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ORIGINAL ARTICLE

Biochemical structure, symptoms, location and treatment of sialoliths

Rafał Stelmach [a], Maciej Pawłowski [b], Leszek Klimek [c], Anna Janas [a*]

[a] Department of Oral Surgery, Medical University of Lodz, Lodz, Poland
[b] Department of Pediatrics and Allergy, Medical University of Lodz, Nicolaus Copernicus Hospital, Lodz, Poland
[c] Institute of Material Science and Engineering, Lodz University of Technology, Lodz, Poland

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Abstract *Background/purpose:* Sialolithiasis is the most common disease of the salivary glands, which can cause acute and chronic infections. More than 80% of sialoliths occur in the submandibular gland or its duct, 6% in the parotid gland, and 2% in the sublingual gland or minor salivary glands. Typical symptoms are recurrent swelling and pain in the involved gland, often associated with eating, due to obstructions of the draining duct. The aim of the study was to analyze biochemical structure, symptoms, size, and location of salivary stones as well as concomitance with nephrolithiasis.

Materials and methods: This study was conducted targeting 46 patients with sialolithiasis who visited the Department of Oral Surgery, Medical University of Lodz, Poland in 2009–2015. Medical records containing patients' age, sex, position of the salivary stone, and symptoms were collected and analyzed. Stones were examined ultrastructurally with a scanning electron microscope and X-ray diffractometer.

Results: Multiple stones were found in 1% of patients. We observed that men had sialolithiasis about twice as often as women. The chemical structure of the stones varied but they mainly contained different traces of carbon, calcium, oxygen, phosphorus, and sulfur. Longitudinal sections of the stones revealed elongated, round, and irregular shapes. We noticed that nephrolithiasis was present in 11 (24%) patients. We observed the unilateral location of sialoliths with multilayer structures, mainly composed of inorganic material, such as hydroxyapatite.

Conclusion: We found that the location of the stones influenced the symptoms, and concomitance of sialoliths and nephroliths was common.

* Corresponding author. Department of Oral Surgery, Medical University of Lodz, 251 Pomorska Street, 92-213 Lodz, Poland.
E-mail address: alergol@kopernik.lodz.pl (A. Janas).

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Introduction

The etiology of sialolith formation is still unknown but there are some factors contributing to stone formation: irregularities in the duct system, inflammation or local irritants.[1,2]

Salivary gland stones may form as a result of an infection. However, in certain cases, chemicals may become crystallized and block salivary ducts. It has been speculated that, in the process of calculi formation, degenerative substances are liberated by saliva and calcification subsequently occurs around those substances to finally lead to calculus formation.[3–5] Nevertheless, the exact mechanism of the formation of calculi is still unclear. The causes of formation of sialoliths seem to be as follows: mechanical, chemical, inflammatory, and neurohumoral. Salivary duct stones may occur in all of the salivary glands, but they are mainly found in the submandibular glands (80–90%), especially the submandibular duct (Wharton duct) because of its long, narrow, and winding transection. Sialolithiasis occurs more frequently in men, with a peak incidence between the ages of 30 years and 60 years.[6] Stones should be differentiated from phleboliths, inflammation of maxillary bones, and calcification of lymph nodes. There is some indication that patients with sialolithiasis are more prone to develop nephrolithiasis.[6] Sialolithiasis has been linked with nephrolithiasis in up to 10% of patients.[6] The aim of the present study was to analyze the biochemical structure, symptoms, size, and location of salivary stones, as well as their coexistence with nephrolithiasis. We also tried to assess whether the patient's age or sex, or location of the stones may be characteristic of specific symptoms.

Materials and methods

This study targeted 46 patients with sialolithiasis who visited the Department of Oral Surgery, Medical University of Lodz, Poland in 2009–2015. Medical records, containing patients' age, sex, position of the salivary stone, symptoms, and concomitance with nephroliths, were collected and analyzed. All patients presented to our clinic because of recurrent or persistent salivary gland complaints such as swelling and pain, or recurrent episodes of sialadenitis. Symptoms, measured from the first visit, lasted 20 months on average (range: 2 days–6 years). Due to their location and smaller diameter, parotid stones could, in some cases, only be treated using endoscopic laser lithotripsy. Characteristics of the study population are presented in Table 1. The patients were diagnosed based on history taking, intraoral examination, pantomographic X-ray and occlusal X-ray (Figures 1 and 2).

Stones were analyzed ultrastructurally by scanning electron microscopy (SEM) and X-ray diffractometry (XRD). During XRD, the samples were pulverized in an agate mortar. XRD was performed on the powder with an X-ray diffractometer (Siemens D 500 Pro; Karlsruhe, Germany) under the following conditions: X-ray beam CaKα, X-ray tube voltage 50 kV, tube current 30 mA, scan speed 2 θ. XRD patterns were obtained for all sialoliths and traces were integrated to present the data in one graph. The XRD pattern of each sample was compared with the standard data for crystalline minerals using powder diffraction files. SEM studies were performed with a Hitachi S300N scanning electron microscope (Tokyo, Japan) with an attached energy-dispersive X-ray (EDX) microanalysis detector system (Nordan MM, Placerville, CA, USA). The sialolith samples kept for SEM were coated with a thin film of evaporated gold. The SEM studies and EDX microanalysis were done at an accelerating voltage of 15 kV and a working distance of 15 mm.

Table 1 Baseline characteristics.

	n	%
Age (y)		
24–40	16	34.7
41–60	20	43.5
61–70	10	21.7
Sex		
Male	30	65.2
Female	16	34.8
Location		
Within the duct of the submandibular gland: right side	20	43.5
Within the duct of the submandibular gland: left side	10	21.7
Outside the duct of the submandibular gland: right side	9	19.6
Outside the duct of the submandibular gland: left side	7	15.2
Symptoms		
Periodic enlargement of the salivary gland	15	32.6
Enlarged parotid duct	23	50.0
Limiting the secretion of saliva	28	60.8
Redness and swelling of the mucosa	28	60.8
Scanty mucopurulent discharge	28	60.8

Statistical methods

During the analysis of data the Fischer exact two-tailed test was used to determine the difference between nominal variables. All statistical analyses were performed using StatSoft Statistica for Windows, release 8.0 (StatSoft, Tulsa, AZ, USA). $P < 0.05$ was considered to indicate statistical significance.

Figure 1 A pantographic X-ray of oral cavity showing a large sialolith in the left submandibular gland.