**Use of Zinc and Fluoride within an in vitro pH-Cycling Model of Post-Eruptive Enamel Maturation.**

**Authors:** E. J. Miles\*, S.P. Valappil, R. Lynch, S. M Higham.

[e.j.miles@liverpool.ac.uk](mailto:e.j.miles@liverpool.ac.uk)

Health Services Research and School of Dentistry, University of Liverpool, UK

The present study aimed to determine the effect of zinc and fluoride when used within an *in vitro* pH-cycling model of post-eruptive enamel maturation. 80 polished bovine enamel blocks were prepared and subjected to pH-cycling for 0 or 20 days (30min Demineralisation (pH 5.11, 2.25mM Calcium Chloride Dihydrate, 17.65mM Potassium Dihydrogen Orthophosphate,32.9mM Lactic Acid, 4.25µM Fluoride (As NaF)) at 9am, 12:30pm and 4pm, stored in remineralisation solution (pH 6.58, 20mM HEPES, 1mM Calcium Chloride Dihydrate, 12.7mM Potassium Dihydrogen Orthophosphate, 130mM Potassium Chloride, 5.7µM Fluoride (As NaF)). At each solution change, blocks were subjected to one of 4 treatment groups (untreated control, 231μmol/l Zn Sulphate, 12mM NaF and Zn and NaF combined). Microhardness measurements were taken for both sound and cycled enamel. Blocks were then subjected to a lactic acid gel demineralisation and results analysed using Quantitative light induced fluorescence (QLF-D), Multispectral imaging (MSI) and Transverse Microradiography (TMR). A significant increase in microhardness was observed compared to sound enamel for pH-cycled blocks treated with Zn/F (P=0.0087). For all analysis methods significant decreases in fluorescence loss was observed for all pH-cycled blocks in comparison to un-cycled controls with the exception of Zn for QLF-D. (P= QLF-D: No treatment: 0.0004, F: 0.001, Zn/F: 0.001, MSI: No treatment: 0.0015, F: 0.001, Zn: 0.0308, Zn/F: 0.001). These results indicate that exposure to plaque-fluid relevant pH-cycling conditions in the presence of zinc and fluoride may decrease susceptibility of enamel to subsequent acid challenges.

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**25 Word summary of Abstract.**

Exposure to plaque-fluid relevant pH-cycling conditions in the presence of zinc and fluoride may decrease susceptibility of enamel to subsequent acid challenges.

**Key phrase**: De- and re-mineralisation