

Characterization of White Spot Lesion Using Focused Ion Beam - Scanning Electron Microscopy

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Abstract : Background: A white spot lesion (WSL) is defined as subsurface enamel porosity from carious demineralisation on the smooth surfaces of the tooth. It appears as a milky white opacity. Lesions shown an apparently intact surface layer, followed underneath by the more porous lesion body. The small pores within the body of the lesion act as diffusion pathway for both acids and minerals, so allowing the demineralisation of enamel to occur at the advancing front of the lesion. Objectives: The objective is to map the porosity and its size on WSL with Focused Ion Beam- Scanning Electron Microscopy (FIB-SEM) Method: The basic method used for FIB-SEM consisted of depositing a one micron thick layer of platinum over 25µm x 25µm of the interest region of enamel. Then, making a rough cut (25µm x 5µm x 20µm) with 3nA current and 30Kv was applied with the help of drift suppression (DS), using a standard "cross-sectional" cutting pattern, which ended at the front of the deposited platinum layer. Two adjacent areas (25µm x 5µm x 20µm) on the both sides of the platinum layer were milled under the same conditions. Subsequent, cleaning cross-sections were applied to polish the sub-surface edge of interest running perpendicular to the surface. The "slice and view" was carried out overnight for milling almost 700 slices with 2Kv and 4nA and taking backscattered (BS) images. Then, images were imported into imageJ and analysed. Results: The prism structure is clearly apparent on FIB-SEM slices of WSL with the dissolution of prism boundaries as well as internal porosity within the prism itself. Porosity scales roughly 100-400nm, which is comparable to the light wavelength (500nm). Conclusion: FIB-SEM is useful to characterize the porosity of WSL and it clearly shows the difference between WSL and normal enamel.

Keywords : white spot lesion, FIB-SEM, enamel porosity, porosity

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