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EVALUATION OF THE EFFECT OF LEDERMIX PASTE AS INTRRACANAL MEDICAMENT ON THE PUSH-OUT BOND STRENGTH OF ENDOCEM MTA - AN IN VITRO STUDY

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ABSTRACT Most endodontic failures occur as a result of leakage of irritants from bacteria and their by-products from pathologically involved root canals[1]. Microorganisms play an essential role in pulpal and periapical disease [2].

AIM AND OBJECTIVE: To evaluate the effect of Antibiotic combined Steroid paste on the push-out bond strength of Endocem MTA using Instron.

MATERIALS AND METHODS: sixty human anterior teeth extracted for periodontal reasons were collected from the Dentofacial health centre, Bailey road, Patna. Ledermix paste, Saline, Endocem MTA (Maruchi) used as medicament and root end filling material. The specimens were tested under the universal testing machine for assessment of push-out bond strength.

CONCLUSION: In our study, the push-out bond strength Endocem MTA was studied after the use of Ledermix paste as intracanal medicaments. It was seen to be less than controll group.

KEYWORDS : endodontic failures, push – out bond strength, intracanal medicament, ENDOCEM MTA

INTRODUCTION

The purpose of endodontic treatment is to eliminate microorganisms from the root canal system and to prevent recontamination by creating a barrier between the oral microflora and the root canal system and periapical tissue. In reality, creating a fluid tight seal apically, laterally and coronally is necessary to prevent recontamination and long-term clinical success [3].

MATERIALS AND METHODS

Source of samples: sixty human anterior teeth extracted for periodontal reasons were collected from the Dentofacial health centre, Bailey road, Patna.

Materials used: - Ledermix paste. - Saline. - 17% EDTA. - Sodium hypochlorite. - Distilled water. - Endocem MTA (Maruchi). - Temporary restoration. Armamentarium: - Slow speed latch type Micromotor hand piece (NSK) - Endomotor (X-Smart) - Ultrasonic unit (Woodpecker) - X-Ray unit. - Parallel post drill (1.25mm diameter) - MTA Gun (GDC) - Protaper universal files (DENTSPLY) - Hand Plugger (GDC) - X-Ray film (Carestream) - Paper points (DENTSPLY). - Ultrasonic U-Files (Woodpecker) - Diamond disc - Incubator - Universal testing machine (Instron)

Composition Of Root-end Materials Used In This Study

Endocem MTA Maruchi, Wonju, Korea

Powder: MTA+ small particle Pozzolan cements*

Liquid: Distilled water/PBS.

***Pozzolan cement** – silicon/Siliconaluminium (having no initial binding capacity itself, later when the water is added they set into hydraulic cement)

Method of collection of samples: sixty human anterior teeth extracted for periodontal reasons were collected from the Dentofacial health centre, Bailey road, Patna, and stored in formalin. Infection Control protocol for the teeth collected for **this study:** Occupational Safety and Health Administration (OSHA) and Centre for Disease Control & Prevention (CDC) guidelines for collection, storage and handling of extracted teeth were followed.

Exclusion criteria: Roots with presence of cracks, caries or restorations were excluded from the study.

Inclusion criteria: Intact Maxillary anterior teeth extracted for periodontal reasons were included.

Procedure

Removal of external residual tissues: The selected teeth were stored in 10% formalin following extraction and calculus was mechanically removed using hand scalers. Sixty freshly-extracted human maxillary anterior teeth with single and straight roots were selected. The crowns were de coronated below the CEJ and the length was adjusted to approximately 12mm. A parallel post drill (1.25 mm diameter) (Coltène/Whaledent, Summit County, OH, USA) was used to create a standardized parallel canal space of 1.25 mm diameter and 10 mm length. The root canals were cleaned and shaped with ProTaper files (DENTSPLY Tulsa Dental, Tulsa, OK, USA) up to size F5 , in conjunction with 2 mL of 5.25% Sodium hypochlorite between each file size. The canals were irrigated with 5 mL of Sodium hypochlorite for 5 min followed by 5 mL of 17% EDTA for 5 min to remove the smear layer. Finally, the specimens were irrigated with 10 mL of distilled water to avoid the prolonged effects of EDTA and Sodium hypochlorite. The root canals were subsequently dried with paper points. Then the specimens were randomly assigned into 2 groups with respect to the use of intracanal medicaments.

Group 1 Antibiotic + Steroid paste

Group 2 Saline (control)

The intracanal medicaments were placed into the root canal

with the Lentulospirals (35 size). And then the orifices were sealed with a cotton plug topped with Intermediate restorative material (IRM). The specimens were stored for 2 weeks in 100% humidity at 370C, after the incubation period the intracanal medicaments were removed by irrigating with 5 mL of Sodium hypochlorite in conjunction with Ultrasonic U-Files, followed by a final flush of 5 mL of EDTA. The root canals were subsequently dried with paper points. The specimens were divided into 2 subgroups according to the root-end filling applied: The materials were mixed according to the manufacturer's instructions and placed into the root canal with MTA carrier and compacted with a hand plugger , to create an Apical plug of 5mm thickness at the root apex and were confirmed with the radiograph . The root canal orifices were sealed with a cotton plug topped with IRM. The specimens were stored in 100% humidity at 370 C for 1 week. Each root was sectioned perpendicular to the long axis of the tooth in the apical third to obtain slices of 3mm thickness. The specimens were tested under the universal testing machine for assessment of push-out bond strength.

Push-out Bond Strength Test: The specimens were subjected to load by using a 1mm-diameter custom stainless-steel cylindrical plunger mounted on a universal testing machine. The push out force was applied in a cervico-apical direction at a crosshead speed of 1mm/min until the root filling material debonded. The load divided by area of bonded interface determines the bond strength failure calibrated in megapascals (MPa). The area in Materials and Methods 31 each section was calculated by using the following formula: Area = $2\pi r \times h$ (where π = constant value of 3.14, r=radius of the intraradicular space, and h=height in mm) [4].

RESULTS

In the present study, 30 samples of each group with the prior application of Ledermix paste, saline respectively was evaluated for the bond strength of Endocem MTA.

Table 1: Mean Difference In Push-out Bond Strength Of Endocem Mta With Ledermix Paste As Intracanal Medicaments

INTRACANAL MEDICAMENT ENDOCEM MTA (MEAN±S.D)
Ledermix paste (Group IIB) 2.67±0.31
Saline (Control) (Group IIIB) 2.85±0.16

Multiple comparison between the study groups and within the groups was done using one-way Anova. The inference was statistically significant (p)

DISCUSSION:

The immature permanent tooth with necrosed pulp poses a challenge for the endodontist due to several characteristic features such as incomplete root formation, resulting in unfavourable crown/root ratio; thin root dentinal wall; wide root canal space; apical root divergence with the loss of an apical constriction resulting in open apex. Apexification is considered to be the treatment option in teeth with necrotic pulps with open apices(5).Historically, calcium hydroxide has been the material of choice used to induce the formation of an apical hard tissue barrier before placing a long-term root filling(6). Many studies have reported favourable outcomes when calcium hydroxide is used alone or in combination with other materials(7).However, despite a long history of use in apical closure procedures, there are several complications of calcium hydroxide has been now replaced by Mineral Trioxide Aggregate (MTA). MTA apexification treatment can be completed in a single visit or in two or more visits with the use of Calcium hydroxide as intracanal medicament[8]. Given its high success rate the treatment of choice for these cases has been considered the placement of a mineral trioxide aggregate (MTA) apical plug[9] .Before placing the MTA apical barrier, the manufacturer recommends the use of Calcium hydroxide for one week as intracanal dressing and its subsequent removal[10]. The use of calcium hydroxide has been considered an important step in the reduction of the intracanal microbial flora[11]. Because of the detrimental effects of an acidic pH, caused by the inflammation of periapical tissues, on various physical properties of MTA, it could be advisable to delay the placement of the MTA plug to a second session, using Calcium hydroxide as inter-appointment intracanal medication in order to achieve additional disinfection and neutralization of an acidic environment[12] .Before placing the apical plug, the removal of Calcium hydroxide has been recommended to allow proper adhesion between the filling material and the root dentin[13].However, it has been shown that complete removal of Calcium hydroxide from the root canal walls is very difficult to achieve if not impossible, at least with the techniques so far available[14]. It is because of this reason, the concern arises about the sealing ability of the MTA apical plug in the presence of the remaining calcium hydroxide which may consequently affect the results of the treatment. The aim of this experimental in vitro study is to evaluate the influence of the intracanal medicament (Ledermix paste), applied as dressing over a period of 1 week, on the apical sealing of the apical barrier (MTA, Endocem MTA) placed in permanent teeth with simulated immature apices and to study the push out bond of Endocem MTA on the apical sealing of the plug under the influence of this dressing. Ledermix paste contains an antibiotic, demeclocycline hydrochloride and a corticosteroid, triamcinolone acetonide in a ratio of (3.2:1) in a polyethylene glycol base. The Ledermix paste easily gets penetrated through dentinal tubules and cementum to reach the periodontal and periapical tissues [15]. MTA are of two types-grey and white. The main difference in composition is the presence of iron, aluminium and magnesium oxides. Asgary et al claim that these oxides are present in less quantity in white MTA [16] while others claim total absence of these oxides in white MTA. However, Mineral trioxide aggregate (MTA) is considered to be predictable, they present few limitations that are mainly related to its long setting time, difficult handling, and tooth discoloration for its use in endodontics. A newly developed material based on pozzolan cement (Endocem, Maruchi, Seoul, Korea) has been manufactured in South Korea endorsing its short setting time (5 minutes). Even though the major component of a pozzolan cement is the amorphous or glassy silica, the Endocem is very similar to that of MTA in respect to chemical constituents 20% bismuth oxide (Bi_2O_3) is added for radiopacity and it is composed of 46.7% CaO, 5.43% Al_2O_3, 12.80% SiO_2, 3.03% MgO, 2.32% Fe_2O_3, 2.36% SO_3, 0.21% TiO_2, 14.5% H_2O/CO_2, and 11% Bi_2O_3 in wt.%. When mixed with sterile water, there is a gradual decrease in the amount of free calcium hydroxide and an increase in formation of calcium silicate hydrate (CaO SiO_2 nH_2O), which lower the hydration heat, neutralize the pH and increase the compressive strength[17]. According to the American Concrete Institute,[18] pozzolan is a siliceous or siliceous and aluminous material that possesses little or no cementitious value in itself; however, in a finely divided form and in the presence of water, it chemically reacts with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties. MTA based cement was developed recently, which contains small particles of pozzolan cement without the addition of chemical accelerators, demonstrated a much shorter setting time than ProRoot MTA as well as antiwashout characteristics and a lack of surrounding marginal gaps[19] .Root canal dentin should be adequately sealed with the biocompatible material to help maintain the integrity of the root filling-dentine interface to resist displacement under static conditions, during function and operative procedures[20]. This property can be evaluated in vitro in terms of bond strength, and the push-out test is a widely accepted method[21]. In this study, open apex was created using the parallel post drill, Peeso reamer no.4 with the diameter of 1.3mm to create parallel root

dentin wall to simulate the open apex and was standardized to all the samples. The present study utilized ultrasonic agitation with U-Files for the removal of intracanal medicaments from the root canal with the concern to abrade the canal walls of the dentin in teeth with open apex because the radicular dentin thickness would already been compromised. Irrespective of the use of several techniques used with or without the aid of chelators, no method till now is proved to be effective in completely removing the intracanal medicament from the root canal walls. This rises concern regarding the effects of medicament residue on the adhesive strength of calcium silicate-based cements to root canal dentine, since it is crucial that these cements remain in place under dislodging forces such as condensation pressure of root filling materials or placement of posts or restorative materials[22]. Proroot MTA has some shortcomings such as difficult handling properties, a prolonged setting time and potential discoloration of teeth or soft tissues[23] .In a laboratory study, it was suggested that hand condensation resulted in better adaptation and fewer voids than ultrasonic compaction[24] .In this study MTA was placed in the root canal using the conventional metal pluggers and the apical plug was created using the hand condensation technique. The MTA apical plug provides the barrier against which the root canal obturation can be done to prevent the micro leakage from the root canal to the peri radicular tissue or vice versa. Therefore, the apical plug thickness is significant to prevent possible leakage. Many of the studies suggest appropriate thickness of the apical plug to be 3 mm to 5 mm. This study, standardized the apical plug thickness of 5mm which was condensed using hand pluggers. MTA without the gutta percha or sealers was used in order to eliminate any confounding factors. The bond strength of Endocem MTA with the prior application of Ledermix paste showed the less bond strength compared to the control group. This may be due to the reason that Ledermix containing the demeclocycline and triamcinolone has less molecular weight resulting in greater diffusion into the dentinal tubules. It was also reported that tetracycline form a relatively strong, reversible bond with the hard-dental tissues and that they exhibit a slow release over an extended period of time[25]. This result was similar to the study conducted by Nagas et al. [4] which stated that Triple Antibiotic Paste, Augmentin, Ledermix was associated with debonding force of MTA and Biodentine.

CONCLUSION:

The root-end filling materials should be biocompatible with the tissue fluids and closely adapt to the walls of root end preparation, be radio opaque and dimensionally stable. To obtain these functional characteristics the filling materials should adhere to the dentinal walls and provide a hermetic seal. In our study, the push-out bond strength Endocem MTA was studied after the use of Ledermix paste as intracanal medicaments. It was seen to be less than controll group.

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