

Chemical stabilization of dentin extracellular matrix detected by FEISEM and EDS

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Dentin collagen degradation represents an important limit to the stability of the resin-dentin interface in conservative dentistry. *In vitro* application of 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (EDC), an imide-based zero-length cross-linking agent, showed [1] the capability to inactivate the endogenous dentin matrix metalloproteinases and to increase the mechanical properties of the organic dentin extracellular matrix. In the present study, a correlative high resolution SEM (FEISEM) with an Energy Dispersive Spectroscopy (EDS) analysis was performed to characterize the fine structure and the chemical modifications of EDC-stabilized human dentin, after compressive mechanical stress (Chewing Simulation - CS). Demineralized human dentin disks were assigned to four groups: (1) artificial saliva at 37°C for 30 days; (2) pre-treatment with 0.5M EDC for 60 s, then as in Group 1; (3) CS challenge for 30 days; (4) 0.5M EDC as in Group 2 and CS challenge as in Group 3. The FEISEM analysis revealed that the EDC-pretreatment made the collagen fibrillar network more compact, in comparison to controls and this effect was particularly evident on the surface of not stressed samples. Along with the increased compactness of the collagen complex, the EDS analysis showed a significant semi-quantitative increase of sulfur. The presence of chlorine in EDC treated samples was also detectable. The increase of sulfur, not present in EDC composition, suggests a possible implication of sulfate glycosaminoglycans containing proteoglycans during the extracellular matrix stabilization, as also suggested by the concurrent increase of the amorphous matrix. The presence of chlorine in EDC treated samples induces to conclude that the activity of the cross-linking agent is stable even after the experimental time intervals.

Reference

[1] Scheffel et al. (2014) Stabilization of dentin matrix after cross-linking treatments, *in vitro*. *Dent Mater* 30: 227-233.

Keywords

Collagen, Dentin Cross-linkers, EDC, High Resolution SEM, Energy Dispersive Spectroscopy.