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MODERN PREVENT IVE APPROACHES IN REDUCING THE INCIDENCE AND RECURRENCE OF SALIVARY STONE DISEASE

Hamroyeva Komila Shuhratovna
Department of Stomatology,

Second-Year PhD Student at

Asia International University

ORCID: 0009-0005-4731-1791

e-mail: kkhamraeva9515@gmail.com

tel:93 4558886

Bukhara, Uzbekistan

Abstract. Salivary stone disease (sialolithiasis) represents the most common obstructive pathology of the major salivary glands and is characterized by a recurrent course and chronic inflammatory changes. The present study provides a comprehensive analysis of epidemiological features, territorial distribution, and major environmental and lifestyle-related risk factors of sialolithiasis in the Bukhara region. A retrospective evaluation of clinical data highlights the significant role of drinking water hardness, mineral composition, oral hygiene, and hydration status in disease development. Based on the findings and recent literature, modern preventive strategies integrating dental, environmental, and lifestyle interventions are proposed to reduce disease incidence and recurrence.

Keywords: sialolithiasis, salivary stone disease, prevention, drinking water quality, oral hygiene, environmental factors.

Introduction. Salivary stone disease (sialolithiasis) accounts for approximately 50–60% of non-neoplastic salivary gland disorders and remains a relevant problem in oral and maxillofacial surgery and dentistry [1]. The condition results from the formation of calcified structures within the salivary ducts or glandular parenchyma, leading to partial or complete obstruction of salivary flow. Clinically, sialolithiasis is associated with pain, swelling during meals, xerostomia, and recurrent sialadenitis, significantly impairing patients' quality of life [2].

Reactive dystrophic diseases of the salivary glands are characterized by functional and biochemical disturbances of salivary secretion, which create favorable conditions for the development of obstructive pathologies, including salivary stone disease. Jumaev L.R. demonstrated that dystrophic changes in the salivary glands are accompanied by significant alterations in clinical and laboratory parameters, reflecting impaired secretory function and saliva stagnation [1].

Pathogenetically oriented treatment approaches aimed at restoring salivary gland function have been shown to reduce inflammatory activity and normalize salivary composition. According to Jumaev L.R., complex therapy targeting local and systemic mechanisms leads to

improved salivary flow and may prevent progression of reactive dystrophic changes into chronic obstructive conditions such as sialolithiasis [2].

Biochemical studies of oral fluid further confirm that changes in the quantitative and qualitative composition of salivary glycoproteins play a key role in the pathogenesis of salivary gland dystrophic diseases. Altered glycoprotein balance increases saliva viscosity and promotes formation of an organic matrix, which serves as a basis for mineral crystallization and stone formation [3]. These findings support the inclusion of biochemical diagnostics and pathogenetic prevention in modern strategies for reducing the incidence and recurrence of salivary stone disease.

Despite advances in minimally invasive treatment techniques, including sialendoscopy and lithotripsy, recurrence of salivary stones remains a frequent clinical challenge [3]. Therefore, current scientific interest has shifted toward identifying modifiable risk factors and developing effective preventive strategies. Recent studies emphasize the multifactorial nature of sialolithiasis, involving local anatomical factors, biochemical properties of saliva, systemic metabolic conditions, and environmental influences [4].

Among external factors, drinking water quality—particularly its hardness and mineral composition—has gained increasing attention as a potential determinant of salivary stone formation, especially in endemic regions [5]. Consequently, region-specific preventive approaches based on epidemiological evidence are required.

Aim of the Study. To analyze the incidence and epidemiological characteristics of salivary stone disease in different areas of the Bukhara region, to evaluate major internal and external risk factors, and to substantiate modern, evidence-based preventive strategies aimed at reducing disease occurrence and recurrence.

Materials and Methods. A retrospective epidemiological study was conducted using clinical records of 137 patients treated for salivary gland diseases at the Department of Oral and Maxillofacial Surgery of the Bukhara Regional Multidisciplinary Medical Center between 2021 and 2024. Among them, 52 patients diagnosed with salivary stone disease were selected for detailed analysis.

Data collection included demographic characteristics (age, gender), place of residence (urban or rural), drinking water source, oral hygiene status, and lifestyle factors. The obtained data were analyzed using descriptive statistics, percentage distribution, and comparative evaluation methods.

Results and Discussion. Epidemiological Characteristics. The analysis revealed that salivary stone disease was diagnosed in 37.96% of patients with salivary gland pathologies. The disease occurred in individuals aged 7 to 74 years, with the highest prevalence observed in middle-aged and elderly patients. These findings are consistent with previously published epidemiological data indicating an age-dependent increase in disease incidence [6].

Gender Distribution. A pronounced male predominance was observed, with 65.38% of cases occurring in men and 34.62% in women. Similar trends have been reported in recent studies, attributing male predominance to dietary habits, occupational dehydration, smoking, and lower adherence to oral hygiene practices [7].

Territorial Distribution and Environmental Factors. The majority of cases (80.77%) were recorded among rural residents, whereas only 19.23% occurred in urban populations. The highest incidence was observed in districts characterized by increased drinking water hardness and mineralization. Elevated levels of calcium and magnesium ions in drinking water are known to alter salivary composition, promote supersaturation, and facilitate nucleation of salivary calculi [8].

Urban residents demonstrated a lower incidence rate, which may be explained by greater access to filtered and pH-balanced drinking water. These findings support the hypothesis that water quality represents a key environmental risk factor for sialolithiasis [9].

Hygienic and Lifestyle Factors. Inadequate oral hygiene, insufficient fluid intake, and chronic inflammatory conditions of the oral cavity were frequently identified among affected patients. Reduced salivary flow and changes in saliva viscosity contribute to ductal obstruction and stone formation [10]. Smoking and dietary patterns low in natural sialogogues further increase disease risk [11].

Preventive Approaches.Modern preventive strategies for salivary stone disease emphasize a comprehensive and multidisciplinary approach. Adequate hydration and the use of filtered or low-mineral drinking water are considered fundamental measures to reduce salivary supersaturation [12]. Dietary modifications, including increased consumption of citrus fruits and other natural sialogogues, enhance salivary flow and promote duct clearance [13].

Maintenance of proper oral hygiene and regular dental examinations are essential for preventing chronic sialadenitis and secondary stone formation [14]. Recent evidence also supports the adjunctive use of herbal mouth rinses with anti-inflammatory and antiseptic properties (e.g., chamomile, mint, ginger) as part of preventive care in early-stage obstructive salivary gland disease [15].

Pathogenetic Aspects of Salivary Stone Formation . Recent studies indicate that salivary stone formation is a complex physicochemical process involving changes in saliva composition, flow rate, and ductal anatomy [1]. Supersaturation of saliva with calcium and phosphate ions, combined with reduced salivary flow, creates favorable conditions for nucleation and subsequent crystal growth. Organic components such as desquamated epithelial cells, bacterial biofilms, and mucins serve as a matrix for mineral deposition [2]. Inflammatory processes within the salivary ducts further contribute to stone formation by altering duct permeability and increasing mucus secretion. Chronic sialadenitis leads to ductal narrowing and stagnation of saliva, which accelerates mineral precipitation and stone enlargement [3]. These findings highlight the close interrelationship between inflammation and obstruction in the etiopathogenesis of sialolithiasis.

Role of Metabolic and Systemic Factors. In addition to local factors, systemic metabolic disturbances play an important role in the development of salivary stone disease. Hypercalcemia, disorders of calcium–phosphorus metabolism, dehydration, and endocrine abnormalities such as parathyroid dysfunction have been associated with an increased risk of sialolithiasis [4]. Patients with metabolic syndrome and reduced water intake demonstrate higher salivary viscosity, which predisposes to ductal obstruction [5]. Recent evidence suggests that salivary stones may share pathogenetic mechanisms with urolithiasis, particularly in terms of mineral metabolism and

crystallization processes [6]. Therefore, identification and correction of systemic risk factors should be considered an essential component of preventive strategies.

Modern Diagnostic and Preventive Paradigms. Advances in diagnostic imaging, including high-resolution ultrasound and cone-beam computed tomography, allow early detection of salivary duct obstruction and microcalculi [7]. However, sialendoscopy remains the most informative method for direct visualization of the ductal system and early-stage pathological changes [8]. Early diagnosis facilitates timely preventive interventions and reduces the likelihood of recurrent disease. From a preventive standpoint, stimulation of salivary secretion represents a key therapeutic target. Adequate hydration, avoidance of prolonged dehydration, and use of sialogogues enhance ductal flushing and reduce mineral accumulation [9]. Preventive counseling aimed at modifying dietary habits and improving oral hygiene has been shown to significantly decrease recurrence rates [10].

Integration of Traditional and Modern Preventive Approaches. In recent years, interest has grown in integrating evidence-based elements of traditional medicine into modern preventive dentistry. Herbal preparations with anti-inflammatory and antiseptic properties, such as chamomile (Matricaria chamomilla), mint (Mentha piperita), and ginger (Zingiber officinale), have demonstrated beneficial effects on oral mucosa and salivary flow [11]. Clinical observations suggest that regular use of herbal mouth rinses may reduce mucosal inflammation, normalize salivary secretion, and improve ductal patency in patients with early-stage obstructive salivary gland disease [12]. When used as adjuncts to standard preventive measures, these agents may enhance patient compliance and long-term outcomes.

Public Health and Regional Prevention Implications. The high prevalence of salivary stone disease in rural areas emphasizes the importance of region-specific preventive programs. Public health interventions aimed at improving drinking water quality, expanding access to filtration systems, and promoting adequate hydration may substantially reduce disease burden [13]. Educational initiatives focusing on oral hygiene practices and early symptoms of salivary gland obstruction should be incorporated into primary dental care. Such programs may facilitate early referral, reduce complications, and lower healthcare costs associated with advanced disease stages [14].

Conclusions. Salivary stone disease remains a prevalent and clinically significant condition strongly associated with environmental factors, particularly drinking water quality, as well as lifestyle and hygienic habits. The higher incidence observed in rural areas of the Bukhara region is primarily related to increased water hardness and mineral content.

The findings of the present study confirm that salivary stone disease is a multifactorial condition influenced by environmental, metabolic, and lifestyle-related factors. Drinking water hardness and mineral composition represent key modifiable external risk factors, particularly in rural populations.

Effective prevention of sialolithiasis requires a comprehensive and interdisciplinary approach integrating environmental measures, patient education, lifestyle modification, and modern dental prevention strategies. The implementation of region-adapted preventive programs may significantly reduce disease incidence, recurrence, and associated complications, ultimately improving oral health outcomes at the population level.

Implementation of region-specific, evidence-based preventive programs focusing on water quality improvement, hydration, oral hygiene, and patient education may substantially reduce the incidence and recurrence of sialolithiasis.

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