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De- and Remineralisation of Human Teeth Induced by Food Stuffs

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Introduction

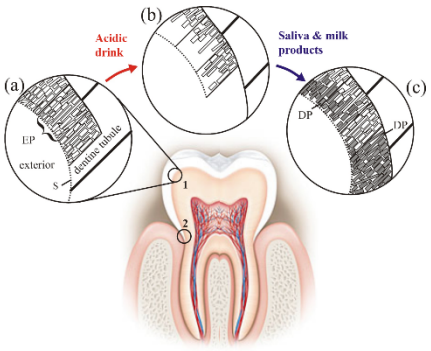
Human teeth are always exposed to the interplay of food-induced demineralisation (DEM) and remineralisation (REM) generated by saliva or milk products as external source for calcium and phosphate ions. In the past 50 years nutrition habits have changed immensely and DEM of enamel and dentine has become a serious problem.[1] Alimentation with mainly fast food or even with mainly fruit as well as the consumption of acidic or fruit drinks of natural origin cause a high degree of DEM.[2] Thus, it is necessary to find and study ways that REM can keep teeth healthy. Here we monitor the nanoscale surface morphology and chemical structure at the dentin-enamel junction during demineralization upon impact of acidic beverages and subsequent remineralisation with a repair paste[3] or milk products.

Methods

The surface alteration in terms of loss or gain of roughness and change in surface morphology was followed by atomic force microscopy (AFM). The chemical changes at the tooth surface are studied using attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR). Studies were carried out *in vitro* using polished, caries-free human tooth slices.

Results & Discussion

In mineralisation studies we show that a stepwise treatment of the tooth with DEM or REM agents followed with repeated AFM imaging of the same place allows us to draw detailed conclusions regarding the specific mechanism of the demineralization and the subsequent remineralisation process. DEM induces a significant shift of the phosphate band ũ(PO_4) to higher wavenumbers in the IR spectrum. This process is reverse by the impact of REM agents and saliva, leading to a red shift of the band. The comparison of the different REM agents reveals that calcium containing food stuff promotes REM as efficient as commercial repair pastes.



Conclusion

Our experiments model the de- and remineralisation process of teeth occurring in everyday life. Successive AFM imaging reveals how the dentine-enamel junction is gradually eroded over time by acids and how mineral nanoparticles are deposited by the commercial REM agent or casein containing food stuff (Fig1). ATR-FTIR is an easy mean of quantifying the DEM/REM impact.

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