) Non –vital pulp
4) Tooth mobility
5) Uncontrolled haemorrhage at the time of exposure
6) Intraoral and extra oral swelling
7) Sinus tract formation

RADIOGRAPHICALLY

1) Radiographic evidence of pulp or peri-radicular degeneration.
2) Widening of PDL space
3) Purulent or serous exudate from the exposure.
4) Presence of internal or external root resorption, calcification.

Procedure

The involved tooth were isolated with a rubber dam under local anaesthesia and disinfected with 0.2% chlorhexidine solution. Gross carious enamel and dentin wias removed using high speed round diamond or carbide bur. Further excavation was done using a low speed round bur or a spoon excavator after application of caries detecting dye. Only those pulps that were exposed at the end of removal of the remaining decayed dentin was selected for direct pulp capping procedure.

Haemostasis was achieved with a cotton pellet wet with Sodium hypochlorite and hydrogen peroxide placed on the exposure site. After haemostasis, the teeth were divided into two experimental groups:

Group 1- MTA Angelus

Group 2 – Endocem Zr

After application of the experimental material, the cavity was temporarily sealed with IRM cement. The patient was recalled after three weeks and permanent restoration was placed after evaluating the prognosis.

Results obtained after follow-up were evaluated statistically and conclusion wias drawn.

Patients were recalled at 3months, 6 months, 12 months and evaluated clinically and radiographically.
Treatment was considered successful clinically, when the pulp remains vital with normal response to thermal and electric tests without the signs of spontaneous pain and radiographically, there was no periapical pathology, furcation radiolucency, internal or external resorption, calcifications.

STATISTICAL ANALYSIS

A total of thirty teeth were selected for this study. The various clinical and radiographic parameters assessed were pain, tender on percussion, thermal tests, EPT and radiographically periapical radiolucency, furcation radiolucency, calcification and resorption. All the data obtained were tabulated and subjected to statistical analysis. The intergroup comparison for the difference of scores between independent groups was done using the independent t test, One Way ANOVA and Chi Square test.

III. Results

- The clinical and radiographic parameters selected for the study were evaluated at 3 weeks, 3 months, 6 months & 12 months for all the three groups.

- For Pain, Tender on percussion, Thermal test, Electric pulp test, periapical radiolucency, furcation radiolucency and calcification & resorption, there was statistically significant difference between Group 1, Group 2 at 3 months, 6 months & 12 months.
- Group 1 was comparatively better than group 2 for all clinical and radiographic parameters but differences were not statistically significant

IV. Discussion

The maintenance of pulp vitality is a major goal of endodontics. Direct pulp capping for tooth decay has always been considered a controversial procedure generating unpredictable and often contraindicated outcomes. Direct pulp capping is a procedure in which an exposed dental pulp is covered with a pulp capping material that protects the pulp and permits healing and repair. Thus, exposed vital pulp which is unaffected possesses an inherent capacity for healing through cell reorganization and bridge formation when a proper biologic seal is provided and maintained.

The Mineral Trioxide Aggregate is a kind of concrete consisting of an aggregate of mineral trioxides according to its name. The team lead by Prof. Torabinejad has developed it at the University of Loma Linda in California (USA) from year 1992 to 1993 to meet the demand to identify an ideal concrete for the endodontic surgery, especially when it is impossible to have a dry surgical field and when the cement has a direct contact with the periradicular tissues and/or the pulp. From a physical–chemical point of view MTA is a powder consisting of fine hydrophilic particles, which harden in presence of moisture. On the chemical point of view MTA is divided into calcium oxide and calcium phosphate as main components. The further physical and structural analysis identifies the cohabitation of two different phases: a crystalline phase rich of calcium, silicon and oxygen; an amorphous phase, rich of calcium and phosphates.[3] The crystalline phase, which consists primarily of calcium oxide, becomes calcium hydroxide when interacting with the exudate, then stimulating the formation of hard tissue repair.

Reference

[1]. **Schröder U.** Effects of calcium hydroxide-containing pulp-capping agents on pulp cell migration, proliferation, and differentiation. J DentRes. 1985;64(1):541–8.
[2]. **Matsuo T, Nakanishi T, Shimizu H, Ebisu S**. A clinical study of direct pulp capping applied to carious-exposed pulps.JOE.1996 Oct 1;22(10):551-6.
[3]. **Cox CF, Subay RK, Ostro E, Suzuki S, SuzukiSH.** Tunnel defects in dentin bridges: their formation following direct pulp capping. Opera Dent.1997;21(1)1: 4– 11.
[4]. **Hebling J, Giro EMA, Costa CA**. Biocompatibility of an adhesive system applied to exposed human dental pulp. JOE.1999; 25(10):676–682.
[5]. **Schuurs AH, Gruythuysen RJ, Wesselink PR**. Pulp capping with adhesive resin- based composite vs. calcium hydroxide: a review. Dental Traumatology: Review article. 2000 Dec;16(6):240-50.
[6]. **Scarano A, Manzon L, Di Giorgio R, Orsini G, Tripodi D, Piattelli A**. Direct capping with four different materials in humans: histological analysis of odontoblast activity. J0E. 2003 Nov 1;29(11):729-34.
[7]. **Medina VO, Shinkai K, Shirono M, Tanaka N, Katoh Y**. Histopathologic study on pulp response to single-bottle and self-etching adhesive systems. Opera Dent 2002;22(2):330–342.
[8]. **Ward J**. Vital pulp therapy in cariously exposed permanent teeth and its limitations. Aust Endod J. 2002;28(1):29–37.
[9]. **Aeinehchi M, Eslami B, Ghanbariha M, Saffar AS**. Mineral trioxide aggregate (MTA) and calcium hydroxide as pulp-capping agents in human teeth: a preliminary report. Inter Endod J, 36, 225^231, 2003

[10]. **Menezes R, Bramante CM, Letra A, Carvalho VG, Garcia RB.** Histologic evaluation of pulpotomies in dog using two types of mineral trioxide aggregate and regular and white Portland cements as wound dressings. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2004 Sep 1;98(3):376-9.

[11]. **Sübay RK, Demirci M**. Pulp tissue reactions to a dentin bonding agent as a direct capping agent. JOE. 2005 Mar 1;31(3):201-4.

[12]. **Accorinte MLR, Loguercio AD, Reis A, Muench A, Araujo VC**. Response of human pulp capped with a bonding ´ agent after bleeding control with hemostatic agents. Oper Dent. 2005, vol. 30(2):147–155.

[13]. **Iwamoto CE, Adachi ER, Pameijer CH, Barnes D, Romberg EE, Jefferies S**. Clinical and histological evaluation of white ProRoot MTA in direct pulp capping. Am J Dent. 2006 Apr 2;19(2):85.

[14]. **Silva GA, Lanza LD, Lopes-Júnior N, Moreira A, Alves JB**. Direct pulp capping with a dentin bonding system in human teeth: a clinical and histological evaluation. Opera dent. 2006 May;31(3):297-307.

[15]. **Silva AF, Tarquinio SBC, Demarco FF, Piva E, and Rivero ERC.** The influence of haemostatic agents on healing of healthy human dental pulp tissue capped with calcium hydroxide. Int Endod J.2006, vol. 39, no. 4, pp. 309–316.

[16]. **Maria de Lourdes RA, Holland R, Reis A, Bortoluzzi MC, Murata SS, Dezan E, Souza V, Alessandro LD**. Evaluation of mineral trioxide aggregate and calcium hydroxide cement as pulp-capping agents in human teeth. JOE. 2008 Jan 1;34(1):1-6.

[17]. **Min KS, Yang SH, Kim EC**. The combined effect of mineral trioxide aggregate and enamel matrix derivative on odontoblastic differentiation in human dental pulp cells. JOE. 2009 Jun 1;35(6):847-51.

[18]. **Cui C, Zhou X, Chen X, Fan M, Bian Z, Chen Z**. The adverse effect of self-etching adhesive systems on dental pulp after direct pulp capping. Quint Inter.2009, vol. 40(6):26-34.

[19]. **Zhang W, Yelick PC**. Vital pulp therapy-current progress of dental pulp regeneration and revascularization. Int J Dent. 2010 Mar;12(1):45-60.

[20]. **Zarrabi MH, Javidi M, Jafarian AH, Joushan B.** Histologic assessment of human pulp response to capping with mineral trioxide aggregate and a novel endodontic cement. JOE. 2010 Nov 1;36(11):1778-81.

[21]. **Paranjpe A, Zhang H, Johnson JD**. Effects of mineral trioxide aggregate on human dental pulp cells after pulp-capping procedures. JOE. 2010 Jun 1;36(6):1042-7.

[22]. **Dammaschke T, Stratmann U, Fischer RJ, Sagheri D, Schafer E**. A histologic investigation of direct pulp capping ¨ in rodents with dentin adhesives and calcium hydroxide. Quint Inter.2010;41(4):62–71.

[23]. **Parolia A, Kundabala M, Rao NN, Acharya SR, Agrawal P, Mohan M, Thomas M**. A comparative histological analysis of human pulp following direct pulp capping with Propolis, mineral trioxide aggregate and Dycal. Aust dent j. 2010 Mar 1;55(1):59-64.

[24]. **Guven EP, Yalvac ME, Sahin F, Yazici MM, Rizvanov AA, Bayirli G**. Effect of dental materials calcium hydroxide–containing cement, mineral trioxide aggregate, and enamel matrix derivative on proliferation and differentiation of human tooth germ stem cells. JOE. 2011 May 1;37(5):650-680.

[25]. **Galler KM, Schweikl H, Hiller KA**. TEGDMA reduces mineralization in dental pulp cells. J. Dent. Res.2011; 90(2):257–262.

[26]. **Al-Hezaimi K, Salameh Z, Al-Fouzan K, Al Rejaie M, Tay FR**. Histomorphometric and micro–computed tomography analysis of pulpal response to three different pulp capping materials. JOE. 2011 Apr 1;37(4):507-12.

[27]. **Taira Y, Shinkai K, Suzuki M, Kato C, Katoh Y**. Direct pulp capping effect with experimentally developed adhesive resin systems containing reparative dentin-promoting agents on pulp mixed amounts of additives and their effect on wound healing. Odontology.2011;99(2):135–147.

[28]. **Guven EP, Yalvac ME, Sahin F, Yazici MM, Rizvanov AA, Bayirli G**. Effect of dental materials calcium hydroxide–containing cement, mineral trioxide aggregate, and enamel matrix derivative on proliferation and differentiation of human tooth germ stem cells. JOE. 2011 May 1;37(5):650-680.

[29]. **Eskandarizadeh A, Shahpasandzadeh MH, Shahpasandzadeh M, Torabi M, Parirokh M**. A comparative study on dental pulp response to calcium hydroxide, white and grey mineral trioxide aggregate as pulp capping agents. J cons dent. 2011 Oct;14(4):351.

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