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Original Article

Prevalence and Severity of Clinical Oral Dryness and Its Association with Medication Use and Socioeconomic Status among Elderly Complete Denture Wearers: A Cross-Sectional Study

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Abstract

Background: Clinical oral dryness is a common oral condition among older adults and is particularly problematic in complete denture wearers because adequate salivary function is essential for denture retention, oral comfort, mastication, and maintenance of oral health. Multiple factors, including aging, medication use, and socioeconomic disparities, may contribute to the development and severity of clinical oral dryness.

Objective: To determine the prevalence and severity of clinical oral dryness among elderly patients wearing complete removable dental prostheses and to evaluate its association with regular medication use and socioeconomic status.

Methodology: A descriptive cross-sectional study was conducted at the Department of Prosthodontics, Bacha Khan College of Dentistry, Mardan, Pakistan, between November 2022 and May 2023. Sixty-eight elderly patients aged 65–85 years wearing complete removable dental prostheses were recruited using consecutive non-probability sampling. Clinical oral dryness was assessed using the Challacombe Clinical Oral Dryness Scale. Demographic characteristics, medication use, and socioeconomic status were recorded using a standardized data collection form.

Results: The mean age of participants was 71.82 ± 4.61 years, and females constituted 51.5% of the study population. Clinical oral dryness was identified in 29.4% of participants. Among affected individuals, 7.4% had mild, 13.2% had moderate, and 8.8% had severe clinical oral dryness. Regular medication use was reported by 58.8% of participants, while 47.1% belonged to a low socioeconomic group. Clinical oral dryness severity showed statistically significant associations with regular medication use ($p = 0.032$) and socioeconomic status ($p = 0.045$). No significant association was observed between gender and clinical oral dryness severity ($p = 0.402$).

Conclusion: Clinical oral dryness is common among elderly complete denture wearers and is significantly associated with regular medication use and lower socioeconomic status. Routine assessment of oral dryness should be incorporated into prosthodontic practice to facilitate early identification, individualized management, and improved oral health outcomes in older adults.

Keywords: Clinical Oral Dryness, Complete Denture, Elderly, Medication Use, Prosthodontics, Socioeconomic Status, Xerostomia.

Introduction

Clinical oral dryness is a frequently encountered condition among older adults and represents an important challenge in geriatric dentistry because of its adverse effects on oral function, comfort, and quality of life [1,2]. Saliva plays an essential role in maintaining oral homeostasis by lubricating oral tissues, facilitating mastication and swallowing, enhancing taste perception, buffering oral pH, promoting remineralization of teeth, and providing antimicrobial protection against oral pathogens [3,4]. A reduction in salivary secretion or the presence of clinically evident oral dryness may impair speech, swallowing, taste perception, and denture retention while increasing the risk of dental caries, mucosal ulceration, oral candidiasis, and other oral complications [5]. These problems are particularly important in prosthodontic patients, as adequate salivary lubrication is essential for the retention, stability, and comfort of complete removable dentures, ultimately influencing treatment success and patient satisfaction [6]. The etiology of clinical oral dryness is multifactorial and involves both physiological and pathological processes. Although aging has traditionally been associated with reduced salivary gland reserve, current evidence suggests that age-related salivary dysfunction is more frequently attributable to chronic systemic diseases and the widespread use of xerogenic medications rather than aging alone [3]. Polypharmacy is highly prevalent among older adults, with medications such as antihypertensives, antidepressants, anticholinergics, antipsychotics, and diuretics being recognized contributors to decreased salivary flow and oral dryness [7]. Furthermore, systemic disorders including diabetes mellitus, Sjögren's syndrome, autoimmune diseases, and neurological conditions may further impair salivary gland function and increase susceptibility to clinical oral dryness [8].

In addition to biological determinants, socioeconomic status plays a significant role in oral health. Individuals from socioeconomically disadvantaged backgrounds often experience reduced access to dental care, delayed healthcare utilization, poorer nutritional status, lower health literacy, and a greater burden of chronic diseases requiring long-term medication use [9,10]. These interconnected factors may increase both the prevalence and severity of clinical oral dryness while simultaneously limiting opportunities for timely diagnosis and effective management [11,12]. Understanding the contribution of socioeconomic factors is therefore important for planning preventive and therapeutic strategies for vulnerable elderly populations.

Although several international studies have investigated the epidemiology of clinical oral dryness among older adults, evidence from Pakistan remains limited, particularly among elderly patients receiving prosthodontic treatment. Furthermore, few local studies have simultaneously examined the relationship between clinical oral dryness severity, medication use, and socioeconomic status in complete denture wearers. The absence of locally generated evidence limits clinicians' ability to identify high-risk patients, implement preventive measures, and optimize prosthodontic treatment outcomes within the Pakistani healthcare setting.

Therefore, the present study was conducted to determine the prevalence and severity of clinical oral dryness among elderly patients wearing complete removable dental prostheses attending a tertiary dental teaching hospital. In addition, the study aimed to evaluate the association between clinical oral dryness severity and important patient-related factors, including regular medication use and socioeconomic status. The findings are expected to contribute to evidence-based prosthodontic care by facilitating early recognition of clinical oral dryness, improving risk assessment, and supporting individualized management strategies for the growing geriatric population.

Methodology

Study Design

This descriptive cross-sectional study was conducted to determine the prevalence and severity of clinical oral dryness among elderly patients wearing complete removable dental prostheses and to examine its association with medication use and socioeconomic status. A cross-sectional design was selected because it allows simultaneous assessment of the prevalence of a clinical condition and its associated factors within a defined population at a single point in time. Data collection was carried out over a six-month period from 20 November 2022 to 20 May 2023 at the Department of Prosthodontics, Bacha Khan College of Dentistry, Mardan, Pakistan. The study methodology was designed and reported in accordance with the principles of observational epidemiological research.

Ethics

Prior to commencement, ethical approval was obtained from the Institutional Ethical Review Committee of Bacha Khan College of Dentistry, Mardan (Approval No.: insert approval number). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All eligible participants received verbal and written information regarding the purpose of the study, study procedures, anticipated benefits, potential risks, confidentiality of personal information, and their right to withdraw from the study at any stage without affecting their treatment. Written informed consent was obtained

from every participant before enrolment. Personal identifiers were removed during data entry, and all information was kept confidential and accessible only to the research team.

Setting

The study was performed in the Prosthodontics Department of Bacha Khan College of Dentistry, Mardan, which serves as a tertiary dental care teaching institution receiving elderly patients from urban and rural areas of Khyber Pakhtunkhwa. Patients attending the outpatient prosthodontic clinics for examination, treatment, or follow-up of complete removable dentures during the study period were screened for eligibility. Clinical examinations were performed in standard dental operatories under routine clinical conditions using appropriate dental illumination and infection-control protocols.

Participants

The study population comprised elderly patients aged 65–85 years who presented to the Prosthodontics Department during the study period and were wearing complete removable dental prostheses. Participants were recruited using a consecutive non-probability sampling technique because of the limited number of eligible patients attending the clinic during the study period and logistical constraints that precluded probability sampling.

Patients were eligible if they were Pakistani nationals, aged 65 years or older, and were wearing complete removable dentures. Patients who were completely dentate, younger than 65 years, using saliva substitutes, unwilling to participate, or had incomplete clinical records were excluded from the study.

During the recruitment period, 86 patients were assessed for eligibility using their National Identity Cards for age verification. Twelve patients failed to satisfy the inclusion criteria, four declined participation, and two were excluded because of incomplete data collection. Consequently, 68 participants fulfilled all eligibility criteria and were included in the final statistical analysis.

Variables

The primary outcome variable was the presence and severity of clinical oral dryness, assessed using the Challacombe Clinical Oral Dryness Scale. Severity was categorized as mild, moderate, or severe according to the scoring criteria of the scale. Independent variables included age, gender, socioeconomic status, and regular medication use. Age was recorded in completed years as a continuous variable. Gender was categorized as male or female. Medication use was recorded as a dichotomous variable (Yes/No) based on participants' self-reported regular use of prescribed medications. Socioeconomic status was categorized into low, middle, and high socioeconomic groups according to participants' self-reported income and social background.

Data sources/measurement

Following informed consent, demographic and clinical information was obtained through structured interviews and review of patients' medical and dental histories. Information regarding age, gender, medication use, and socioeconomic status was recorded on a standardized data collection form designed specifically for the study.

Clinical oral dryness was assessed by a trained examiner using the Challacombe Clinical Oral Dryness Scale, a validated clinical assessment tool that evaluates objective signs of oral dryness. The examination was performed under standardized clinical conditions using adequate dental chair illumination and disposable mouth mirrors. Each participant underwent a comprehensive intraoral examination, and the observed clinical signs were scored according to the Challacombe Scale recommendations. The total score was subsequently categorized into mild, moderate, or severe clinical oral dryness according to established criteria.

To ensure consistency of measurements, all examinations were conducted by the same examiner. Intra-examiner reliability was assessed by re-examining approximately 10% of participants after an interval of 1–2 weeks under similar clinical conditions. Agreement between the two assessments was evaluated using weighted Cohen's kappa coefficient, which demonstrated substantial reliability ($\kappa = 0.82$).

Bias

Several measures were implemented to minimize potential sources of bias. Standardized eligibility criteria were applied throughout participant recruitment to reduce selection bias. Consecutive enrolment of all eligible patients attending the clinic during the study period further minimized investigator selection bias. Clinical examinations were performed by a single calibrated examiner using a validated assessment instrument to reduce inter-examiner variability and measurement bias. Standardized data collection forms were used for all participants to ensure uniform recording of information.

Recall bias regarding medication use could not be completely eliminated because medication history was primarily obtained through participant self-report. However, whenever available, medication histories were verified using available medical prescriptions or patient records. Confounding variables such as smoking status, systemic diseases, hydration status, duration of denture

use, and polypharmacy were not adjusted because of the observational cross-sectional design and relatively small sample size.

Study size
The required sample size was calculated using OpenEpi Version 3.01. The calculation assumed a 95% confidence level, 5% margin of error, and an anticipated prevalence of clinical oral dryness of 16%, based on previously published literature [12]. The minimum required sample size was calculated as 68 participants, which was achieved during the study period.

Quantitative variables
Age was treated as a continuous quantitative variable and summarized using mean and standard deviation. Clinical oral dryness severity was treated as an ordinal categorical variable (mild, moderate, and severe). Gender, medication use, socioeconomic status, and the presence of clinical oral dryness were considered categorical variables and summarized using frequencies and percentages. No transformation or categorization of continuous variables was performed other than reporting descriptive statistics.

Statistical methods
Data were entered, cleaned, and analyzed using IBM SPSS Statistics Version 23.0 (IBM Corp., Armonk, NY, USA). Prior to analysis, data were checked for completeness, coding accuracy, and entry errors. Continuous variables were assessed for normality using the Shapiro–Wilk test. Normally distributed continuous variables were presented as mean ± standard deviation, whereas categorical variables were summarized using frequencies and percentages. The prevalence of clinical oral dryness and its severity categories were calculated descriptively. Associations between clinical oral dryness severity and categorical independent variables, including gender, medication use, and socioeconomic status, were evaluated using the Chi-square test. Whenever expected cell frequencies were less than five, Fisher's exact test was applied to ensure statistical validity. All statistical tests were two-tailed, and a p-value <0.05 was considered statistically significant.

Results

Participants
A total of 86 elderly patients presenting to the Prosthodontics Department during the study period were assessed for eligibility. Twelve patients did not satisfy the inclusion criteria because they were younger than 65 years, were completely dentate, or were using saliva substitutes. Four eligible patients declined participation, while two participants were excluded because of incomplete clinical data. Consequently, 68 participants were included in the final analysis, representing the study population. The participant recruitment process is described in the methodology section.

Descriptive data
The study population consisted of elderly individuals aged 65–85 years, with a mean age of 71.82 ± 4.61 years, indicating that the participants represented the targeted geriatric population requiring complete removable prosthodontic treatment (Table 1). Gender distribution was nearly equal, with 33 (48.5%) male participants and 35 (51.5%) female participants (Table 1). Regarding medication history, 40 participants (58.8%) reported regular use of prescribed medications, whereas 28 (41.2%) reported no regular medication use. Assessment of socioeconomic status showed that 32 participants (47.1%) belonged to the low socioeconomic group, 26 (38.2%) to the middle socioeconomic group, and 10 (14.7%) to the high socioeconomic group (Table 1).

Outcome data
Clinical oral dryness was identified in 20 of the 68 participants, giving an overall prevalence of 29.4%. Among those affected, disease severity varied. Mild clinical oral dryness was observed in 5 participants (7.4%), moderate dryness in 9 participants (13.2%), and severe dryness in 6 participants (8.8%), demonstrating that moderate clinical oral dryness constituted the largest proportion of affected individuals (Table 2).

Main results
The relationship between clinical oral dryness severity and selected participant characteristics was evaluated using Chi-square and Fisher's exact tests. No statistically significant association was observed between gender and the severity of clinical oral dryness ($p = 0.402$), suggesting that the distribution of disease severity was comparable between male and female participants.

In contrast, regular medication use was significantly associated with greater severity of clinical oral dryness ($p = 0.032$). Participants who reported regular medication use were more likely to experience moderate and severe clinical oral dryness than those not taking medications.

Similarly, socioeconomic status demonstrated a statistically significant association with clinical oral dryness severity ($p = 0.045$). Participants belonging to lower socioeconomic groups exhibited comparatively higher levels of clinical oral dryness than those from middle or higher socioeconomic backgrounds.

Detailed cross-tabulation further illustrated that among participants using regular medications, 2 (5.0%) had mild, 7 (17.5%) had moderate, and 5 (12.5%) had severe clinical oral dryness. In comparison, among participants not taking regular medications, 3 (10.7%) had mild, 2 (7.1%)

had moderate, and only 1 (3.6%) had severe clinical oral dryness (Table 3). These findings indicate that increasing severity of clinical oral dryness was more frequently observed among elderly individuals receiving regular medications.

The findings demonstrate that while approximately one-third of elderly complete denture wearers exhibited clinical oral dryness, medication use and socioeconomic status were significant determinants of disease severity, whereas gender was not significantly associated with the outcome.

Table 1: Demographic and Clinical Characteristics of the Study Participants (n = 68)

Variables		n(%)
Age (years); Mean ± SD		71.82 ± 4.61
Gender	Male	33 (48.5)
	Female	35 (51.5)
Medication Use	Yes	40 (58.8)
	No	28 (41.2)
Socioeconomic Status	Low	32 (47.1)
	Middle	26 (38.2)
	High	10 (14.7)

Table 2: Prevalence and Severity of clinical oral dryness (n=68).

Variables	Frequency (n)	Percentage (%)
Severity		
Mild	5	7.4
Moderate	9	13.2
Severe	6	8.8

Table 3: Cross-tabulation of clinical oral dryness Severity by Medication Use (n=20).

Clinical Oral Dryness Severity	Medication Use		p-value
	Yes	No	
Mild	2 (5.0%)	3 (10.7%)	0.032*
Moderate	7 (17.5%)	2 (7.1%)	
Severe	5 (12.5%)	1 (3.6%)	

*Statistically significant at $p < 0.05$.

Discussion

The present study evaluated the prevalence and severity of clinical oral dryness among elderly complete denture wearers and examined its association with medication use and socioeconomic status. Nearly one-third (29.4%) of participants exhibited clinical oral dryness, with varying degrees of severity ranging from mild to severe. Furthermore, regular medication use and lower socioeconomic status were significantly associated with increased severity of clinical oral dryness, whereas no significant association was observed with gender. These findings highlight the multifactorial nature of oral dryness in elderly prosthodontic patients and emphasize the importance of comprehensive assessment during routine dental care.

The prevalence of clinical oral dryness observed in this study is consistent with previously published literature reporting prevalence rates ranging from approximately 1% to 29% among older adults, depending on the study population, diagnostic criteria, and methods of assessment [13]. Differences in reported prevalence across studies may be explained by variations in age distribution, systemic health conditions, medication burden, and the distinction between subjective xerostomia and objectively assessed clinical oral dryness. The present study employed the Challacombe Clinical Oral Dryness Scale, an objective clinical assessment tool that strengthens the validity of the reported prevalence compared with studies relying solely on patient-reported symptoms.

The distribution of disease severity demonstrated that moderate clinical oral dryness constituted the largest proportion of affected participants, followed by severe and mild disease. This finding suggests that a substantial proportion of elderly denture wearers experience clinically meaningful oral dryness requiring professional management. Reduced salivary lubrication compromises denture retention and stability, increases frictional trauma to the oral mucosa, and negatively affects mastication, swallowing, speech, and overall oral health-related quality of life [5,6]. Consequently, routine assessment of oral dryness should become an integral component of prosthodontic evaluation in elderly patients.

Gender was not significantly associated with clinical oral dryness severity in the present study. Similar findings have been reported in previous investigations indicating that, after adjustment for other risk factors, gender alone is not a strong determinant of clinical oral dryness among older adults [14]. Instead, the influence of systemic diseases, medication exposure, salivary gland dysfunction, and behavioral factors appears to outweigh any independent effect of biological sex. The nearly equal gender distribution in the present study may also have minimized gender-related differences.

A significant association was observed between regular medication use and increased severity of clinical oral dryness. Participants taking regular medications were more likely to exhibit moderate and severe forms of oral dryness than those not receiving medications. This finding is biologically plausible and consistent with extensive evidence demonstrating that polypharmacy and xerogenic medications are major contributors to salivary gland hypofunction in older adults [15,16]. Numerous commonly prescribed medications, including antihypertensives, antidepressants, anticholinergics, diuretics, and psychotropic drugs, interfere with autonomic stimulation of salivary glands and reduce salivary secretion [7,15,16]. Given the increasing prevalence of multimorbidity and polypharmacy in aging populations, medication review should be incorporated into routine dental assessment to identify potentially modifiable causes of clinical oral dryness. The American Dental Association has similarly highlighted dry mouth as one of the most frequently encountered oral complaints among geriatric dental patients [17].

Age-related physiological changes may further exacerbate medication-induced salivary dysfunction. Progressive structural alterations within salivary glands, together with chronic systemic diseases such as diabetes mellitus, autoimmune disorders, and neurological conditions, may reduce salivary reserve and increase susceptibility to oral dryness [18–20]. These mechanisms likely interact synergistically, making elderly patients particularly vulnerable to clinically significant oral dryness. Although the present study did not evaluate individual medications or specific systemic diseases, the observed association supports previous evidence emphasizing medication burden as a major determinant of oral dryness in geriatric populations [21].

Socioeconomic status also demonstrated a significant relationship with clinical oral dryness severity. Participants from lower socioeconomic backgrounds experienced more severe oral dryness than those from middle- or higher-income groups. This observation is consistent with evidence suggesting that socioeconomic disadvantage contributes to poorer oral health through reduced access to healthcare, delayed treatment seeking, nutritional deficiencies, lower health literacy, and a greater burden of chronic diseases requiring long-term medication use [22-24]. Individuals with limited financial resources may also experience barriers to preventive dental care and reduced access to supportive therapies such as saliva substitutes and regular prosthodontic maintenance. However, the influence of socioeconomic status remains inconsistent across published studies, indicating that cultural, healthcare system, and population differences may modify this relationship [22,25,26].

The findings of this study have important clinical implications. Early recognition of clinical oral dryness allows clinicians to implement preventive measures before complications such as denture intolerance, mucosal ulceration, candidiasis, dental caries of remaining teeth, and impaired nutrition develop. Incorporating standardized screening tools such as the Challacombe Clinical Oral Dryness Scale into routine prosthodontic practice may facilitate timely diagnosis and individualized management. Interdisciplinary collaboration between dentists and physicians is particularly important for reviewing xerogenic medications, optimizing management of systemic diseases, and improving overall quality of life in elderly patients.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study was conducted at a single tertiary dental institution using consecutive non-probability sampling, which may limit the generalizability of the findings to the wider elderly Pakistani population. Second, the relatively small sample size may have reduced statistical power for detecting weaker associations. Third, because of the cross-sectional design, temporal or causal relationships between medication use, socioeconomic status, and clinical oral dryness cannot be established. Fourth, information

regarding medication use was largely self-reported, introducing the possibility of recall bias, while detailed assessment of medication classes, duration of therapy, dosage, and polypharmacy was not performed. Similarly, important potential confounding variables including smoking status, systemic diseases such as diabetes mellitus and Sjögren's syndrome, hydration status, nutritional factors, duration of denture use, and objective salivary flow measurements were not included in the analysis. Finally, multivariable regression analysis was not undertaken; therefore, residual confounding cannot be excluded. Future multicenter longitudinal studies with larger sample sizes, objective salivary flow assessment, and comprehensive adjustment for confounding factors are recommended to better understand the determinants of clinical oral dryness among elderly prosthodontic patients.

Conclusion

Clinical oral dryness is a common clinical finding among elderly patients wearing complete removable dental prostheses, affecting nearly one-third of the study population. Greater severity of clinical oral dryness was significantly associated with regular medication use and lower socioeconomic status, whereas gender was not significantly associated with disease severity. These findings reinforce the importance of routinely screening elderly prosthodontic patients for clinical oral dryness, particularly those receiving long-term medications or belonging to socioeconomically disadvantaged groups. Incorporating standardized clinical assessment, comprehensive medication review, patient education, and individualized preventive and therapeutic interventions into routine prosthodontic practice may improve denture function, oral comfort, and overall quality of life in this growing geriatric population. Further multicenter prospective studies are warranted to validate these findings and evaluate interventions aimed at reducing the burden of clinical oral dryness in older adults.

Authors' Contributions:

All authors meet the ICMJE criteria for authorship.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 3: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 4: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.
Author 5: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 6: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

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