Solubility, Bond strength and Sealing ability of Biodentine as a retrograde filling

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بسم الله الرحمن الرحيم

"قالوا سبحانك لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم"

صدق الله العظيم

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Dedication

To my great Father

To my Dearest mother

To my lovely wife

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The success of any restorative procedure mainly depends on the sealing ability, biocompatibility and good mechanical properties of the filling material. In non-surgical approach leakage along the root canal system as a result of lack of hermetic seal leads to periapical lesions and failure of root canal therapy. Other possible causes of failure could be due to anatomical complexities or canal blockage. Therefore surgical intervention becomes mandatory. The most common surgical approach in endodontics is apicectomy with retrograde filling materials [(1)].

Ideally, the material used in root-end filling should be biocompatible with the periapical tissues, stimulate regeneration of normal peridontium, dimensionally stable, and capable of adhering to root dentin to seal root-end cavities or improve that of existing filling material. It should also be non-resorbable, impervious to dissolution by tissue fluids and not affected by moisture either in set or unset state.

Many materials have been used as amalgam, cavit, resin and IRM for root-end fillings. Most of these materials exhibit significant shortcomings in one or more of the following areas: solubility, leakage, biocompatibility, and handling properties. Currently, Mineral Trioxide Aggregate (MTA) is the main material used in repairing fulcural perforations and as a retrograde filling, it has been favored due to its high biocompatibility and sealing ability [2].

Recently, Biodentine, with active biosilicate technology, has been introduced. It is a new class of dental materials which could conciliate high mechanical properties with excellent biocompatibility. This material can be used as dentin replacement. Biodentine is a calcium silicate material which can be used in root dentine repair, repair of perforations, apexification and root-end fillings. Therefore, it was thought that a study aiming to evaluate Biodentine as a retrograde filling material might be of value.

Solubility:

Water sorption and solubility assessment are important screening tests to insure the stability of any root-end filling material. Ideally, these materials should exhibit both lower water uptake and solubility. Mineral Trioxide Aggregate has been developed to seal off pathways of communication between the root canal system and the external tooth surface.

Torabinejad and Parirok [3] determined the solubility of MTA, and compared it with that of amalgam, Super EBA and IRM. After mixing, each substance was made into small discs (20mm x 1.5mm). Mixing and weighing the samples were performed at 23 ± 2^0 C and relative humidity of 50 ± 5%. Six discs of each material were fabricated and tested. They were then placed in 100% humidity for 21 hours and stored individually in glass bottles containing 50 ml of distilled water for one day. All discs were then desiccated for one hour at 37^0 C and weighed to the nearest microgram. Discs were replaced back in the bottles and the water inside was not changed nor added. This procedure was performed at 1, 7 and 21 days. Statistical analysis of the data regarding weight loss changes showed no significant changes for amalgam, Super-EBA, and MTA at different time intervals. However, when the mean weights of IRM specimens were compared between day 1 and those on days 7 and 21 days, significant differences were noted. Similar differences were noted when the mean weight of the specimens were compared at day 7 versus day 21.

Fridland and Rosado [(4)] tested mineral trioxide aggregate (MTA) solubility and porosity with different water to powder proportions. Four sets of specimens using the following water to powder proportions were prepared: 0.26, 0.28, 0.30, and 0.33 grams of water per gram of cement. It was determined that the degree of solubility and porosity increased as the water-to powder ratio increased. Significant differences were found among the sets of specimens. They stated that the calcium found in the solution should be in its hydroxide state at this high pH level. This ability to release calcium hydroxide could be of clinical significance because it could be related to the proven capacity of MTA to induce mineralization.

Chng et al [(5)] studied the physical properties of viscosity enhanced root repair material (VERRM); and compared it with Mineral Trioxide Aggregate (MTA).VERRM has a composition similar to mineral trioxide aggregate, with handling characteristics and consistency similar to commercially available materials such as IRM and Super EBA. The pH, setting times, solubility, radiopacity, dimensional change upon setting, and apical sealing ability of VERRM were evaluated and compared to that of ProRoot MTA (GMTA) and ProRoot MTA (Tooth

Colored Formula) (WMTA). The results showed that VERRM had physical properties similar to WMTA. Further development of VERRM is indicated to produce a biocompatible root-end filling material with superior handling characteristics

Poggio et al (6) tested solubility of 3 root-end filling materials (IRM, Pro Root, and Superseal) and an endodontic sealer (Argoseal) used as positive control. The test was performed according to the International Standards Organization 6876 standard and the American Dental Association specification #30. Six specimens of each material were prepared and immersed in water. Solubility was determined after 24 hours and 2 months and analyzed statistically with a one-way analysis of variance test. All retrograde filling materials were of low solubility. Under the conditions of their study, IRM, Superseal, and Pro Root are virtually insoluble; this is an adequate physical property for use as root end filling materials.

Bodanezi et al (7) investigated the solubility of mineral trioxide aggregate (MTA) and Portland cement since its mixture until 672 hours, by means of two complimentary methods. Metal ring molds filled with the cements were covered with distilled water and, at each experimental time (3, 24, 72, 168, 336 and 672 hours), were weighed as soon as the plates in which the samples have been placed. Empty rings served as the control group (n=8). Mean weight gain and loss was determined and analyzed