

SPECTRAL ANALYSIS OF THE SUBMANDIBULAR GLAND SIALOLITHS

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Introduction. Sialoliths are intraductal or intraparenchymal calculi of the large salivary glands. They consist of organic and inorganic mater, with a nucleus and plastic peripheral structures. The sialoliths predominantly are composed of calcium phosphate, with a low content of carbonates and insignificant content of magnesium, potassium and ammonia. Our aim was to study the composition of the submandibular glands calculi in order to assess the mechanisms of their mineralization in sialolithiasis.

Materials and methods. The spectral analysis of the sialoliths, extracted from the submandibular gland of 7 patients (4 males and 3 females) with a mean age of 37.3 ± 6.2 years, who were treated in the Institute of Emergency Medicine, was carried out. To achieve the proposed goal, scanning electron microscopy with VEGA TESCAN TS 5130MM equipment and radio-spectral microanalysis of the concrements by energy-dispersive X-ray spectroscopy, using the EDX (Oxford Instruments energy-dispersive X-ray system) materials detector, was performed. Identification of different crystalloid forms of calcium phosphate was based on at least 3 measurements of the Ca/P ratio: for brushite within range of 0.85-1.0; whitlockite – 1.1-1.5; Ca-deficient hydroxyapatite – 1.5-1.63; hydroxyapatite ≈ 1.67 .

Results. Energy-dispersive X-ray spectroscopy revealed the following mean ratios at the interface peripheral part/core of the sialoliths chemical elements (atom%): Carbon (C) – $65.54 \pm 1.67/50.16 \pm 3.1$ ($p < 0.001$); Oxygen (O₂) – $30.49 \pm 0.76/34.19 \pm 2.1$ ($p = 0.171$); Calcium (Ca) – $0.77 \pm 0.20/2.56 \pm 0.9$ ($p = 0.029$); Phosphorus (P) – $0.63 \pm 0.15/2.2 \pm 0.7$ ($p = 0.02$); Sulfur (S) – $0.3 \pm 0.05/0.2 \pm 0.02$ ($p = 0.058$); Sodium (Na) – $0.19 \pm 0.01/0.28 \pm 0.03$ ($p = 0.225$); Chlorine (Cl) – $0.09 \pm 0.01/0.08 \pm 0.01$ ($p = 0.141$).

Conclusions. In the core of the sialoliths, the atomic concentration of calcium ($p < 0.05$) and phosphorus ($p < 0.05$) was higher, compared to the peripheral part of the sialoliths. The mean value of the calcium/phosphorus ratio (Ca/P) at the interface peripheral part/core of the sialoliths was $1.1 \pm 0.2/1.2 \pm 0.1$. The reduced concentration of Ca and P contributes to the formation of apatite, while the increased concentration leads to the formation of whitlockite.

Keywords: sialoliths, spectral analysis, submandibular gland