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THERAPEUTIC OPERATIVE STRATEGIES COMBINED WITH BIOACTIVE/BIOMIMETIC ION-RELEASING MATERIALS ON DENTINE PERMEABILITY AND REMINERALISATION

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The aim of this lecture is to present the outcomes of several experimental therapeutic approaches we tested in our previous and current research studies such as dentine specimens air-abraded with bioactive glass 45S5 (BAG) and then treated with fluoride-releasing glass ionomer (GIC) or resin-modified glass ionomer cements (RMGIC). Moreover, experimental resin-based varnishes containing different bioactive fillers formulated and then applied onto demineralised dentine pre-treated with or without different biomimetic primers doped with sodium trimetaphosphate, aspartic acid (PASA) and/or poly(acrylic acid) (PAA). Dentin permeability evaluation using a fluid filtration system working at a simulated pulpal pressure of 20 cm H2O and finally processed and assessed with AFM nano-indentation, XRD, FTIR-ATR, FEG-SEM (fractographic analysis), TEM, dye-assisted confocal microscopy and Raman microscopy. The results of our studies showed that air-abrasion technique performed with BAG is able to create a therapeutic "bioactive smear-layer-covered surface", which reacted with body fluids, evoking hydroxyapatite (HAP) precipitation, and hence remineralisation of mineral-depleted dentine and occluding the dentinal tubules. These outcomes were especially evident when BAG air-abraded dentine specimens treated with GICs or RMGICs. Moreover, the use of experimental resin-based systems containing bioactive fillers in combination with biomimetic primers doped with PAA/PASA and TMP evoked "bottom-up" dentine remineralisation that restored the modulus of elasticity of demineralised dentine. The application of minimally invasive therapeutic operative strategies along with the use of current or innovative ion-releasing containing biomimetic reagents may represent a suitable strategy to remineralise demineralised dental hard tissues completely, enhancing the clinical outcomes and longevity. Moreover, bioactive glasses reacts with saliva depositing hydroxycarbonate apatite (HCA) within the demineralised collagen fibrils and occluding dentinal tubules. Therefore, it may be used as a suitable desensitizing bioactive material for the treatment of dentine hypersensitivity and as an air-polishing powder to prevent further demineralisation.

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