Electrospun Ethylcellulose Nanofibers for Dental Resin Modified Glass Ionomer Cement

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With the growth of the dental cement field, there are various needs of patients such as aesthetic, mechanical strength, and chemical resistance. To achieve these goals, some materials for dental cement had been suggested like resin, glass ionomer cement (GIC), zinc phosphate cement (ZPC), and zinc oxide eugenol (ZOE). Recently, resin-modified glass ionomer cement (RMGIC) which combines resin and GIC to improve strength and lower solubility, has been widely used. Although RMGIC shows better performance than other materials such as ZPC and ZOE, there are still areas that need improvement like work difficulty and bonding strength. In this study, RMGIC was improved by using ethyl cellulose, a natural polymer with high chemical resistance, biocompatibility, and mechanical strength. Ethyl cellulose was prepared as a viscous solution by dissolving it in a binary solvent, and it was jet-stretched through electrospinning to fabricate long and uniform nanofibers. The electrospun ethyl cellulose nanofibers (ECNFs) were pulverized to powder form via cryogenic milling and then mixed with RMGIC. It was expected that the ethyl cellulose nanofiber network uniformly dispersed in the RMGIC matrix would increase the fracture resistance and extend the working time through high water binding capacity. The microstructure of ECNFs and cross-section of ECNFs impregnated RMGIC composite were analyzed using a field emission electron microscope. Chemical bonding data between ECNFs and RMGIC was obtained by Raman spectroscopy. Mechanical properties of ECNFs/RMGIC were measured by a universal testing machine. The average diameter of ECNFs was measured to be ~300 nm and an increase in compressive and shear strength was observed. The flexural strength of the ENCFs/RMGIC composite structure was measured to be more than 30 MPa, and it was confirmed that it had a working time of 90 seconds or more.