Evaluation of Changes in Physical Properties of Ortho MTA IITM by various Root Canal Cleaning Agents

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Abstract: ***Background/Objectives: One of the most difficult situations facing dentists is having extensive lesions in immature permanent teeth. Dental surgeons will face situations where significant pulp exposure is inevitable, reducing the frequency of direct pulp exposure that indirect in-pulp treatment faces. In dealing with important pulp treatments, the main challenge is to avoid bacterial recontamination after treatment is complete. MTA is an excellent evaluation of biocompatibility and sealing ability compared to conventional materials Methods/Statistical analysis: The ingredients are mixed according to the manufacturer's instructions. The RetroMTATM 50 samples were allocated at random ten by county. The surface hardness of the sample is a digital knoop hardness test device. The intensity of the surface curvature of the specimen was measured using an Instron. Findings: The Ortho MTA II (RetroMTA)TMis a high purity bioceramic manufactured from a hydroponian manufacturing process. Information on the various irrigants response of Ortho MTA II (RetroMTA)TM is limited despite the increase in the use of muscle root canal treatment materials care drug Ortho MTA II (RetroMTA)TM. This study was conducted prior to the application of the Ortho MTA II (RetroMTA)TM to assess and compare physical breakdowns that may occur when using various commercially available root canal cleaning agents.***

Improvements/Applications: According to the results of the study, all of the physical characteristics were lower than the controls. However, there is no statistically significant difference.

Keywords: Flexural strength, Microhardness, Mineral trioxide aggregate (MTA) cement, Ortho MTA II(RetroMTA)TM , Root canal irrigant

I. INTRODUCTION

The American Academy of Pediatrics (AAPD) helps diagnose pulp health versus pathosis and describes the adaptation, goals and intended intervention of pulp [1]. Adaptation and purpose of pulp treatment depends on the condition of the various dimensions for example, normal, reversible pulpitis, symptom-like or non-symptomatic pulpal responses [2,3]. Advances in dentistry required skills to treat teeth that had been removed in the past. A typical method is root canal treatment. In case of Gutta-percha, which is most commonly used to fill an empty space inside the root canal during pulp treatment a lack of root canal care is impaired by poor quality canals and fine leaks. Many new materials are being developed and studied to overcome these shortcomings. When the inner wall of the tooth is thin in immature permanent teeth, charge the inside of the root canal using composite resin or MTA instead of the Gutta-percha. Over the past decade, the development of new materials and medicines as well as the introduction of new treatment concepts has been continued [4,5]. In many studies of MTA recombination, the biological mechanism cement required for the repair of physiological active substances is tri and tetra calcium aluminate, dicalciumcyclicate and tricalcium silicate. The set-up reaction starts with contact with MTA powder that contains fine hydrophilic particles and water [6].

The ProRoot MTA^{TM} (DENTSPLY, Tulsa, USA) first commercialized in 1998 contains 75 percent Portland cement, 20 percent oxide bismuth and 5 percent plaster [7]. It is advantageous in terms of marginal adaptability, biomechanical and antibacterial action [8-10]. However, there are disadvantages of prolonged curing time and discoloration, and they are composed of heavy metals [11-13].

Recently calcium-silicate based quick-cured root canal treatment materials were developed in the Korean market. One material, Endocem^{TM} (Maruchi, Kangwon-do, Korea), calcium hydroxide with pozzolan and other substances called Ortho MTA^{TM} (BioMTA, Daejeon, Korea) fine particle size calcium silicate. Retro MTA^{TM} (BioMTA, Daejeon, Korea) is also known as Ortho MTA II and is a high purity biocermic produced by hydroponic manufacturing processes. It consists of a calcium carbante, silicon dioxide, a hydrophobic calcium and zirconium particle and aluminum oxide [14].

In vitro tests showed that the RetroMTA^{TM} had biocompatibility and angiogenesis similar to ProRoot MTA^{TM} [15]. In has the advantage of short curing time, no discoloration, low heavy metals, and low cell toxicity [14]. Successful root care requires three-dimensional sealing of the inside of the core and the use of appropriate cleaning methods and cleaning agents to remove residual bacteria within the root canal [16].

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A typical cleaning agent known to have a strong tissue melting effect and the elimination of bacteria within the root canal is sodium hypochlorite (NaOCl) [17]. Acid solvents, citric acid and EDTA(Ethylene Diamine Tetra Acetate ethylenediinetetic acid), are used to remove smear layer [18]. A combination of EDTA ethylenediaminetetic acid and sodium hypochlorite (NaOCl) is generally recommended to effectively remove bacteria and smear layer within the root canal [19]. QMix^{TM} (Dentsply, Tulsa, USA) is a recently introduced irrigation solution containing clorehexidine, NaOCl and detergents [20]. A new chelating agents, Maleic acid (MA) has shown a better smear layer removal effect to compared to 17% EDTA [21]. To form calcium and compounds, the concentration of hydrogen peroxide (0.5 % to -2.25 %) and acetic acid (PAA) remove the smear layer comparable to EDTA [22,23].

Despite the increased use of RetroMTA^{TM} in root canal care, information on the effects of various smear Smith layer deodorants on the physical characteristics of RetroMTA^{TM} is limited. The aim ami of this study was to evaluate the effectiveness of EDTA, QMix, MA and PAA for the micro and flexural strength of RetroMTA^{TM}. One test null hypothesis was that there were no differences in the capabilities of each test matrials about the micro and flexural hardness of the OrthoMTA II (Retro MTA)^{TM}. If this solution is used as a final core irrigation tool.

II. MATERIALS AND METHODS

2.1. *Study design*

50 RetroMTA^{TM} (BioMTA, Daejeon~~—Seoul~~, Korea) cylindrical specimens with 50 mm diameter and 40mm diameter were prepared. The ingredients are mixed according to the manufacturer's instructions. A plastic spatula was used to mix 0.3 g of RetroMTA^{TM} powder from the pouch with 3 drops of RetroMTA^{TM} liquid from the pipette for 20 seconds at the bottom of the RetroMTA^{TM} cap. Once the shiny surface of the compound had disappeared, a mixture such as Putty was wrapped and condensed into a split mold using an amalgam carrier. All samples were kept at room temperature for a week. Once the specimen is fully seated, it is detached from the mould. The surface of the specimen is raised from the surface grinding machine to distilled water (500, 800, 1000 and 1200 grit). The rotating felt discs (Ultra-Sol ®, Eminess.Inc., Monroe, USA) were washed with 0.1µm alumina suspension. All specimens were washed and dried in distilled water.

The RetroMTA^{TM} 50 samples were allocated at random ten by county.

1) EDTA : Each specimen was treated for one minute with a 17% EDTA (Merck, Dermstadt, ~~and~~ Germany) of 2%.
2) MA: Each sample was treated with 2ml of KMC Pharmacy (India) for one minute.
3) QMix^{TM} : Each sample was treated for one minute with 2ml of QMix^{TM} (Dentsply, Tulsa, OK, USA).
4) PAA : Each specimen was treated for one minute with 2 milliliters of 2.25 % generalistic acid (Sigma Aldrich, Germany).
5) Control group: 2ml of distilled water was treated for one minute.

2.2. *Microhardness Evaluation*

The surface hardness of the specimen is measured Vickers Hardness Tester (Matsuzawa, Japan) digitally at three different points. The crush was applied to each test specimen for 15 seconds with a load of 100 grams. The diamond-shaped crush was evaluated digitally using a digital camera and analysis program, with a close observation with an optical microscope. The mean length value of the diagnostic line was converted to a hardness value. Analysis was performed using average values.

2.3. *Flexural strength evaluation*

The RetroMTA^{TM} material was mixed in a similar way to a micro hardness test. RetroMTA^{TM} specimens of length 25mm and thickness 2mm were prepared using split molds. The RetroMTA^{TM} 50 samples were allocated at random ten by county and treated with other irrigation drugs similar to micro hardness tests. All specimens were tested for three-point bending and flexural strength. The three-point bending test consisted of placing the RetroMTA^{TM} beam at a distance of 20mm. The RetroMTA^{TM} beam was then centrally loaded with the striker. The bending strength was measured in software (Instron 3366, UK) using the S = 3PL / 2bh2 (MPa) equation.

2.4. *Statistical analysis*

Statistical processing one-way ANOVA, Tukey HSD tests and Mann Whitney U test is carried out in the significant range of 0.05.

III. RESULTS AND DISCUSSION

3.1. Microhardness

There was a significant difference ($p < 0.001$) between all test detergents and the control group and the control group with higher microhardness values when compared to test group. However, between 7 % MA and QMix ($p = 0.641$); 7 % MA and 2.25 % PAA ($p = 0.693$); 7 % MA and 17 % EDTA ($p=0.986$); QMix and 2.25% PAA ($p= 1.000$); QMixTM and 17% EDTA ($p=0.336$); 2.25% PAA and 17% EDTA ($p=0.382$) there was no significant difference (Figure 1).

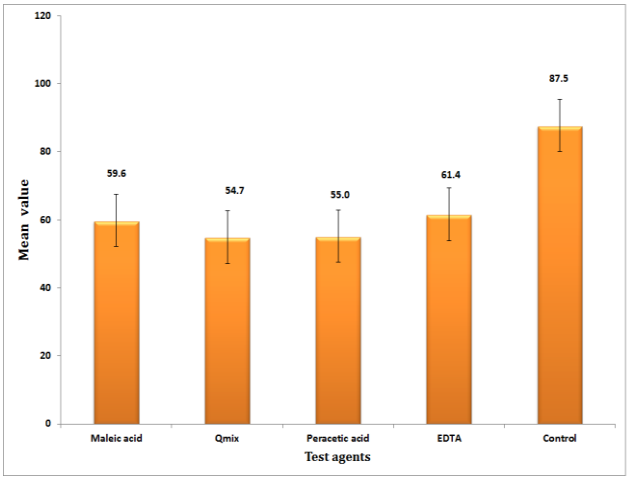

Figure 1.Microhardness of the test Materials

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3.2. Flexural strength

Compared to the control and PA, there was a decrease in bending strength with statistically significant differences between 7% MA, 17% EDTA and QMixTM($p < 0.001$). However, there was no significant difference between the three materials ($p > 0.05$). (Figure 2).

One of the most difficult situations facing dentists is having extensive lesions in immature permanent teeth. Dental surgeons will face situations where significant pulp exposure is inevitable, reducing the frequency of direct pulp exposure that indirect in-pulp treatment faces [24]. In dealing with important pulp treatments, the main challenge is to avoid bacterial recontamination after treatment is complete. MTA is an excellent evaluation of biocompatibility and sealing ability compared to conventional materials [25]. Calcium silicate system is a cement or root canal sealing material made based on the composition of calcium and silicate. The Portland Cement Induction silicate Calcium System Hydraulic Cement, MTA developed at Loma Linda University in early 1990 was approved by the FDA in 1998. MTA consists of tricalcium silicate, deicalcium silicate, tricalcium alkaline, tetracalciumaluminiferite, calcium hydroxide gel and calcium hydroxide [26].

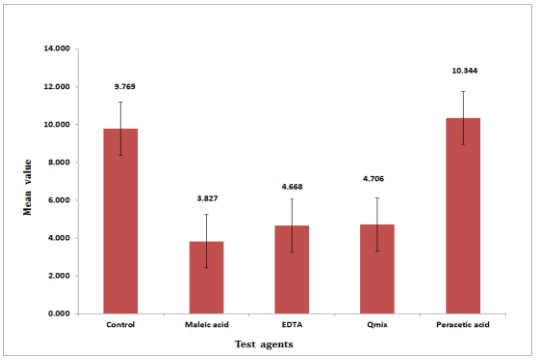

Figure 2. Results of Flexural Strength test

Recently, various MTA products are available in the domestic market. Despite the increased use of RetroMTATM as a root care agent, information on RetroMTATM's responses with a variety of irrigants is limited. This study was conducted prior to the application of RetroMTATM to assess and compare physical breakdowns that may occur when using various commercially available root cleaning agents. All of the cleaning agents tested in this study reduced the physical properties of RetroMTATM. Sodium hypochlorite (NaOCl) of 0.5 to 6 % has been considered a irrigation tool chosen for root canal cleaning agents because of its elimination of bacteria and a strong tissue melting effect. The high basicity of sodium hypochlorite acts on the cell walls of bacteria to produce an antibacterial effect. However, NaOCl does not affect the weapons content of the layer. Ethylene Diamine Tetra Acetate (EDTA) is the most widely used irrigation tool for removing smears. In addition to the cleansing function, it reacts with calcium ions in ivory, acting on inorganic matter, causing calcium killing that promotes the removal of ivory at a depth of 20 to 30 μm within five minutes. Due to the harmful effects on the nearsighted tissue, we continue to search for non-EDTA biocompatibility solutions. Experiments have been conducted on the concentrations at which the smear layer can be removed from various Pharmacids such as citric acid, maleic acid, and apple vinegar [27]. At other concentrations, it was also found to remove the underlying smear layer, indicating that 17% EDTA could be used as an alternative to routine use at 5% and 7% [28]. The pH of a QMiXTM (Dentsply, Tulsa Dental) solution is considered slightly higher than neutral. QmixTM increases the wettability and reduces the surface tension, so it has excellent antibacterial and penetration ability [19].

This study was conducted prior to the application of Retro MTATM to assess and compare physical degeneration that could occur when using various commercially available root cleaning agents. According to the results of this study, There was no statistically significant difference, all of the physical characteristics (fine hardness and bending strength) were decreased.

IV. CONCLUSION

This study was conducted prior to the application of the OrthoMTA II (Retro MTA)TM to assess and compare physical breakdowns that may occur when using various commercially available muscle cleansers. In conclusion, this study showed that the micro and flexural strength of RetroMTATM decreases when used as final irrigation drugs for EDTA, MA and QMixTM.

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