

Mineralization of Sialoliths Investigated by Ex Vivo and In Vivo X-ray Computed Tomography

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Abstract

The fraction of organic matter present affects the fragmentation behavior of sialoliths; thus, pretherapeutic information on the degree of mineralization is relevant for a correct selection of lithotripsy procedures. This work proposes a methodology for in vivo characterization of salivary calculi in the pretherapeutic context. Sialoliths were characterized in detail by X-ray computed microtomography (μ CT) in combination with atomic emission spectroscopy, Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, and transmission electron microscopy. Correlative analysis of the same specimens was performed by in vivo and ex vivo helical computed tomography (HCT) and ex vivo μ CT. The mineral matter in the sialoliths consisted essentially of apatite (89 vol%) and whitlockite (11 vol%) with average density of 1.8 g/cm³. In hydrated conditions, the mineral mass prevailed with 53 \pm 13 wt%, whereas the organic matter, with a density of 1.2 g/cm³, occupied 65 \pm 10% of the sialoliths' volume. A quantitative relation between sialoliths mineral density and X-ray attenuation is proposed for both HCT and μ CT.

Keywords: X-ray attenuation; composition; computed tomography; lithotripsy efficiency; lithotripsy methods; multimodal management; sialoliths.