

Review

Clinical Management of Dry Mouth in Patients Taking Long-Term Medications

Zahra Saud Alfaraj^{1*}, Azza Saad Alhothali²

¹ Department of Dental Hygiene, Dental Clinic in North Riyadh, Ministry of Health, Riyadh, Saudi Arabia

² Aladel Primary Healthcare Center, Ministry of Health, Mecca, Saudi Arabia.

Correspondence should be addressed **Zahra Saud Alfaraj**, Department of Dental Hygiene, Dental Clinic in North Riyadh, Ministry of Health, Riyadh, Saudi Arabia, Email: zahraalfaraj@hotmail.com

Copyright © 2025 **Zahra Saud Alfaraj**. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 01 December 2025, Accepted: 30 December 2025, Published: 30 December 2025.

Abstract

Xerostomia is a common complication in patients receiving long-term pharmacological treatments, particularly among older adults and individuals with chronic illnesses. It results from the salivary glands' impaired ability to produce saliva, often caused by medications with anticholinergic or sympathomimetic properties. The condition affects oral function, speech, taste, nutritional intake, and increases the risk of dental caries, periodontal disease, and mucosal infections. Despite its high prevalence, xerostomia is frequently underdiagnosed and undertreated in both primary care and specialist settings. Pharmacologic interventions, including muscarinic receptor agonists such as pilocarpine and cevimeline, have shown efficacy in stimulating salivary flow but are often limited by systemic side effects. Saliva substitutes, gels, and sprays provide temporary symptom relief without improving gland function. Non-pharmacologic strategies like xylitol-based products, chewing gums, and low-level laser therapy may be beneficial for select patients with residual glandular activity. Personalizing these interventions requires assessment of individual gland function, medical comorbidities, and cognitive status. Emerging therapies in regenerative medicine, including stem cell applications and gene transfer technologies, present new possibilities for long-term improvement in patients with irreversible salivary gland damage. Early clinical trials indicate potential for functional recovery, particularly in patients with radiation-induced hypofunction. However, accessibility, cost, and regulatory considerations remain barriers to widespread use. Long-term management is further complicated by poor treatment adherence, lack of standardized care protocols, and limited integration between dental and medical professionals. Gaps in follow-up and low prioritization of oral health in chronic disease care contribute to suboptimal outcomes. Improving patient education, strengthening interprofessional collaboration, and expanding access through digital platforms may enhance the continuity and effectiveness of care. A comprehensive, individualized approach is essential to minimize the functional and quality-of-life impacts of medication-induced xerostomia.

Keywords: *xerostomia, long-term medications, salivary gland dysfunction, pharmacologic management, oral health*

Introduction

Dry mouth, or xerostomia, is a common condition characterized by a subjective sensation of oral dryness, which frequently affects individuals undergoing long-term medication therapy. It is particularly prevalent in older adults, where the combination of age-related salivary gland hypofunction and polypharmacy contributes to a higher incidence. Studies estimate that up to 30% of individuals over the age of 65 experience persistent dry mouth symptoms, with prevalence strongly linked to the number and type of medications consumed (1). This condition can significantly impact oral health and overall quality of life, making its recognition and management a clinical priority.

The pathophysiology of medication-induced xerostomia often involves interference with autonomic nervous system function, especially the inhibition of parasympathetic stimulation necessary for salivary gland activity. Many commonly prescribed drugs, such as antidepressants, antipsychotics, antihypertensives, and diuretics, possess anticholinergic properties that reduce salivary flow (2). Tricyclic antidepressants and certain antipsychotics are particularly potent in this regard, but even medications not primarily acting on the nervous system may cause xerostomia as a secondary effect. The synergistic effects of multiple drugs, even at low doses, can significantly impair salivary secretion (3).

Beyond the sensation of dryness, the clinical consequences of xerostomia can be extensive. Saliva plays an essential role in oral defense by maintaining mucosal integrity, buffering oral pH, facilitating digestion, and exerting antimicrobial action. Reduced salivary flow leads to a higher risk of dental caries, periodontal disease, oral candidiasis, mucosal trauma, and halitosis. Denture retention becomes problematic, and speech and taste may also be affected, particularly in older patients with multiple comorbidities (4). These complications may further diminish nutritional intake and social interaction, especially among elderly and medically complex populations.

Effective clinical management of medication-related xerostomia begins with proper identification of the underlying causes, including the review of current pharmacological regimens. In some cases, adjusting or substituting the offending medication can reduce symptoms, but this may not always be feasible due to therapeutic necessity. Therefore, a multidisciplinary approach is often required, combining pharmacologic solutions (such as salivary stimulants or substitutes) with non-pharmacologic interventions including rigorous oral hygiene, lifestyle modifications, and use of sugar-free chewing gum or lozenges to enhance residual salivary gland function (5). Despite various management strategies, many patients report persistent symptoms, highlighting the need for more individualized care models and evidence-based protocols.

Review

The management of xerostomia in patients on long-term medication remains clinically challenging due to the multifactorial nature of the condition and limitations in therapeutic efficacy. While drug substitution or dose adjustment may reduce symptoms, this is often impractical when the medication is essential for the management of chronic systemic conditions. As a result, treatment frequently relies on symptom management through both pharmacologic and non-pharmacologic strategies. Pharmacological agents such as pilocarpine and cevimeline have shown some benefit in stimulating salivary secretion, particularly in patients with residual gland function, but their use may be limited by side effects like sweating, gastrointestinal discomfort, or cardiovascular concerns (6).

Non-pharmacological interventions, including the use of saliva substitutes, sugar-free chewing gums, oral moisturizers, and improved hydration, play a supportive role and are generally well tolerated, although they offer only temporary relief. Preventive dental care is essential to reduce the risk of secondary complications like dental caries and candidiasis, which are common in chronically dry oral environments. Emerging research is also

investigating novel therapies, such as low-level laser therapy and acupuncture, which may provide alternative pathways for symptom relief with fewer systemic effects (7). However, larger randomized trials are needed to validate their efficacy and define clinical guidelines for broader use.

Pharmacological and Non-Pharmacological Interventions for Medication-Induced Xerostomia

The treatment of medication-induced xerostomia often requires a tailored strategy, as no single therapy fully reverses the condition. Pharmacologic options such as muscarinic receptor agonists have been studied extensively for their ability to stimulate residual salivary gland tissue. Pilocarpine and cevimeline, in particular, are commonly prescribed in clinical practice. These agents act on M3 receptors to enhance salivary secretion, especially effective in individuals with functioning glandular tissue. Cevimeline has demonstrated a favorable safety profile and longer duration of action compared to pilocarpine, making it suitable for managing persistent symptoms throughout the day (8). However, side effects such as sweating, dizziness, and gastrointestinal disturbances may limit tolerability in some patients. These medications also require caution in those with asthma, cardiac arrhythmias, or narrow-angle glaucoma.

Salivary substitutes and oral moisturizing agents are widely used as supportive therapies. These products mimic the viscosity and lubricating properties of natural saliva but do not stimulate glandular function. Available in the form of sprays, gels, and mouth rinses, they provide transient relief of dryness, especially when used before meals or bedtime. Studies suggest that formulations containing carboxymethylcellulose or glycerin are more effective in increasing oral comfort than plain water or basic lubricants (9). Their effects, however, are short-lived and require frequent reapplication throughout the day. This approach can become burdensome in patients with cognitive decline or manual dexterity limitations, often observed in elderly populations.

Chewing gum and lozenges containing xylitol have also been explored for their salivary-stimulating potential. Mechanical stimulation of the oral mucosa through mastication can promote reflexive salivation, particularly when residual gland function remains. Xylitol not only acts as a sweetening agent but also has cariostatic properties, offering added benefit in reducing the risk of dental caries in xerostomic patients. A randomized controlled trial reported increased unstimulated and stimulated salivary flow in subjects using xylitol-containing chewing gum over a two-week period, although the improvements were modest and more noticeable in younger adults (10). Additionally, routine use of such products may be impractical for those with temporomandibular joint disorders, edentulism, or difficulty chewing.

Low-level laser therapy (LLLT) and electrostimulation have gained attention in recent years as potential non-pharmacological interventions. These techniques aim to enhance salivary flow through stimulation of glandular cells or neural pathways. Clinical data on LLLT suggest a biostimulatory effect on salivary gland tissue, leading to increased blood flow and cell regeneration. In a pilot study involving head and neck cancer survivors, LLLT applied to the parotid and submandibular glands resulted in measurable increases in salivary output and patient-reported dryness scores after multiple sessions (11).

Tailoring Salivary Gland Stimulation Strategies to Patient Profiles

Effective management of xerostomia often hinges on how well treatment strategies align with the patient's individual clinical profile. The heterogeneity of salivary gland dysfunction across age groups, comorbidities, and medication loads demands a more stratified approach. For example, patients with residual gland function and minimal systemic disease may respond well to gustatory and mechanical stimulants such as citric acid lozenges or sugar-free mints. These agents trigger salivation through direct activation of taste receptors and oral sensory pathways. A study investigating the efficacy of acid-based lozenges showed that patients with mild xerostomia and intact glandular tissue

experienced improved flow rates and reported reduced subjective dryness after consistent use for two weeks (12). However, their acidic nature may pose a risk to dental enamel, particularly in those with pre-existing demineralization.

In contrast, individuals with extensive glandular atrophy, often due to long-standing systemic conditions or head and neck radiation, benefit less from peripheral stimulation. These patients are typically non-responders to conventional sialogogues and require systemic pharmacologic agents or device-based interventions. Pharmacological agents are not universally effective across all demographics; older adults with cardiovascular conditions may poorly tolerate drugs like pilocarpine due to their cholinergic side effect profile. Clinical decision-making in such cases is aided by detailed evaluation of salivary output using sialometry and imaging to assess gland viability. Objective metrics can guide treatment selection and prevent overuse of ineffective interventions.

In immunocompromised populations or those with autoimmune etiologies, particularly Sjögren syndrome, tailored regimens must consider the chronic inflammatory milieu affecting salivary tissue. Topical immunomodulatory therapies, such as cyclosporine rinses, have been explored to target local inflammation while avoiding systemic exposure. Though not yet standard of care, early studies suggest these rinses can reduce lymphocytic infiltration and improve both subjective symptoms and glandular output in select patients (13). Immunologically mediated xerostomia requires close collaboration between dental specialists and rheumatologists, as systemic disease control may indirectly influence oral outcomes. Beyond pharmacotherapy, behavioral strategies such as scheduled water sipping, humidifier use during sleep, and reduction of dietary irritants can complement medical management and are often effective in stabilizing day-to-day symptoms.

In patients undergoing antineoplastic therapies, proactive planning becomes essential. Pre-treatment dental evaluation and initiation of salivary stimulation strategies before the onset of radiation

or chemotherapy can minimize irreversible glandular damage. Techniques like transcutaneous electrical nerve stimulation (TENS) have shown modest success in patients anticipating therapy-induced xerostomia. A randomized trial assessing TENS therapy over four weeks demonstrated improvements in salivary flow and oral comfort, particularly among younger patients and those with less aggressive treatment regimens (14). This modality is noninvasive and well tolerated, making it an attractive option for anticipatory care. Patient selection, however, remains key, as individuals with neuropathy or altered neural pathways may not experience similar benefits.

Age-related decline in salivary function presents its own challenges. In elderly patients with cognitive decline or physical limitations, the practicality of certain therapies must be weighed carefully. For instance, oral appliances designed to stimulate salivary flow during wear may be effective but unsuitable for those unable to maintain proper oral hygiene. Customized education on symptom recognition and caregiver support systems can substantially improve outcomes in these settings. Studies have noted that incorporating xerostomia management into routine geriatric care can reduce secondary complications such as denture sores and malnutrition (15).

Clinical Challenges and Future Directions in Long-Term Management

Managing medication-induced xerostomia over extended periods involves more than prescribing a treatment. Clinicians must navigate fluctuating symptoms, changing medication regimens, and diverse patient needs, all within systems that may lack integrated oral healthcare. The absence of standardized diagnostic protocols complicates early detection. Patients often report symptoms only after they become disruptive to eating or sleeping. By that stage, irreversible glandular changes may already be present. A 10-year observational study revealed that many general practitioners do not routinely screen for oral dryness, particularly in patients taking long-term antihypertensives or antidepressants, despite their known xerogenic potential (16). This delay reduces the window of time in which interventions

might preserve gland function or prevent downstream complications.

Follow-up presents a separate layer of difficulty. Patients with chronic xerostomia frequently experience fatigue managing multiple symptoms from coexisting diseases. As a result, oral dryness often receives lower priority during consultations. Inconsistent communication between dentists, primary care physicians, and specialists can limit coordinated care. Efforts to implement shared management plans are sporadic, and clinical records often lack documentation of xerostomia-related interventions. Without a reliable flow of information, treatment adjustments that could alleviate dryness are missed. A multi-center analysis of geriatric patients on five or more medications found that fewer than 20 percent had documented oral health assessments during annual reviews (17).

The problem extends into treatment sustainability. Long-term adherence to saliva substitutes, sialogogues, or hygiene routines is often poor. Patients discontinue use due to minimal perceived improvement, taste aversion, cost, or adverse effects. Current interventions provide temporary relief but fail to offer regenerative or disease-modifying results. Advances in tissue engineering have begun to shift focus toward biologically restorative approaches. Researchers are exploring stem cell therapies and bioengineered salivary gland constructs designed to integrate into host tissue and produce functional saliva. Preliminary findings from animal models show promise, with successful reinnervation and glandular regeneration observed after transplantation of epithelial stem cells (18). Translating these techniques into clinical use, however, will require rigorous safety testing and complex delivery systems that align with human physiology.

Gene therapy is also under investigation. Experimental delivery of aquaporin-1 gene into salivary ductal cells has been trialed to restore water transport and enhance secretion. In a Phase I clinical study involving head and neck cancer patients, targeted gene transfer using viral vectors showed increased salivary output with minimal adverse

events (19). These results suggest potential for durable improvement, particularly in patients with irreversible radiation damage. However, the approach remains experimental and faces hurdles in regulation, cost, and accessibility. Integrating such technologies into real-world care will depend not just on scientific success, but also on policy adaptation and public trust. The direction of care must also account for disparities. Rural populations and individuals in lower socioeconomic groups often lack access to dental professionals trained in xerostomia management. Reforms in providing education and reimbursement models will play a critical role in expanding care. Moreover, mobile health tools and tele-dentistry platforms may offer scalable solutions for follow-up and patient engagement, particularly for those unable to attend regular in-person visits.

Conclusion

Effective long-term management of medication-induced xerostomia requires personalized strategies aligned with patient profiles and evolving clinical needs. While current therapies offer symptom relief, they remain limited in durability and regenerative potential. Advances in biotechnology and interdisciplinary care models hold promise for more sustainable outcomes. Future approaches must prioritize accessibility, integration, and innovation to improve patient quality of life.

Disclosure

Conflict of interest

There is no conflict of interest.

Funding

No funding.

Ethical consideration

Non applicable.

Data availability

All data is available within the manuscript.

Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

References

1. Thomson WM, Chalmers JM, Spencer AJ, Williams SM. The Xerostomia Inventory: a multi-item approach to measuring dry mouth. *Community dental health.* 1999;16(1):12-7.
2. Sreebny LM, Schwartz SS. A reference guide to drugs and dry mouth—2nd edition. *Gerodontology.* 1997;14(1):33-47.
3. Smith RG, Burtner AP. Oral side-effects of the most frequently prescribed drugs. *Special care in dentistry.* 1994;14(3):96-102.
4. Navazesh M, Kumar SK. Measuring salivary flow: challenges and opportunities. *The Journal of the American Dental Association.* 2008;139:35S-40S.
5. Villa A, Connell CL, Abati S. Diagnosis and management of xerostomia and hyposalivation. *Therapeutics and clinical risk management.* 2014:45-51.
6. Vivino FB, Al-Hashimi I, Khan Z, LeVeque FG, Salisbury PL, Tran-Johnson TK, et al. Pilocarpine tablets for the treatment of dry mouth and dry eye symptoms in patients with Sjögren syndrome: a randomized, placebo-controlled, fixed-dose, multicenter trial. *Archives of internal medicine.* 1999;159(2):174-81.
7. Cohen L, Danhauer SC, Garcia MK, Dressler EV, Rosenthal DI, Chambers MS, et al. Acupuncture for chronic radiation-induced xerostomia in head and neck cancer: a multicenter randomized clinical trial. *JAMA network open.* 2024;7(5):e2410421-e.
8. Fox PC, van der Ven PF, Sonies BC, Weiffenbach JM, Baum BJ. Xerostomia: evaluation of a symptom with increasing significance. *The Journal of the American Dental Association.* 1985;110(4):519-25.
9. Plemons JM, Al-Hashimi I, Marek CL. Managing xerostomia and salivary gland hypofunction: executive summary of a report from the American Dental Association Council on Scientific Affairs. *The Journal of the American Dental Association.* 2014;145(8):867-73.
10. Söderling E, Hirvonen A, Karjalainen S, Fontana M, Catt D, Seppä L. The effect of xylitol on the composition of the oral flora: a pilot study. *European journal of dentistry.* 2011;5(01):024-31.
11. Gautam AP, Fernandes DJ, Vidyasagar MS, Maiya AG, Vadhiraja BM. Low level laser therapy for concurrent chemoradiotherapy induced oral mucositis in head and neck cancer patients—a triple blinded randomized controlled trial. *Radiotherapy and Oncology.* 2012;104(3):349-54.
12. Palma LF, Gonnelli FAS, Marcucci M, Giordani AJ, Dias RS, Segreto RA, et al. A novel method to evaluate salivary flow rates of head and neck cancer patients after radiotherapy: a pilot study. *Brazilian journal of otorhinolaryngology.* 2018;84(2):227-31.
13. Al-Hashimi I, Schifter M, Lockhart PB, Wray D, Brennan M, Migliorati CA, et al. Oral lichen planus and oral lichenoid lesions: diagnostic and therapeutic considerations. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology.* 2007;103:S25. e1-S. e12.
14. Dhillon M, Raju SM, Mohan RS, Tomar D. Efficacy of transcutaneous electric nerve stimulation on parotid saliva flow rate in relation to age and gender. *Journal of Dentistry.* 2016;17(3):164.
15. Hopcraft M, Tan C. Xerostomia: an update for clinicians. *Australian dental journal.* 2010;55(3):238-44.
16. Guggenheimer J, Moore PA. Xerostomia: etiology, recognition and treatment. *The journal of the american dental association.* 2003;134(1):61-9.
17. Turner MD, Ship JA. Dry mouth and its effects on the oral health of elderly people. *The Journal of the American Dental Association.* 2007;138:S15-S20.
18. Pringle S, Van Os R, Coppes RP. Concise review: Adult salivary gland stem cells and a

potential therapy for xerostomia. *Stem cells*. 2013;31(4):613-9.

19. Baum BJ, Zheng C, Alevizos I, Cotrim AP, Liu S, McCullagh L, et al. Development of a gene transfer-based treatment for radiation-induced salivary hypofunction. *Oral oncology*. 2010;46(1):4-8.