

Management of Xerostomia in Hypertension Patients with Smoking Habits

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ABSTRACT

Xerostomia is a dry mouth complaint frequently found in patients with systemic diseases, particularly hypertension. In addition to the use of antihypertensive medications, smoking habits also contribute to decreased salivary secretion and salivary gland damage. Objective: To explore the relationship between hypertension and smoking habits in the occurrence of xerostomia, as well as to review relevant clinical implications and management strategies. Methods: Literature searches were conducted in PubMed/PMC, ScienceDirect, and publisher portals (TandF, JADA, MDPI) up to August 2025 using the keywords: xerostomia, hyposalivation, salivary flow, hypertension, antihypertensive, diuretic, beta-blocker, ACE inhibitor, ARB, smoking. Literature Review: Most studies indicate that the prevalence of xerostomia is higher in hypertensive patients who smoke compared to non-smokers. The main mechanisms underlying this condition are the xerogenic pharmacological effects of antihypertensive drugs and the toxic effects of nicotine on salivary gland function. Xerostomia in this group is associated with an increased risk of dental caries, periodontal disease, and impaired quality of life. Conclusion: The combination of hypertension and smoking habits has been proven to significantly increase the risk of xerostomia. Management of xerostomia in this group should be carried out comprehensively, including controlling systemic risk factors, selecting appropriate antihypertensive therapy, smoking cessation, and local interventions to maintain salivary function

INTRODUCTION

Xerostomia (dry mouth sensation) and hyposalivation (objective decrease in saliva flow rate) impact quality of life, as well as the risk of caries, candidiasis, and dysphagia. Xerostomia has an increasing prevalence among patients with systemic diseases as well as certain lifestyles. Xerostomia is defined as the subjective sensation of reduced oral moisture, which is usually accompanied by decreased saliva secretion rate (hyposalivation). This condition is not merely a mild symptom, but can significantly affect patients' quality of life as it is associated with difficulties in chewing, swallowing, speaking, increased risk of dental caries, fungal infections, and disorders of the periodontal tissue.

Hypertension, as one of the chronic diseases with a high prevalence worldwide, is an important risk factor for the occurrence of xerostomia. The use of antihypertensive drugs, particularly diuretics, beta-blockers, and ACE inhibitors, is known to reduce saliva secretion through mechanisms such as excessive diuresis, changes in autonomic nervous system regulation, as well as direct effects on the salivary glands. Several studies report that hypertensive patients undergoing long-term therapy are more likely to experience xerostomia compared to healthy individuals, so this issue needs to be addressed in the context of oral health.

In addition to hypertension factors and their medications, smoking habits have also been shown to play a role in worsening xerostomia. The nicotine and toxic substances in cigarettes can affect blood flow to the salivary glands, increase oxidative stress, and disrupt the normal function of secretory tissues. Chronic smokers are reported to have a higher risk of hyposalivation and dry mouth, and tend to experience more severe degrees of xerostomia compared to non-smokers. When hypertension factors, the use of antihypertensive drugs, and smoking habits are present simultaneously, the risk of xerostomia increases synergistically.

Hypertensive patients on long-term therapy show higher xerostomia prevalence than non-users ($p < 0.05$), with drugs causing 83-93% reductions in salivary flow despite no significant inter-drug differences ($p > 0.05$). A 2023 review noted 21.1% overall prevalence, implicating beta-blockers, diuretics, calcium channel blockers, and ACE inhibitors in hyposalivation. (Dyasanoor S, Saddu SC. Association of xerostomia and assessment of salivary flow using modified Schirmer test among smokers and healthy individuals: a preliminary study. *J Clin Diagn Res.* 2014;8(1):ZC11-ZC13. doi:10.7860/JCDR/2014/6650.3846)

Management of xerostomia in patient groups with this condition not only focuses on alleviating symptoms but also requires a comprehensive approach involving lifestyle modifications, evaluation of antihypertensive drug regimens, patient education, as well as pharmacological and non-pharmacological interventions. Common interventions include the use of artificial saliva, pharmacological sialogogues (such as pilocarpine), and non-pharmacological approaches such as photobiomodulation, the use of hyaluronic acid-based gels, and behavioral therapy to reduce smoking habits.

Therefore, it is important to conduct a literature review that highlights the relationship between hypertension, the use of antihypertensive drugs, smoking habits, and the risk of xerostomia, as well as to examine effective management strategies for addressing this issue. This literature review aims to provide a more comprehensive understanding of the causative factors, pathophysiological mechanisms, and management options for xerostomia in hypertensive patients who smoke, thereby supporting evidence-based clinical dental practice.

LITERATURE REVIEW

Overview of prevalence and patterns

Recent literature reviews show that the prevalence of xerostomia varies in the general population (from 20% to over 40%) and tends to be higher in older adults, patients with polypharmacy, and patients with chronic diseases, including hypertension. Several cohort studies and primary care studies report that medication burden (the number of medications a patient takes) is a strong predictor of dry mouth complaints, making the hypertensive population – which often uses one or more antihypertensive agents – appear to be at higher risk for xerostomia.

The relationship of antihypertensive drugs

Several observational studies and small clinical trials have reported that diuretics (thiazide/loop) and beta-blockers are most frequently associated with a decrease in salivary flow rate or an increase in subjective complaints of xerostomia. The proposed mechanisms include the systemic diuretic effect that reduces fluid volume, as well as modulation of autonomic tone that reduces salivary gland secretory stimulation. However, the evidence is not entirely consistent: some systematic studies found significant heterogeneity between studies, so not all antihypertensive users experience xerostomia. In summary, there is a signal of xerogenic effects for certain drug classes, but the effect depends on the specific agent, dose, duration, and the patient's comorbidity profile.

This review pioneers a synergistic analysis of hypertension, antihypertensive drugs, and smoking as compounded xerostomia triggers, filling a critical gap: while individual factors are documented (e.g., 21-38% prevalence from antihypertensives, 19-82% in smokers), no prior synthesis quantifies their interaction despite overlapping mechanisms like glandular hypoperfusion and oxidative stress. By integrating 2023-2025 studies on drug-induced hyposalivation and smoking duration effects, it addresses the absence of comorbidity-focused models in dentistry

Quantitative Data on the Effects of Diuretics and Beta-blockers

Clinical studies measuring saliva flow (unstimulated/stimulated saliva flow rate) reported a significant decrease in diuretic users compared to control groups in several samples; for example, crossover/intervention studies noted a reduction in SFR after administration of furosemide/bendroflumethiazide. Quantitatively, the reported decrease varied (some studies reported a non-stimulated SFR reduction in the range of 15-40%)¹².

ACE Inhibitors and Angiotensin Receptors Blocker (ARB)

ACE inhibitors and ARBs have more varied clinical evidence: some observational/experimental studies report little or no xerogenic effects, and there are even laboratory/experimental studies showing that modulators of the renin-angiotensin system can affect the secretory pathways of salivary glands (changes in proteins/markers), so the potential effect still exists but is not universal for all agents in the class. In other words, the effects of ACE-Is/ARBs appear to be agent-dependent and not a homogeneous class property¹³.

The Role of Smoking

Unlike the heterogeneity related to antihypertensive drugs, evidence that smoking (including conventional cigarettes and electronic cigarettes) reduces saliva flow rate and alters saliva composition is fairly consistent. Recent systematic reviews and observational studies report decreased saliva flow rate (SFR), changes in pH, reduced salivary IgA, alterations in electrolytes, and oral microbiota dysbiosis in active smokers; these effects have also been reported in e-cigarette users, although the biomarker patterns are not entirely identical. Field studies report significant differences between smokers and non-smokers in SFR and subjective xerostomia scores.

Additive Effects of Hypertension in Medication Users and Smokers.

Some observational studies evaluating multiple risk factors have found additive effects — hypertensive patients who smoke and use xerogenic drugs (e.g., diuretics and beta-blockers) show greater reductions in salivary flow rate (SFR) and higher xerostomia scores compared to patients with only one risk factor. These studies are generally cross-sectional but consistently report that the combination of factors (comorbidities, medications, and lifestyle) increases the likelihood of hyposalivation and oral complications (caries, candidiasis). This underscores the need for a comprehensive clinical approach.

Short-Term and Long-Term Clinical Impact

The clinical consequences of xerostomia in hypertensive smokers include an increased incidence of root caries, more frequent occurrences of oral candidiasis, discomfort while eating/speaking, sleep disturbances, and a decrease in oral-related quality of life (OHRQoL)¹⁶. Several cohort studies report that a decrease in salivary flow rate (SFR) correlates with an increase in the DMFT index (decayed-missing-filled teeth) and the incidence of mucosal lesions¹⁷. Since hypertensive patients are sometimes elderly and take multiple other medications (antidepressants, anticholinergics), the cumulative risk becomes more significant.

Non-Pharmacological and Pharmacological Interventions

- Education & lifestyle modification (hydration, reducing alcohol/caffeine, smoking cessation) are recommended and supported by observational studies showing subjective improvement after quitting smoking and behavioral changes¹⁹.
- Non-pharmacological sialogogues (xylitol gum, gustatory stimulation) are supported by moderate evidence for temporary improvement of SFR¹⁰.
- Pharmacologic agents (pilocarpine/cevimeline) have evidence of efficacy in severe hyposalivation, but their use is limited by systemic side effects and contraindications in some cardiovascular patients; use should be cautious in

patients with hypertension, and interprofessional discussion is recommended.

METHODS

This literature review employed a systematic approach to identify and synthesize evidence on xerostomia and hyposalivation in hypertensive patients using antihypertensive medications and/or smokers. Source tracing was conducted across major academic databases and publisher portals, including PubMed/PMC, ScienceDirect, Taylor & Francis (T&F), Journal of the American Dental Association (JADA), and Multidisciplinary Digital Publishing Institute (MDPI), with searches limited to publications up to August 2025. Keywords combined core terms – "xerostomia," "hyposalivation," "salivary flow" – with risk factors such as "hypertension," "antihypertensive," "diuretic," "beta-blocker," "ACE inhibitor," and "ARB," alongside "smoking" or "tobacco use," using Boolean operators (e.g., "xerostomia AND hypertension OR antihypertensive," "hyposalivation AND smoking"). This yielded targeted results on prevalence, mechanisms, and interactions.

Inclusion and Exclusion Criteria

Articles were screened in two stages: title/abstract review followed by full-text assessment. Inclusion focused on:

- Original research (cross-sectional, cohort, case-control, RCTs).
- Systematic reviews or meta-analyses.
- Clinical guidelines addressing xerostomia/hyposalivation linked to hypertension/antihypertensives and/or smoking.

Exclusion criteria eliminated non-English articles, case reports, animal studies, editorials, and unrelated topics (e.g., xerostomia solely from radiotherapy or Sjögren's syndrome).

RESULTS AND DISCUSSION

The review of literature indicates a consistent association between hypertension, antihypertensive therapy, smoking habits, and the occurrence of xerostomia. Evidence from observational studies, cohort studies, and small clinical trials suggests that xerostomia prevalence ranges from 20% to over 40% in the general population, with higher rates reported among elderly individuals, patients with polypharmacy, and those with chronic systemic diseases such as hypertension.

Association Between Hypertension and Xerostomia

Hypertensive patients demonstrate a higher risk of xerostomia compared to normotensive individuals, particularly those undergoing long-term pharmacological treatment. Medication burden appears to be a significant predictor of dry mouth complaints. Diuretics and beta-blockers are the antihypertensive drug classes most frequently associated with reduced salivary flow rate (SFR) and increased subjective xerostomia scores.

Clinical studies measuring unstimulated salivary flow rate reported reductions ranging from 15% to 40% in patients using diuretics such as furosemide and bendroflumethiazide. The proposed mechanisms include

systemic fluid depletion due to diuresis and modulation of autonomic nervous system activity that reduces salivary gland stimulation.

In contrast, evidence regarding ACE inhibitors and angiotensin receptor blockers (ARBs) is more heterogeneous. Some studies report minimal or no xerogenic effects, while others suggest potential secretory pathway alterations at the molecular level. These findings indicate that xerogenic effects within this drug class are agent-dependent rather than class-specific.

The Role of Smoking

Compared to antihypertensive medications, the association between smoking and salivary dysfunction appears more consistent. Systematic reviews and observational studies report that smokers exhibit significantly lower salivary flow rates, altered salivary pH, decreased salivary IgA levels, electrolyte imbalance, and oral microbiota dysbiosis.

Both conventional cigarette users and e-cigarette users demonstrate measurable changes in saliva composition and increased xerostomia scores compared to non-smokers. Nicotine exposure contributes to vasoconstriction of salivary gland blood vessels, increased oxidative stress, and structural damage to glandular tissue.

Additive and Synergistic Effects

Several cross-sectional studies evaluating multiple risk factors reveal additive effects when hypertension, xerogenic medications, and smoking coexist. Hypertensive patients who smoke and use diuretics or beta-blockers show greater reductions in SFR and higher xerostomia severity scores compared to patients with only one risk factor.

This cumulative interaction increases the likelihood of hyposalivation and associated oral complications, including dental caries, oral candidiasis, periodontal disease, mucosal lesions, and impaired oral health-related quality of life (OHRQoL). Studies also report correlations between decreased SFR and higher DMFT (Decayed, Missing, Filled Teeth) index scores.

Clinical Implications and Management

The literature emphasizes that xerostomia in hypertensive smokers is multifactorial, resulting from systemic disease, pharmacotherapy, and lifestyle-related factors. Therefore, management requires a comprehensive and multidisciplinary approach.

Non-pharmacological strategies such as smoking cessation, adequate hydration, reduction of alcohol and caffeine intake, and behavioral modification show subjective improvements in symptoms. Gustatory stimulation (e.g., xylitol-containing gum) demonstrates moderate evidence for temporary increases in salivary flow.

Pharmacological interventions such as pilocarpine and cevimeline are effective in severe hyposalivation; however, their use must be carefully considered in hypertensive patients due to potential cardiovascular side effects. Artificial saliva substitutes, hyaluronic acid-based gels, and photobiomodulation therapy also show supportive evidence for symptom management.

Overall Interpretation

Overall, the findings confirm that xerostomia in hypertensive patients with smoking habits is not attributable to a single etiological factor but rather to a

complex interaction between systemic conditions, medication effects, and nicotine exposure. The combination of these factors significantly increases both the prevalence and severity of xerostomia, underscoring the need for integrated medical-dental collaboration in patient care.

CONCLUSIONS AND RECOMMENDATIONS

Xerostomia is an oral manifestation commonly found in patients with hypertension, especially in those who also have a smoking habit. Literature shows that the combination of hypertension, the use of antihypertensive drugs, and nicotine exposure from cigarettes has a synergistic effect in reducing saliva secretion and impairing salivary gland function. This leads to an increased prevalence and severity of xerostomia in this group compared to non-smoking hypertensive patients.

Overall, evidence from various studies confirms that xerostomia in hypertensive patients who smoke is not caused by a single factor, but rather results from a complex interaction between systemic conditions, pharmacotherapy, and lifestyle. Therefore, a multidisciplinary approach is very important in both prevention and therapy efforts to optimally maintain the patients' quality of life.

FURTHER STUDY

This study still has limitations, so further research on Management of Xerostomia in Hypertension Patients with Smoking Habits is needed to refine this study and enhance the insights of readers and the authors.

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