**Use of QLF-D, MSI and TMR to Test an *in vitro* Post-Eruptive Enamel Maturation Model.**

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The present study aimed to use QLF-D, MSI and TMR to determine whether exposure to pH-cycling conditions representative of plaque fluid could be used as a basis to model *in vitro* the decreased susceptibility to acid challenges observed in post-eruptively matured enamel. 24 polished bovine enamel blocks were exposed 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). The model was tested through a standard 72h demineralisation challenge and results analysed using Quantitative light induced fluorescence (QLF-D), Multispectral imaging (MSI) (0, 3, 6, 12, 24, 48 and 72h time points) and Transverse Microradiography (TMR) (72h time point). For all analysis methods significant decreases in mineral/fluorescence loss was observed for all pH-cycled blocks in comparison to un-cycled controls at 72h (QLF-D: P= 0.023, MSI: P=0.014 and TMR: P=0.033, n=12, Independent samples Mann-Whitney U test). Additionally, a non-significant decrease was observed for all methods between pH-cycled and non-cycled enamel for each treatment group. At each time point, a non-significant decrease was observed between pH-cycled enamel and non-cycled controls for all treatment groups. These initial results indicate that exposure to plaque-fluid relevant pH-cycling conditions in the presence of zinc and fluoride may provide a basis for the development of an *in* vitro model of post-eruptive maturation.

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**25 Word summary of Abstract.**

Exposure to plaque-fluid representative pH-cycling conditions may provide a suitable basis from which to develop an *in vitro* model of post-eruptive enamel maturation.

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