

Poster Presentations - Research Supported by P&G

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Raman Spectroscopic Changes in Teeth Interiors When Externally Bleached In-Vitro

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In previous studies we observed changes in fluorescence properties of bleached teeth irradiated under Raman examination. **Objective:** The location and magnitude of bleach effects on teeth were examined by comparing fluorescence and Raman Total Spectral Intensity changes in subsurface tooth enamel, DEJ and dentin in teeth bleached externally – as part of a kinetic study to determine maximum changes associated with saturated external bleach activity. **Methods:** Extracted human premolars were analyzed for external CIELAB (L*a*b*) color with a Fuji-1000CCD and stratified into treatment groups for kinetic study. Teeth were subsequently subjected to bleaching with whitening strips (Crest® Whitestrips® Supreme containing 14 % hydrogen peroxide) in a cycling protocol including topical bleach exposure alternating with storage in pooled human saliva. Teeth were analyzed in cross section by nondestructive confocal laser scanning microscopy coupled with a Raman spectrometer (excitation He/Ne laser at 632 nm). Combined line scans at discrete intervals were measured from the enamel surface through central DEJ and dentin with magnitude of fluorescence change in the form of the Raman Total Spectral Intensity. **Results:** Raman Spectra showed no chemical changes in mineral components associated with bleaching throughout the kinetic process. The Raman Total Spectral Integral (50-3600 cm⁻¹) for non bleached enamel was larger for subsurface enamel (range 7-10 x 10⁶) than subsurface dentin (4 x 10⁶) and largest for DEJ regions (15 x 10⁶). RSTI in subsurface enamel was reduced following bleaching in a depth and rate dependent fashion. **Conclusion: Vital bleaching of teeth is non-destructive to mineral components and associated with strong changes in optical properties, particularly including fluorescence in dental enamel.**

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Ultrastructural Effects of Maximum Bleaching on Normal Teeth In Vitro

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Despite widespread applications, there is interest in establishing the boundaries of safe and effective tooth whitening with oxidation technologies including both in office and OTC techniques. **Objectives:** The aim of this study was to examine bleach induced effects on tooth ultrastructure as determined by Confocal Laser Scanning Microscopy (CLSM) under conditions of bleaching confirmed to produce a maximum color change in teeth in vitro. **Methods:** Ultrastructural characterizations of control and bleached teeth were carried out with a prototype confocal laser scanning microscope. Images were collected in line scans from tooth surface to dentin/pulp junction using Ar ion laser excitation at 488 nm. The line scan technique allowed placing cubic-micrometer size subsurface AOIs at discrete distances (some ten µm) from the tooth surface, through enamel and DEJ down to the dentin/pulp junction. Substrates for analysis included extracted human premolars which were part of a kinetic study to determine maximum color changes possible in normal dentition with extended external bleaching (Crest Whitestrips Supreme containing 14 % hydrogen peroxide) using a cycling protocol including topical bleach exposure alternating with storage in pooled human saliva. **Results:** Maximum tooth color change was recorded at -8.35 delta b CIELAB units which took 66 hours of total bleach treatment with strips – provided as sequenced additive bleach exposures. Observation revealed that the CLSM ultra-structure of teeth is not affected by a maximum bleaching procedure. Comparisons to acid damaged, eroded or fluorotic dentition revealed that peroxide was passive to tooth structure even under conditions of maximum bleaching. **Conclusion: Bleaching of teeth to maximum color change does not affect structural features of subsurface enamel, dentin and DEJ as assessed by ultrasensitive CLSM.**