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Mean X-ray attenuation of salivary calculi computed from microtomography data

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Salivary calculi, or sialoliths, have an estimated clinical prevalence of 0.12 to 0.45% [1]. Long-term obstruction of the ducts by sialoliths can lead to atrophy of the salivary glands with concomitant ceasing of the secretory function and ultimately fibrosis [2]. Shock wave lithotripsy (SWL) is a non-invasive therapeutic technique that can be used to eliminate salivary calculi [3], however the method has had a less than desirable success rate [3,4,5], which may be justified by the sialoliths' fraction of organic mater [6]. Earlier studies have found a correlation between the calculi size and degree of mineralization with the outcome of SWL treatment [7,8]. It is therefore essential to systematically characterize salivary calculi in terms of these parameters. The present work aims to characterize the volume and degree of mineralization of salivary calculi through X-ray micro computed tomography (μCT).

Figure 1 shows a microradiograph of a submandibular sialolith (a) and a median longitudinal reconstructed cross-section obtained from μCT data (b) where brighter regions correspond to higher mineralization and dark regions represent essentially organic matter. Table 2 presents the average volume and X-ray attenuation of submandibular calculi (S_i) together with the corresponding Ca+Mg fraction determined by induced couple atomic emission spectroscopy. Although the results present high variability, there is a correlation between the amount of Ca+Mg and the degree of mineralization as measured by the mean X-ray attenuation. These results indicate that X-ray tomography may be used to identify the patients with calculi susceptible to ultra-sound shockwaves.

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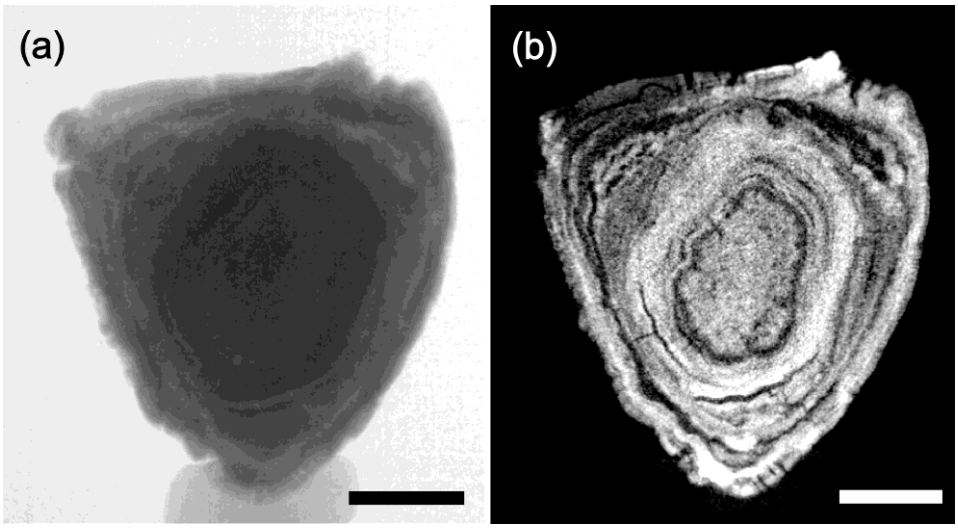

Figure 1 - (a) Microradiograph of a submandibular sialolith and (b) a median longitudinal reconstructed cross-section obtained from μCT data. The scale bars correspond to 2 mm.

Table 1 – Mean attenuation and volume determined from μCT data, and Ca+Mg fraction measured by induced couple atomic emission spectroscopy.

Sample	Mean attenuation (10^3 m^{-1})	Volume (10^{-9} m^3)	Fraction of Ca+Mg (wt %)
S_1	0.017	227.82	8.86
S_2	0.025	61.26	11.71
S_3	0.033	384.64	18.54
S_4	0.045	455.66	23.96

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