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Salivary stones crystallization. Previous study

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The present work is part of a multidisciplinary research project that is being carried out between components of the Complutense Research Group "Crystallographic and geological techniques. Non-conventional applications" and the Otorhinolaryngology Service of Jiménez Díaz Foundation University Hospital, Villalba General Hospital and Infanta Elena University Hospital from Madrid.

The sialolithiasis is a frequent cause of salivary flow obstruction that causes a pathology called chronic obstructive sialadenitis. Most salivary stones are produced in the submandibular or submaxillary gland followed by the parotid gland. Their chemical composition is carbonate and calcium phosphate, with impurities of magnesium, potassium and ammonium. The genesis of the stones is associated with the partial obstruction of a calcium-rich saliva, but to date the mechanism of their formation is not well understood [1, 2].

Through this paper we have studied salivary stones from 25 anonymous patients with different ages and gender, with different glandular and anatomical origin, most of them whole and extracted by sialoendoscopy.

The mineralogical and morphological characterization was made using XRPD, OM and SEM-EDX.

Although each of them has unique characteristics, they show a series of common features that have allowed us to suggest a crystallization model that we hope to confirm as the number of cases studied increases.

The macroscopic size of the stones ranges from 2 to 22 mm. In all of them hydroxyapatite ($Ca_{10}(OH)_2(PO_4)_6$) and octacalcium phosphate ($Ca_8H_2(PO_4)_6.5H_2O$) have been identified as crystalline phases. In addition, withlockite ($Ca_3(PO_4)_2$) was identified in eight of the samples studied. All phases have a very low degree of crystallinity.

Morphologically, they could be defined as concentric oolites, in which an inner core stands out. The texture of the layers is granular; consisting of aggregates of microspheres whose size increases from the core, where they are nanometric, towards the surface, where they adopt botroidal appearances perceptible to the naked eye.

These morphological characteristics suggest a heterogeneous initial nucleation of multiple nuclei from organic components present in saliva. The nuclei anastomose during their growth, forming agglomerates that serve as substrate for the nucleation of new layers of spheres, repeating the process until reaching the final size.

These results agree with the low degree of crystallinity observed in the diffractograms and suggest a mechanism of continuous growth, far from the equilibrium at high supersaturation, which occurs rhythmically, originating the different concentric layers in a similar way to the formation process of pearls [3].

References:

[1] Tanaka, N., Shizuko Ichinose, S., Adachi, Y, Mimura, M. & Kimijima, Y. (2003) Med Electron Microsc, 36:120–126. https://doi.org/10.1007/s00795-002-0210-z

[2] Im Y-G, Kook M-S, Kim B-G, Kim J-H, Park Y-J, Song H-J. (2017) Oral
Surgery, Oral Medicine, Oral Pathology and Oral Radiology. doi: 10.1016/j.oooo.2017.03.011.

[3] Grégoire, Ch. (1961). jcb.rupress.org. 395-400. http://doi.org/10.1083/jcb.9.2.395

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