AN IN-VITRO COMPARISON FOUR ROOT END FILLING MATERIAL’S SOLUBILITY
Saurabh Vikas Jain, Sandeep Kothamachu, Manoj Chandak, Pradnya Nikhade

ABSTRACT

Background: Retrograde filling is one of the most important factors based on which success of the endodontic surgeries depends. The ideal properties of a retrograde filling material must be biocompatibility; good marginal seal and it should not be soluble in periapical tissue. Aims and objectives: To compare the solubility of four-root end filling materials. Materials and method: Four commercial dental root end-filling materials were compared. Group 1 Mineral Trioxide Aggregate, Group 2 Intermediate Restorative Material, Group 3 Light cure Glass Ionomer type II cement and Group 4 Poly acid modified resin. Ten disc specimens were prepared for each cement material using a stainless steel mold with 5 mm in inner diameter and 2 mm in thickness. Water solubility of different cement materials was calculated by weighing the samples before and after water immersion (after 24 hours and after 1 month) and desiccation. Results: Statistical analysis of data was done using one-way analysis of variance (ANOVA). After 24 hours the Poly acid modified resin shows highest resistance to solubility followed by Intermediate restorative material, Mineral trioxide aggregate and then glass ionomer cement II. Conclusion: Poly acid modified resin composite had the highest resistance to solubility in comparison with other root end-filling materials.

Keywords: Root-End Filling; Cement Solubility; Poly Acid.

Introduction
The Success of root canal treatment depends on the cleaning, shaping and complete obturation of the root canal system. Solubility is an important feature in assessing the clinical durability of cements. The root-end filling material should provide an apical seal to the periapical tissues. The search for ideal restorative material to replace natural tooth tissue and the demand for products with adhesive and a simple clinical application procedure have led to the recent development of restorative materials that combine conventional glass ionomers and light-cured resin. Conventional and light cured glass ionomers cements are known to absorb water and dissolve by surface wash-off, diffusion through pores and cracks in the cement, and diffusion from the bulk. Nevertheless, the new light-curing glass ionomer cements have improved properties in the initial phase of setting, including a reduced early solubility. Some glass ionomer components have also been combined with resin composite substances, like di-meth-acrylates, benzo-phenone and camphor-quinone, these poly acid-modified resin composites are intended to combine the advantages of both types of filling materials. Mineral Trioxide Aggregate (MTA) was developed as a new root-end filling material at Loma Linda University, California, USA. Tom was there at the outbreak of the MTA story. He was the supervisor of Mahmoud Torabinejad’s 1995 PhD thesis Investigation of Mineral Trioxide Aggregate for root-end filling. Consequently, solubility of root end filling materials has been widely evaluated in vitro. Solubility may cause degradation of the material, leading to debonding of the restoration.

Material and Methods
Four root end filling materials were selected: Intermediate Restorative Material (IRM) Mineral Trioxide Aggregate (MTA) Light cure Glass Ionomer Cement (LC II) and (Dyract). 40 samples of Stainless steel ring molds with an internal diameter of 5mm and a height of 2mm were used for sample preparation. All molds were cleaned with acetone in an ultrasound bath for 15 minutes and then weighed three times before use. The molds were placed on a glass plate and filled to slight excess with the mixed materials. After filling the molds, another glass plate covered with a Mylar strip was placed on top of the molds, exerting a light pressure to remove any excess material. 10 sets of specimens for each material were prepared in one operation. All samples were left to set for 24 hours on a grating in a cabinet at 37°C and 100% relative humidity. Then samples in their molds were then exposed to air for 15 minutes and weighed three times, and the average reading was recorded to three decimal places. The specimens of each material were individually placed in tarred bottles containing 5ml of distilled water. The bottles were then transferred to an oven at 37°C in which they were maintained for 24 hours. They were then removed from the oven and rinsed with distilled water, which was then collected in the same bottles. The water was left to evaporate at a temperature slightly below boiling point. Bottles and residues were dried in an oven at 105°C, cooled down in the same desiccators, and weighed. The differences found between this weight and the original bottle weight were divided by the initial dry weight of the specimens and multiplied by 100. The solubility test was performed again at one month by using the same method. Results were analyzed by analysis of variance test.

Results
Using a NOVA test after 24 hrs the Poly acid modified resin shows highest resistance to solubility followed by IRM (Intermediate restorative material), MTA (Mineral trioxide aggregate) and then Light cure GIC (glass ionomer cement) II (Table 1). After 1 month using a NOVA test Dyract (Poly acid modified resin) shows highest resistance to solubility followed by IRM (Intermediate restorative material), light cure GIC (glass ionomer cement) II and then MTA (Mineral trioxide aggregate) (Table 2). However the amount of solubility after 24 hrs and 1
The purpose of inserting a root-end filling material is to provide an apical seal that inhibits the leakage of irritants from the root canal system into the periradicular tissues. According to Miguel A et al and Pearson GJ for light cure GIC-II the method of mixing may generate air voids. Air voids incorporated in the material increase its surface exposed to the oral environment (water) that in turn increase the water sorption may lead to inhibitions zones with unpolymerized materials this leading to increased solubility.

According to Fridland et al MTA might partially release its soluble fraction composed of calcium hydroxide that yields high Ph values. According to Torabinejad et al and Bonson et al MTA promotes healthy apical tissue formation more often than other materials as confirmed by a lower incidence of inflammation. According to Walker et al The property of releasing calcium hydroxide is the cause of solubility of MTA Placing a moistened cotton pellet onto the intracanal MTA surface under temporary restoration, will lead to improved mechanical properties.

According to Vasudev SK et al, Claudio Poggio et al the addition of resin into the composition improves the properties of IRM. Zinc Oxide Eugenol part of IRM has significant solubility. But incorporation of resin increases the strength and reduces the solubility of IRM. The obtundent property of Eugenol increases the healing. According to Pertot et al differences in mechanisms of the setting reaction between the light-cured GIC and the compomer significantly reduced the shrinkage of the latter. Areas of direct contact between bone and Dyract was found more frequently than with Super EBA. The polymerization setting of dyract produces a strong crosslinking there by reducing the solubility.

Conclusion
In conclusion, after 24 hours the Poly acid modified resin shows more resistance to solubility followed by IRM (Intermediate Restorative Material) MTA (Mineral Trioxide Aggregate) and L C II (Light cure Glass Ionomer Cement II). After 1 Month the Poly acid modified resin shows more resistance to solubility followed by IRM (Intermediate Restorative Material) L C II (Light cure GIC II) and MTA (Mineral Trioxide Aggregate).

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References
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3. Kuhn AT, Wilson AD. The dissolution mechanisms of sil-

### Table 1. Result after 24 hours

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<th>95% Confidence Interval for Mean</th>
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### Table 2. Result after 1 month

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How to cite this article

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