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Structural typologies of salivary calculi

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Several theories have been put forward regarding the aetiology and pathogenesis of salivary calculi, although a comprehensive understanding of the nucleation and growth mechanisms involved in the formation of these structures is still lacking.

In general, sialoliths present one core partially or highly mineralized surrounded by concentric layers of organic and mineralized matter that alternate in succession following a chronologic sequence [1]. The layers consist of fine mineralized strata intercalated with fine organic ones and threaded globular structures with variable degrees of mineralization [1].

The exact mechanism involved in the genesis of sialoliths remains largely unknown, theories defending an initial organic nidus or an initial precipitation of minerals, with subsequent deposition of organic and inorganic layers, can be found in the literature [2-4]. Nevertheless, it remains object of discussion the etiologic factors responsible for the formation of the first nidus or the initial precipitation, since infection, inflammation of the gland, viscous nature of the mucous secretions or naturally existing sialomicroliths have all have been implicated [4-6].

Aiming at an exhaustive systematization of salivary calculi morphogenesis, their morphology has been studied by micro-computed tomography (μCT) and scanning electron microscopy (SEM). μCT studies were done on as-extracted dried samples using μCT SkyScan 1172 instrument with a 1.3 Megapixel camera, operated at the maximum available power of the source (10W). Radiographs acquisition was performed with a rotational step in the 0.70-1° range, until a maximum of 180º, with an exposure time in the 3.1-5 s range. Microscopy observations were carried out with backscattered electron (BSE) signals using a JEOL JSM 7001F operated at 15 kV, samples were previously prepared following metallographic procedures [1].

The submandibular and parotid calculi investigated presented similar growth patterns, which can follow either concentric (Figure 1) or perturbed-growth typologies (Figure 2), although in most situations a gradation between them has been found. Nevertheless, a single well-defined core constituted by material with low mineralization was frequently present, supporting the nucleation hypothesis of an initial organic nidus [7].

The combination of μCT with SEM enabled a comprehensive characterization of the sialoliths: (i) the former technique allowed for a precise localization of the core and other morphological features within the calculus volume, while (ii) investigation of details at higher resolution could be achieved with the latter method. However, due to the friable nature of the sialoliths, handling during sample preparation results often in material loss (compare (a) and (b) in both Figures).

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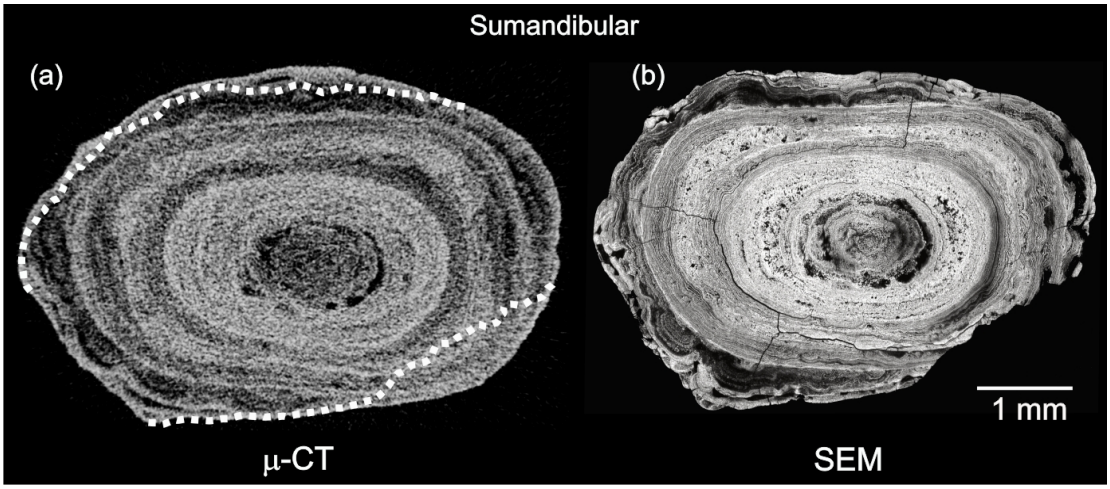

Figure 1. (a) μ-CT and (b) SEM images of a submandibular calculus presenting an approximately concentric growth typology.

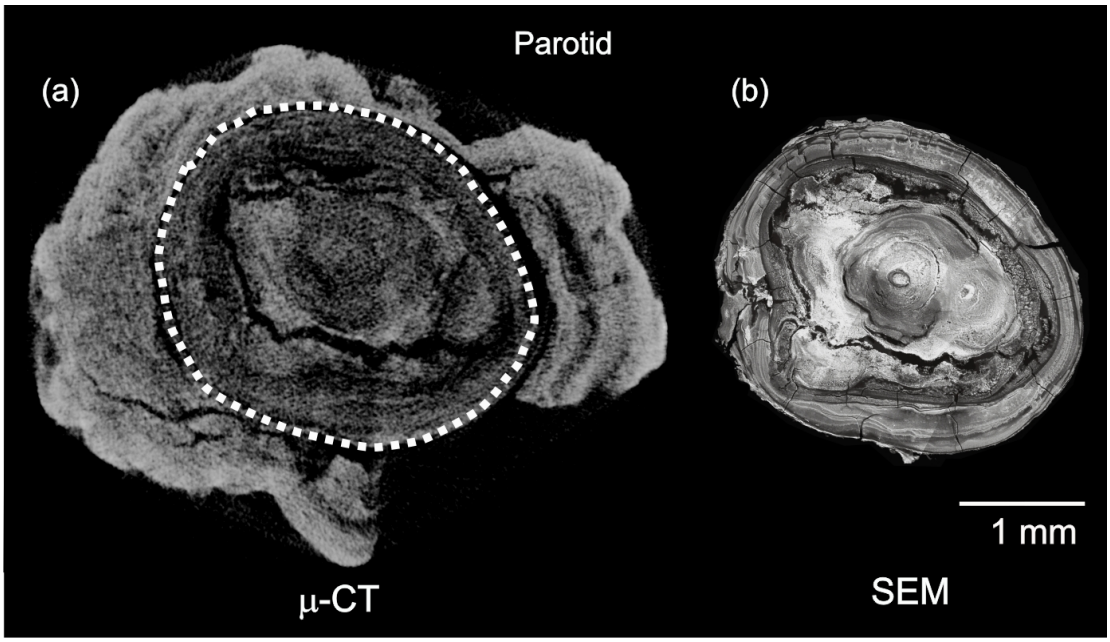

Figure 2. (a) μ-CT and (b) SEM images of a parotid calculus presenting a perturbed-growth typology.

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