Evaluation of fast-setting calcium silicate (Protooth): fluoride-release, compressive strength, radiopacity

H Løvschall1, B Ranjkes1, JB Skibsted1, F Isidor1, JS Thomsen2
1Department of Dentistry, 2Department of Biomedicine, Faculty of Health, 3Department of Chemistry, Interdisciplinary Nanoscience Center (iNano), Faculty of Science, Aarhus University, Denmark.

Objective: Novel dental cement (Protooth) with fluoride and fast-setting has been developed for practical treatments in the crown. Earlier studies revealed significant apatite around the material in physiological fluid (PBS). The aim of this study was to evaluate initial setting time, fluoride release, radiopacity and compressive strength of Protooth in comparison to frequently used cements.

Material and methods: The Protooth is nanohybrid calcium silicate powder including calcia, silica, soluble fluoride, alumina, sulphate, phosphate, and zirconia as radiopaque. The liquid contains long-chained weak 2% polycarboxylic acid (Protooth™ pa., Dentosolve Aps). Liquid and powder was capmixed to paste at flowable or condensable consistency. Initial setting time was measured in Gillmore test. The released fluoride in water was determined by electrode (Orion Research, Beverly, Mass., USA). Radiopacity was measured by using a photographic densitometer (Denso-dent, Pehamed, Germany) to measure density of radiographic images of samples. Compression samples were stored at 37°C in 100% humidity for 24h. The strength was tested in universal testing machine (Instron). Dental materials including Dycal® (Caulk), IRM® (Caulk), Zn-phosphate (DeTrey), Biodentine (Septodont), and Proroot® MTA (Maillefere) were mixed according to the manufacturers instructions.

Results: Protooth has initial setting time in the practical range of 2-10 min. Presence of soluble fluorides is associated with increased fluoride release. The compressive strength of Protooth was significantly higher in comparison to all tested dental cement materials including Zn-phosphate cement, IRM, Biodentine, and Proroot MTA. The use of dental materials with long setting-time in the tooth crown may be a disadvantage due to risks of material dissolution and displacement.

Conclusion: In this study we observed that the novel calcium silicate has radiopacity, fluoride release, improved compressive strength, and fast setting, allowing for new applications in the crown. Further studies on use of Protooth for cementation and caries prevention seem relevant.

Keywords: calcium silicate, biomaterials, caries, fluoride, prevention, operative dentistry