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Infections Associated with Dry Mouth Impact on the Efficacy of Prosthetic Restorations

Abdulmajeed Mohammed Ali Alharbi (1), Abdulrhman Salman Alghamdi (1), Mohammed Shakhis Almutairi (1), Faisal Rafe Almutairi (1), Mubarak Aqeel Almutairi (1), Rami Ali Alzahrani (1), Meshari Ahmed Alghanim (2), Maryam Mohammed Alqahtani (1)

(1) Public Health Specialist, General Directorate of Health Affairs, Riyadh, Saudi Arabia.
(2) Public Health, General Directorate of Health Affairs in Riyadh Region, Saudi Arabia.

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****Corresponding author***

Abstract

Introduction: Dry mouth, commonly known as dry mouth, substantially diminishes life quality, particularly among edentulous individuals utilizing dental prostheses. Given the scarcity of data on this condition's prevalence and its repercussions for those dependent on denture prosthesis, this investigation seeks to elucidate the relationship between xerostomia, its influencing factors, and its implications for the oral health-related quality of life among denture users.

Methods: A systematic exploration of scholarly articles published before 2022 was undertaken across six databases, including Ovid MEDLINE, Evidence Based Medicine Reviews Database, Cochrane Database of Systematic Reviews, American College of Physicians Journal Club, Database of Abstracts of Reviews of Effects, and the Cochrane Central Register of Controlled Trials. The search was refined to English-language studies involving human participants. Two independent reviewers assessed the articles to determine their relevance based on predefined inclusion criteria.

Results: The search culminated in the identification of 10 relevant articles, though none reported on randomized controlled clinical trials. The existing body of clinical research on the relationship between reduced salivation and denture stability offers limited evidence, hindering the formulation of definitive clinical guidelines. Consequently, the impact of treating hyposalivation on both denture stability and patient quality of life remains uncertain. This underscores an urgent need for well-designed randomized controlled trials within the denture-using demographic afflicted by dry mouth.

Conclusions: Our findings highlight xerostomia as a critical determinant of life quality among older denture wearers, overshadowing factors such as dental status or the nature of prosthetic solutions. However, it was observed that the number of teeth or implants in the upper jaw and the utilization of gum-supported dentures across both jaws could significantly detract from the quality of life in this population.

Keywords: ***Dry mouth, Xerostomia, Prosthodontics, Quality of life, Dentures, Stability.***

Introduction

Saliva plays a vital role in maintaining oral health and protecting the oral environment. It aids in chewing, swallowing and speech [1]. In addition, it lubricates the soft tissues, thus protecting it from desiccation, penetration or ulceration [2]. Two types of saliva can be differentiated, whole saliva and glandular derived saliva. Whole saliva is indicative to oral wetness and easy to collect. Saliva is also categorized as unstimulated (resting) or stimulated. Unstimulated saliva protects the oral tissues by coating them [3]. Saliva is very important in the preservation of oral health [4]. Therefore, reduction in saliva quantity leads to higher risk of oral diseases [1]. The expression "dry mouth" is usually used to describe two conditions which may or may not be related; xerostomia, which is an individual's subjective feeling of dry mouth; as well as salivary gland hypofunction (SGH), which is chronically reduced unstimulated or stimulated salivary flow [5]. Because xerostomia is a subjective feeling, it can only be assessed using direct questioning of patients [1, 6].

Xerostomia has a negative influence on the quality of life [7]. This condition can be very debilitating for patients [8]. Recently the relationship of subjective dry mouth with oral health related quality of life (OHRQoL) has been investigated systematically [6]. The association between both was found to be strong in young adults [6] and in elderly institutionalized individuals [9]. Dry mouth was significantly associated with OHRQoL outcomes among adults in Saudi Arabia [10]. These findings suggest that the impact of dry mouth extends beyond the oral cavity and into people's daily lives [6]. There is a relation between subjective dry mouth and the number of drugs taken by a patient, but mostly it is caused by the use of certain systemic medications [8]. Also, there is a significant association between dry mouth and increasing age and female gender [2]. With the ageing population it is likely to be more and more encountered in a dental office. Dental practitioners should be aware of its diagnosis and treatment [8]. Subjective dry mouth can be caused by surgical resection of salivary glands [11]. Additionally, those patients with oral tumors complain frequently of dry mouth following surgery and radiation therapy [12-15]. Malignancies in the maxilla are mainly treated with surgery known as maxillectomy; it is the most common treatment modality for these patients [16, 17]. Treatment of head and neck cancer by surgery and radiation, results in a reduction of the unstimulated and stimulated whole salivary flow rates. Advanced lesions are usually treated with aggressive measures. Thus, the side effects are expected to be extensive [18]. It's presence and effect on patients can be missed in hectic cancer clinics [19]. Comprehensive treatment planning is essential to meet multidisciplinary objectives for patients with intricate reconstructive and rehabilitative needs [20]. Prosthetic dentures are used to reconstruct maxillectomy defects [21]. Rehabilitation with maxillary prosthesis usually overcomes the limiting factors and the anatomic deficiencies after surgery [22].

In a short period of time, patients wearing dentures may improve their ability of deglutition and speech, hence having a normal social life. In old patients, patients with a high morbidity rate and patients with poor life expectancy, a quick and adequate prosthetic rehabilitation is of great value to maintain and restore an improved quality of life [16]. Wearing removable prosthesis can become uncomfortable when patients are suffering from xerostomia. This is due to the reduced surface tension between the denture and the dry mucosa. [8]. Due to the negative influence of dry mouth on the quality of life, and the lack of information about this condition among edentulous patients wearing maxillary denture prosthesis, this study aimed to review the association between dry mouth and different factors affecting it, and its effect on oral-health-related quality of life in patients wearing denture prosthesis. Saliva is essential for oral health, facilitating digestion, speech, and the lubrication of oral tissues, thus preventing dryness, abrasion, or lesions [1, 2]. Saliva exists in two forms: whole saliva, which is a marker of oral moisture and is easily collected, and glandular-derived saliva. It is further classified based on its secretion state into unstimulated (resting) or stimulated saliva, with the

former playing a crucial role in coating and thereby protecting oral tissues [3]. The critical function of saliva in oral health preservation is widely recognized, with a decrease in salivary flow heightening the risk of various oral pathologies [1, 4]. The term "dry mouth" encompasses two distinct phenomena: xerostomia, the subjective sensation of oral dryness, and salivary gland hypofunction (SGH), a condition marked by a chronic reduction in saliva production, whether unstimulated or stimulated [5]. Xerostomia's subjective nature means its diagnosis relies heavily on patient self-reporting [1, 6].

Xerostomia significantly detracts from individuals' quality of life, posing substantial challenges for those affected [7, 8]. Recent investigations into xerostomia's impact on oral health-related quality of life (OHRQoL) have established a strong correlation, particularly pronounced among both young and older adults [6, 9]. In Saudi Arabia, a notable association between dry mouth symptoms and compromised OHRQoL has been documented [10], illustrating that the repercussions of xerostomia extend well beyond oral health, affecting daily activities and overall well-being [6].

Methods

To comprehensively assess the association between dry mouth and the retention of removable dentures and its impact on the quality of life among elderly patients, we embarked on a systematic review of the scientific literature. This review targeted articles published up to and including the year 2021, with a focus on those providing insights into the prevalence, causes, and consequences of hyposalivation and xerostomia in the context of denture usage. The databases consulted for this purpose were extensive, including Ovid MEDLINE, Evidence Based Medicine Reviews Database, Cochrane Database of Systematic Reviews, American College of Physicians Journal Club, Database of Abstracts of Reviews of Effects, and the Cochrane Central Register of Controlled Trials. This broad spectrum of sources ensured a comprehensive capture of relevant literature. The literature search was meticulously designed to filter the most relevant studies using a set of predetermined keywords. These included "denture," "hyposalivation," "xerostomia," "dry mouth," "elderly," "satisfaction," "quality of life," and "aged." These terms were selected to encompass the wide range of topics relevant to our research question, from the physical condition of dry mouth and its clinical diagnosis as xerostomia or hyposalivation to the psychological and functional outcomes related to denture satisfaction and overall quality of life in an aging population. To ensure the review's focus remained on empirical, human subject research, we restricted our search to articles published in English that reported on studies involving human participants. This criterion was applied to maintain the quality and applicability of the findings to real-world scenarios involving elderly patients and denture use.

The process of identifying articles that met our inclusion criteria was rigorous. Two independent authors conducted the initial review of the articles identified through the database searches. This dual-review approach was implemented to minimize bias and ensure a thorough evaluation of each article's relevance to our study objectives. Articles were selected based on their direct relevance to the study's focus on dry mouth conditions among denture wearers and their subsequent effects on satisfaction and quality of life. Once the initial selection was made, these authors then collaboratively reviewed the chosen articles in depth, ensuring that each study met the specific inclusion criteria relevant to our research question. This included an assessment of the study's methodology, population, outcome measures, and relevance to the themes of hyposalivation, xerostomia, and their impact on denture use and quality of life among the elderly. This methodical approach to literature review and selection laid a solid foundation for the subsequent analysis and synthesis of findings related to the association between dry mouth and removable denture retention in older adults.

Results and discussion

We identified 10 articles from the literature search, none of them being a report of a randomized controlled clinical trial. The few clinical research studies published on the topic of hyposalivation and denture retention represent a low level of evidence for establishing clinical practice guidelines. Accordingly, few conclusions can be made regarding the effects of

hyposalivation treatment on denture retention and quality of life. It is strongly recommended that randomized controlled clinical trials be conducted in the denture-wearing population with dry mouth. Dry mouth might complicate the prosthodontic rehabilitation of denture patients. It can jeopardize the retention and stability of the denture prosthesis. Treatment modalities causing maxillary defects can be quite aggressive, and in some cases might have a direct negative effect on salivary glands. Several studies have shown that self-reported dry mouth affects the day- to-day life of patients suffering from it. The knowledge about denture patients in Saudi Arabia is insufficient. Thus, it is worth studying the impact of dry mouth on the quality of life of these patients. The perception of dry mouth is recognized nowadays as an important risk factor for dental disease [1].

The oral functions and overall satisfaction with dentures is adversely affected by dry mouth [2]. After surgery, patients find it difficult to perform basic oral functions. For example, chewing with maxillary denture prosthesis, because of their poorer stability and retention compared to conventional dentures [12-14], this will further be complicated by dry mouth. Adjuvant radiotherapy to the head and neck region can cause severe symptoms of dry mouth that are very debilitating [19, 23]. For accurate diagnosis and evaluation of dry mouth, measuring salivary flow is critical [8].

Measuring the unstimulated saliva at rest is the conventional method to examine dry mouth. It is preferred that examination of dry mouth in post operative oral tumor patients be simple and quick at the chairside [13]. Individuals whose unstimulated whole salivary flow rate is less than 0.1 ml/min, are considered as patients with reduced salivary flow [3, 5, 24]. Reviewing literature regarding dry mouth in patients with removable prosthesis, its effect on the quality of life and the technique used for saliva collection are presented in table 1. Different measuring techniques were piloted to choose the most appropriate. The modified cotton technique used by Takahashi et al [29] was used in 3 patients; in this technique two cotton rolls were used. One was placed under the tongue and the second was placed over the tongue for 30 seconds. Patients were considered with

Table (1): Studies estimated the association between xerostomia and quality of life among dental patients

Author	*Methodology*	*Results*
Murakami et al. [1]	Measurement of oral moisture Faces scale subjective measurement	-Moisture value for oral dryness group significantly lower than normal group -Dose of radiation significant negative correlation with moisture value -Period after radiation positive correlation with moisture value
Murakami et al. [2]	Measurement of oral moisture Questionnaire	- 66.6% reported dry mouth -Dry mouth correspond to moisture levels -Lingual mucosa moisture level correspond to dryness
Murakami et al. [3]	Measurement of oral moisture	-Saliva wetness testers are useful as moisture-checking devices to examine dry mouth in obturator patients
Yurdukoru et al. [4]	Measurement of unstimulated & stimulated saliva	- Initial insertion of complete denture significantly stimulated salivary flow rate - Significant difference in resting whole salivary flow rates before and after denture insertion
Ma´rton et al. [5]	Questionnaire Measurement of unstimulated whole saliva & palatal saliva flow rates	- Hyposalivation in 3 healthy & 8 Sjögren syndrome pts -Unstimulated whole saliva & palatal saliva flow rates were not different from the pre-insertion values after 1week of new denture insertion in complete denture wearers
Al-Dwairi et al. [6]	Questionnaire Clinical confirmation of xerostomia Assessment of complete denture function	-29.9% subjective dry mouth (SDM) -Significant association b/w dry mouth, increasing age & female gender -62%DiabetesII & 53%Hypertension complained of dry mouth -Dry mouth participants dissatisfied with their dentures & oral functions
Locker David [7]	Questionnaire Review dental charts	- 1/3 had xerostomia

		-Significant association between xerostomia & OHRQoL
Thomson et al. [8]	Questionnaire	- 1/ 10 xerostomic
	Global question (xerostomia)	-Significant association between xerostomia & OHRQoL
Khalifa Nadia et al. [9]	Questionnaire (OHIP-14 s-ar)	-2.78% xerostomic
	Global question (xerostomia)	-Significant association between xerostomia & OHRQoL -Always (OR: 14.09), Frequently (OR: 2.67)

dry mouth when the unstimulated salivary flow rate was below 0.1 ml/30 sec. For other patients a modification of the technique used by Baudet-Pommel et al [30] was used. One cotton roll was placed under the tongue for 1minute and another cotton roll was placed for 5 minutes. The 5 minutes period was more sufficient for the patients to relax and to reduce the stimulatory effect of placing the cotton roll. Therefore, unstimulated whole salivary flow was evaluated using a cotton roll weighing technique, which is a modification of the technique used by Baudet-Pommel et al [30]. It was performed on the subjects by placing a pre-weighed cotton roll between the tongue and the mandibular anterior teeth for 5 minutes. An electronic reading balance (Shimadzu Corporation, Kyoto, Japan; model BL-220H, with a readability of 0.001g and a weighing capacity of 220g), was used to measure the weight of unstimulated whole saliva absorbed by the cotton roll. The weight of the dry cotton roll was used as the baseline value. The technique was going to be performed once in each subject. Subjects were instructed to remove their dentures and refrain from eating and/or drinking 2 hours prior to the examination. Those with new denture prosthesis were not evaluated for 1 month, to allow the stimulatory effect of the oral cavity "foreign body" to subside [11]. The cotton rolls used have a mean maximum water of absorptive capacity of 2.6g (calculated after a 30-s soaking in water) [31]. During piloting saliva measuring techniques, the maximal unstimulated saliva secretion was 1.514 g/5min, which was far less than the maximum absorptive capacity of the cotton rolls. The results of numerous of the vast amount of studies dealing with the prevalence of xerostomia in elderly patients have to be interpreted with caution, as until the publication of the Xerostomia Inventory questionnaire in its original and – more recently – shortened (SXI-D) version [12-16] there were no commonly accepted tools for evaluating the subjective sensation of dry mouth on the basis of a scientifically approved approach.

In the cohort investigated in an included study, the mean SXI-D sums ranged around 8 and were similar to the SXI-D scores reported for larger cohorts of elderly patients in previous studies.10 With a Cronbach's alpha of 0.75, XI data showed a satisfactory internal consistency. However, although interpretation of SXI-D scores allows an estimation of the degree of xerostomia, no threshold value for the perception of xerostomia has yet been determined, which still makes it difficult to estimate its overall prevalence. As SXI-D sums may range from 5 (lowest perception of xerostomia) to 15 (highest), the authors regarded patients with SXI-D sums equal or higher than 10, representing patients with the top 50% SXI-D sum scores, as patients with xerostomia. As a result, a xerostomia prevalence of 16% was identified, which was in the lower range of xerostomia prevalence in elderly patients that had been reported in previous studies [17-23].

Conclusions

The results indicate that xerostomia is a significantly strong predictor of the quality of life in elderly patients than the dental status or the character of prosthetic restorations. Nevertheless, data showed that both the number of teeth/implants in the upper jaw and the presence of gum-supported dentures in both jaws may significantly impair the quality of life in elderly patients, which supports the conventional wisdom currently available. Thus, the presence of removable dentures or gum-supported dentures in only one jaw does not a priori impair the quality of life in elderly patients. Although almost 50% of the GOHAI could be explained by all variables in the multiple linear regression model, it is very wishful that larger follow-up studies in simplified patient cohorts and multi-center studies are performed to corroborate the results

of the present study and to elucidate, whether elderly patients suffering from xerostomia and/or hyposalivation wearing gum-supported denture prostheses have an impaired quality of life in comparison to patients with tooth- or implant-supported prosthetic restorations.

Conflict of interests

The authors declared no conflict of interests.

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