

***In-vitro* comparisons of erosion-abrasion on sound  
versus hypomineralised human enamel**

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## Abstract

**Aim:** To measure differences in tooth wear progression in sound versus hypomineralised human enamel on an *in-vitro* erosion/abrasion model.

**Methods:** Forty enamel sections (20 sound controls (C), and 20 Molar Incisor Hypomineralised (MIH)) were mounted in flat acrylic resins discs. Samples were subjected to 10 wear cycles. Each cycle consisted of 1 hour in artificial saliva followed by 10 minutes immersion in 0.3% citric acid (pH 2.8) and finally tooth-brush abrasion under a load of 200g in either in slurry of 3:1 by weight of artificial saliva:dentifrice or artificial saliva; G1= ((C) + artificial saliva), G2= ((C) Fluor Protector Gel™ (FPG)), G3= ((MIH) + artificial saliva) and G4= (MIH + FPG). Samples were scanned before and after the experiments using a contacting scanner profilometer (Incise™). The scans were superimposed using surface matching software (Geomagic® control) for 3-D measurements of tooth wear (µm). Three samples from each group were scanned before and after the wear cycles using Optical Coherence Tomography (OCT). Surface hardness measurements were taken for five samples from each group using Wallace hardness measurements (VHN). One sample per group was scanned using Scanning Electron Microscopy (SEM).

**Results:** Kruskal-Wallis showed there were statistically significant difference in wear between the groups ( $p=0.000$ ). Mann Whitey U test showed no statistically significance differences in median wear between G1 (8.570 µm) and G2 (8.770 µm),  $p=0.669$ . While unpaired t-test found statistical significant differences in results when comparing mean wear between G3 (19.650 µm) and G4 (15.880 µm),  $p=0.004$ .

OCT scans showed the extent of MIH lesion and that surface wear was observed in some samples. SEM images groups (G3 and G4) showed rough surface topography, surface porosities, enamel surface depressions and disruption compared to images

from groups (G1 and G2) which showed smooth surface topography. MIH teeth had a lower surface hardness (VHN) value, compared to teeth with normal enamel.

**Conclusions:** MIH teeth are more prone to wear than normal enamel with a mean loss in G1 (9.29  $\mu\text{m}$ ), G2 (8.49  $\mu\text{m}$ ), G3 (19.65  $\mu\text{m}$ ) and G4 (15.88  $\mu\text{m}$ ). Using the OCT, MIH lesions extent and morphological surface changes can be observed. MIH have a more rough surface topography, surface porosities, and enamel surface depressions when observed under the SEM. The enamel hardness of MIH teeth is reduced when compared to teeth with normal enamel. Fluor Protector Gel™ was effective in reducing the wear rate in MIH teeth.