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Can Simulated Mastication Remineralise Mineral-Deficient Dentine Restored With ion-Releasing Materials?

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Objectives To evaluate whether simulated chewing could promote the remineralise of mineral-deficient dentine (artificial caries) restored with an experimental restorative material containing fluoride-doped calcium phosphate fillers (FDCP), in combination with a surface conditioner doped with biomimetic analogues of remineralisation.
Methods Standardised occlusal cavities were prepared in caries-free human molars (n:8/group), submitted to pH cycling (14 days) using demineralising (pH 4.8; 8h) and remineralising (pH 7.0; 16h) solutions, creating artificial dentine lesions. An experimental resin-based adhesive and flowable composite, containing FDCP (10wt% and 20wt%, respectively), were applied +/- dentine pre-treatment (60s) using a water-based conditioner doped with sodium-tripolyphosphate and polyacrylic acid (analogues of remineralisation). A glass-ionomer cement (RIVA SC, SDI, Australia) and a conventional adhesive/composite system (Bond-Force II/Estelite Quick, Tokuyama, Japan) were placed. 50% specimens were sectioned immediately (1.5mm slabs). The remainder were stressed in a chewing simulator [dual-movement system: vertical (3mm); horizontal (2mm) at 60 mm/s] with artificial saliva (49N, 1.6 Hz; 100,000 cycles)) and then sectioned. 4 slabs/group underwent microhardness testing along 3 parallel indentation lines (10 gf; 5s) 50 µm periodicity, up to 200 µm from the interface. The remaining 4 slabs/group were immersed in fluorescein-isothiocyanate (12h) and the dentine-material interfaces analysed using confocal scanning microscopy (CLSM). The microhardness data were statistically analysed (α=0.05).
Results The simulated mastication induced mineral diffusion and a significant increase ($p>0.05$) in microhardness underneath the interfaces between 100 and 150 µm, in specimens restored with the experimental material containing FDCP with the use or the biomimetic conditioner ($p<0.05$). No significant sign of remineralisation ($p>0.05$) was observed in specimens restored with GIC or conventional adhesive/composite.
Conclusions Simulated chewing in artificial saliva promotes the remineralisation of artificial caries lesions in dentine when restored with the biomimetic conditioner and

experimental material containing FDCP.