ORIGINAL ARTICLE

Utility of two methodologies in the clinical assessment of oral dryness in postmenopausal women

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ABSTRACT

Objective: The aim of this study was to assess the oral dryness in postmenopausal women and to correlate the salivary flow rate determined by sialometry with the clinical oral dryness score (CODS) obtained from Challacombe Scale. To correlate between subjective and objective oral dryness and relationship of salivary flow rate with that of the duration of menopause.

Materials and Methods: Sixty postmenopausal women were questioned regarding their oral dryness status and the duration of menopause. Patients complaining of xerostomia formed the case group and rest formed the control group. CODS was assessed based on the 10 features of oral dryness. Unstimulated whole salivary (UWS) flow rate was assessed by sialometry for 5 min.

Results: Highly significant negative correlation was observed between UWS and CODS ($r = -0.651$), low negative correlation was noted between the duration of menopause and UWS flow rates ($r = -0.159$), and no significant correlation was found between subjective oral dryness with that of UWS flow rates ($P = 0.0964$). There was no statistically significant difference between case and control group with regard to CODS ($P = 0.525$).

Conclusion: A good correlation of CODS with sialometry scores indicates that CODS can be utilized for semiquantitative assessment of oral dryness. It appears that UWS has poor correlation with duration of menopause. Xerostomia and UWS were not significantly related.

Key Words: Clinical oral dryness score, postmenopausal women, sialometry, xerostomia

INTRODUCTION

Saliva plays a vital role in maintaining oral health. Alterations in salivary function may lead to impairment of oral tissues, and risk of patients developing dental caries, oral discomfort, and candidiasis is increased. Decreased salivary flow rates can have a large impact on patient's quality of life.

Menopause is the time of life when menstrual cycles cease and is caused by reduced secretion of the ovarian hormones estrogen and progesterone.[1]

Natural menopause is diagnosed after 12 months of amenorrhea not associated with a pathological cause.[1]

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Certain individuals who have attained menopause may exhibit significant physiological and sensorial oral changes.[2] The prevalence of oral symptoms was found to be significantly greater in menopausal women (43%) than in premenopausal females (6%).[3] Increased incidences of xerostomia, lichen planus, pemphigoid, Sjogren's syndrome, burning mouth syndrome, and periodontal disease are observed during menopause.[3]

Estrogen deprivation has been attributed to oral symptoms in postmenopausal women.[4] Sex hormone receptors have been detected in the oral mucosa and salivary glands.[5-7] Estrogen can affect oral mucosa directly or through neural mechanism, thus altering the periodontal health in menopausal women.[8]

Xerostomia denotes the subjective sensation of dry mouth.[9] This is associated with qualitative and quantitative changes of the saliva, which needs to be objectively assessed referred to as salivary hypofunction.[10]

Estimation of quantitative and qualitative salivary changes is challenging in a clinical setup owing to the lack of standardization in saliva collection methods. The qualitative or quantitative salivary changes vary considerably, which can be attributed to differences in whole versus glandular saliva and unstimulated versus stimulated methods of collection.[11]

The Challacombe Scale of clinical oral dryness could be used routinely and effectively by the general dental practitioner and specialist to assess and semiquantify the severity of oral dryness owing to its simplicity. We hypothesize that salivary flow rate measured by sialometry correlates with clinical oral dryness score (CODS), and hence, the latter could be used to assess oral dryness. We also hypothesize that xerostomia is distinct from unstimulated salivary flow rates and visual assessment of a dry mouth. This study was carried out to assess the oral dryness in postmenopausal women and to correlate the salivary flow rate determined by sialometry with the CODS obtained from Challacombe Scale. In addition, the correlation between subjective and objective oral dryness and relationship of salivary flow rate with duration of menopause was evaluated.

MATERIALS AND METHODS

A cross-sectional, descriptive study was conducted on sixty postmenopausal women attending the Department of Oral medicine and Radiology, Coorg Institute of Dental Sciences, who had not had a menstrual cycle for at least 12 months. Patients on known xerogenic drugs such as cytotoxic drugs, anticholinergic drugs, centrally acting psychoactive agents, opioids, sympathomimetic drugs, and diuretics were excluded from the study.

Patients with certain systemic diseases such as diabetes mellitus, Sjogren's syndrome, patients under corticosteroid or hormone replacement therapy, and patients with poor gingival and periodontal health were excluded. Gingival status of the patients was assessed using gingival index of Loe and Silness (1963). Patients with a gingival index of 0 and 1 were included in the study.

The presence of xerostomia was assessed by questioning the patient about the subjective perception of oral dryness. Of 60 patients, based on the response, 23 patients with xerostomia formed the case group and remaining 37 patients without xerostomia formed the control group.

The signs of dryness in the mouth were examined using a scoring system (CODS) which is composed of ten features: (1) Mirror sticks to buccal mucosa, (2) mirror sticks to tongue, (3) saliva frothy, (4) no saliva pooling in floor of mouth, (5) tongue shows loss of papillae, (6) altered gingival architecture/smooth (especially anterior), (7) glassy appearance to oral mucosa (especially palate), (8) tongue lobulated/deeply fissured, (9) cervical caries (more than two teeth), and (10) mucosal debris on palate (excluding under dentures). Each feature scores 1 point and the total is determined. The symptoms will not necessarily progress in the order shown above.

The evaluator made use of a pro forma with illustrations of dry mouth features for scoring oral dryness. Challacombe *et al*. in the year 2008 validated this technique.[12,13]

Unstimulated whole saliva (UWS) was collected under resting conditions between 9 am and 12 pm at least 2 h after the last intake of food or drink. The participants were asked to swallow the saliva pooled in the mouth. Subsequently, resting UWS samples were collected using the "spit" method over a period of 5 min. The patients were asked to spit into a dry, disposable plastic preweighted cup for 5 min at 1 min intervals. The patients were instructed not to swallow the saliva during the saliva collection.

The volume of saliva was determined and flow rate expressed as mL/min, where 1 g saliva = 1 ml. The UWS flow rates were categorized as very low (<0.1 ml/min), low (0.1–0.25 ml/min), and normal (>0.25 ml/min), as per the classification of whole saliva flow rate proposed by Ericsson and Hardwick.[14] Two observers were recruited for the assessment of CODS and sialometry. To avoid bias, both observers were blinded to the respective obtained results.

Informed consent was obtained from all the cases participating in the study. The study was approved by the institutional review board and the ethics committee of the institution.

Statistical analysis

The mean and standard deviation were used to summarize the baseline characteristics. Pearson's correlation coefficient was used to analyze the relationship between UWS flow rates and CODS and also to determine the relationship between duration of menopause and UWS flow rates.

Independent sample *t*-test assessed the relationship of subjective oral dryness with that of CODS and UWS flow rates. $P < 0.05$ level of significance was chosen. All the analyses were carried out with the use of Statistical Package for the Social Sciences (SPSS) IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. (Armonk, NY: IBM Corp).

RESULTS

Age

The age range of patients was between 42 and 66 years with a mean age of 54.45 years.

Mean unstimulated whole salivary and clinical oral dryness score in sixty cases

The mean unstimulated salivary flow rate was 0.28 ml/min and mean CODS was 4.2. 13.3% patients had very low UWS flow rate, 23.3% patients had low UWS flow rate, and 63.3% patients had normal UWS flow rate [Figure 1].

Relationship between the clinical oral dryness score and unstimulated whole salivary

The results of the Pearson's correlation coefficient showed highly significant negative correlation between UWS and CODS ($r = -0.651$), i.e. cases with low salivary flow rates had higher CODS [Figure 2].

Relationship between duration of menopause and unstimulated whole salivary

The duration of menopause [Table 1] ranged from 1 to 26 years among the study population.

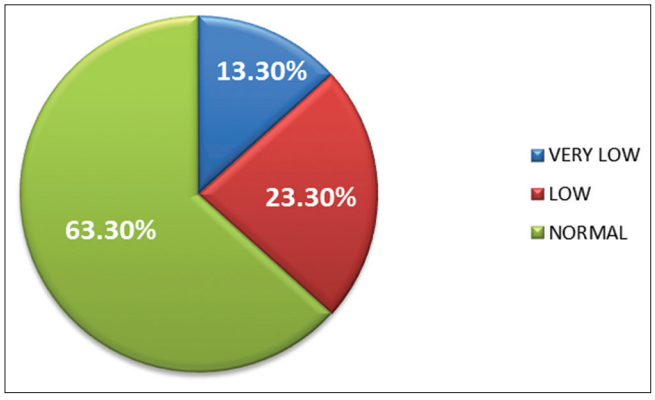

Figure 1: Percentage of unstimulated salivary flow rates among sixty postmenopausal women

A low negative correlation was observed between the duration of menopause and UWS flow rates ($r = -0.159$).

Relationship between subjective oral dryness and unstimulated whole salivary

Among 23 cases who reported with subjective oral dryness, only 11 had very low and low unstimulated salivary flow rates. Of 37 cases who did not report having xerostomia, 11 had very low and low unstimulated salivary flow rates [Table 2].

The independent sample *t*-test showed no significant correlation between subjective oral dryness with that of UWS flow rates ($P = 0.0964$).

Relationship of clinical oral dryness score with case and control groups

Independent *t*-test showed no statistically significant difference between the case group and control group with

Table 1: Number of years since menopause ranged from 1 to 26 years

Duration of menopause (in years)	Number of cases, *n* (%)
1-5	21 (35)
6-15	33 (55)
16-26	6 (10)

35% (*n*=21) of cases had a duration of 1-5 years. 55% (*n*=33) of cases had a duration of 6-10 years. 10% (*n*=6) of cases had a duration of 16-25 years

Table 2: Twenty-three cases reported having xerostomia, of which 11 had very low and low unstimulated whole saliva and 12 had normal unstimulated whole saliva. Thirty-seven cases did not report having xerostomia, of which 11 had very low and low unstimulated whole saliva and 26 had normal unstimulated whole saliva

Subjective oral dryness			
Yes (*n*=23): 38.3%		No (*n*=37): 61.6%	
Very low and low UWS[a]	Normal UWS[a]	Very low and low UWS[a]	Normal UWS[a]
11	12	11	26

[a]Unstimulated whole saliva

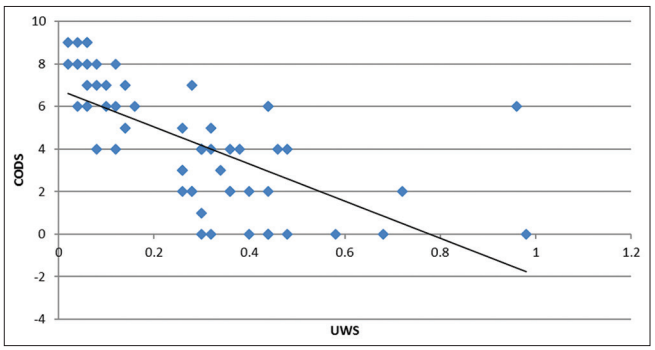

Figure 2: Scatter plot of correlation between unstimulated whole saliva flow and clinical oral dryness score (Pearson's $r = -0.651$)

Table 3: Mean clinical oral dryness score for cases with xerostomia (*n*=23) is 4.5652; mean clinical oral dryness score for cases without xerostomia (*n*=37) is 4.0811

Xerostomia	Number of cases	Mean of CODS[a]	SD	*P*
Present	23	4.5652	2.64276	0.525
Absent	37	4.0811	2.97563	

[a]Clinical oral dryness score. SD: Standard deviation

regard to the CODS score ($P = 0.525$) [Table 3].

DISCUSSION

Saliva is crucial for maintenance of the health of the oral tissues. Dry mouth occurs more often in women than in men. Nederfors *et al*. interviewed 3,313 randomly selected individuals aged 20–80 years in Sweden and found that the prevalence of perceived xerostomia was 21.3% for men and 27.3% for women. This difference in gender was found to be statistically significant.[15]

There is a controversy regarding the effect of menopause on the quantity of saliva. Some studies demonstrated reduction while others have not found any change in the saliva of menopausal women. Along with the physiological aging of the oral tissues, the hormone changes that take place in menopausal women are responsible for the alterations observed within the oral cavity. A weak negative correlation was observed between the duration of menopause and salivary flow rates in our study. Minicucci *et al*.[16] and Yalcin *et al*.[17] have found a strong association of menopause with low saliva flow rate. Our study showed that only a small number of cases exhibited very low salivary flow rates.

Sialometry is customarily employed in evaluation of whole salivary flow rates. Food debris, microorganisms, and gingival crevicular fluid are other components of the whole saliva.[11] Five minutes has been generally used collection time in the assessment of flow rate of unstimulated and stimulated saliva.[18] Irrespective of the absence or presence of stimulation in the evaluation of salivary flow, whole saliva primarily reflects the functional status of the submandibular and sublingual glands, as these are mainly responsible for basal secretion.

Determination of flow rates of glandular saliva requires special armamentarium and is essential for research purposes since whole saliva constitutes other components other than saliva. Routinely performing these procedures in clinical settings in clinical assessment is tedious and time consuming. Other factors which affect salivary flow assessment are ambient temperature, air humidity, environmental noises, time of sampling, duration of collection, type of gustatory stimulation, consistency and size of the mechanical stimulus, fasting period, environment brightness, and season of the year.[11,19,20] Hence, evaluation of xerostomia is intended to be done at specific time of the day, and standardization of sialometry collection techniques needs to be undertaken to avoid variations.

Pai *et al*.[21] and Thomson[22] have utilized visual analog scale questionnaire and xerostomia inventory, respectively, for the subjective assessment of salivary dysfunction and have found that the questionnaires are helpful in detecting changes in salivary flow over time.

Xerostomia denotes the subjective sensation of dry mouth and may occur despite normal salivary gland activity. Xerostomia may also occur with the changes in the quality of saliva even when amount of saliva is unaffected. This is the reason that people sometimes complain of dry mouth but have proper salivation. Therefore, a patient complaining of dry mouth cannot automatically be assumed to have salivary dysfunction while oral dryness may have many causes. Hence, the reliability of subjective assessment of xerostomia becomes questionable. Fox *et al*. examined the intimate relationship between subjective reports of xerostomia and flow rates of parotid and submandibular/sublingual saliva in 93 cases. They concluded that oral dryness and salivary hypofunction were not quantitatively related to each other which were similar to the findings of our study.[10]

Several semi-quantitative tests have been performed in the past for the clinical assessment of oral dryness. Sánchez-Guerrero *et al*. performed wafer test for screening of xerostomia. A high negative correlation (−0.60) was found between the time of dissolution of wafer and unstimulated whole saliva flow rate. They concluded that wafer test is valid and reliable for identifying cases with xerostomia.[19]

A study was conducted by Wiener *et al*. to investigate the association between three measures of oral dryness: Hyposalivation (low unstimulated salivary flow), self-reported xerostomia, and clinically assessed dry mouth in dentate older adults. They have reported that visually inspecting oral tissues for dryness and asking a patient if his or her mouth is dry are insufficient measures for clinicians to use to determine whether the patient has hyposalivation.[13] The authors recommend that clinicians determine the patient's unstimulated salivary flow rate.[13] Our study, however, showed a highly significant negative correlation between CODS and UWS.

Osailan *et al*. in their study have shown CODS to be reliable and easy to use for routine assessment of the severity of dry mouth. Apart from finding a general inverse relationship between CODS and salivary flow rate, CODS

was higher in cases with lower mucosal wetness. They also hypothesized that CODS could discriminate between those with moderate reductions in mucosal wetness even when the UWS was within the accepted normal range.[23] In addition, a very good agreement between two examiners was found when comparisons were made of the scores as well as the features scored by each examiner.[23]

Since CODS is unaffected by the time of the day and the ease involved in the use of CODS, makes it effective to be used routinely in evaluation of oral dryness. The shortcoming we came across during the study was inability to utilize CODS for edentulous cases. Recommendations are put forward to modify CODS for edentulous patients. CODS also imposes minimal discomfort to patients. Further studies are needed to be performed to validate CODS as a screening tool.

CONCLUSION

The majority of the postmenopausal women in our study had normal salivary flow rates. A highly significant negative correlation was found between UWS flow rates and CODS. No statistically significant difference was observed when the relationship between subjective and objective oral dryness was assessed. A low negative correlation was noted between the duration of menopause and UWS flow rates.

Oral dryness needs to be identified early so that suitable interventions can be carried out to augment patient's quality of life. CODS is a semiquantitative measure of oral dryness which involves visually inspecting the oral cavity which is beneficial in assessing the effectiveness of treatment given for reduced salivation.

Since CODSs correlated well with sialometry, CODS can be utilized routinely by the dental practitioners for semiquantitative assessment of oral dryness.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Nelson HD. Menopause. Lancet 2008;371:760-70.
2. Zachariasen RD. Oral manifestations of menopause. Compendium 1993;14:1584, 1586-91.
3. Frutos R, Rodríguez S, Miralles-Jorda L, Machuca G. Oral manifestations and dental treatment in menopause. Med Oral 2002;7:26-30, 31-5.
4. Ferris GM. Alteration in female sex hormones: Their effect on oral tissues and dental treatment. Compendium 1993;14:1558-64, 1566.
5. Leimola-Virtanen R, Pennanen R, Syrjänen K, Syrjänen S. Estrogen response in buccal mucosa – A cytological and immunohistological assay. Maturitas 1997;27:41-5.
6. Leimola-Virtanen R, Salo T, Toikkanen S, Pulkkinen J, Syrjänen S. Expression of estrogen receptor (ER) in oral mucosa and salivary glands. Maturitas 2000;36:131-7.
7. Välimaa H, Savolainen S, Soukka T, Silvoniemi P, Mäkelä S, Kujari H, *et al.* Estrogen receptor-beta is the predominant estrogen receptor subtype in human oral epithelium and salivary glands. J Endocrinol 2004;180:55-62.
8. Cao M, Shu L, Li J, Su J, Zhang W, Wang Q, *et al.* The expression of estrogen receptors and the effects of estrogen on human periodontal ligament cells. Methods Find Exp Clin Pharmacol 2007;29:329-35.
9. Fox PC, van der Ven PF, Sonies BC, Weiffenbach JM, Baum BJ. Xerostomia: Evaluation of a symptom with increasing significance. J Am Dent Assoc 1985;110:519-25.
10. Fox PC, Busch KA, Baum BJ. Subjective reports of xerostomia and objective measures of salivary gland performance. J Am Dent Assoc 1987;115:581-4.
11. Navazesh M, Kumar SK; University of Southern California School of Dentistry. Measuring salivary flow: Challenges and opportunities. J Am Dent Assoc 2008;139 5 Suppl: 35S-40S.
12. Osailan S, Pramanik R, Shirodaria S, Challacombe SJ, Proctor GB. Investigating the relationship between hyposalivation and mucosal wetness. Oral Dis 2011;17:109-14.
13. Wiener RC, Wu B, Crout R, Wiener M, Plassman B, Kao E, *et al.* Hyposalivation and xerostomia in dentate older adults. J Am Dent Assoc 2010;141:279-84.
14. Ericsson Y, Hardwick L. Individual diagnosis, prognosis and counselling for caries prevention. Caries Res 1978;12 Suppl 1:94-102.
15. Nederfors T, Isaksson R, Mörnstad H, Dahlöf C. Prevalence of perceived symptoms of dry mouth in an adult Swedish population – relation to age, sex and pharmacotherapy. Community Dent Oral Epidemiol 1997;25:211-6.
16. Minicucci EM, Pires RB, Vieira RA, Miot HA, Sposto MR. Assessing the impact of menopause on salivary flow and xerostomia. Aust Dent J 2013;58:230-4.
17. Yalcin F, Gurgan S, Gul G. Oral health in postmenopausal Turkish women. Oral Health Prev Dent 2006;4:227-33.
18. Falcão DP, da Mota LM, Pires AL, Bezerra AC. Sialometry: Aspects of clinical interest. Rev Bras Reumatol 2013;53:525-31.
19. Sánchez-Guerrero J, Aguirre-García E, Pérez-Dosal MR, Kraus A, Cardiel MH, Soto-Rojas AE. The wafer test: A semi-quantitative test to screen for xerostomia. Rheumatology (Oxford) 2002;41:381-9.
20. Shannon IL, Suddick RP. Effects of light and darkness on human parotid salivary flow rate and chemical composition. Arch Oral Biol 1973;18:601-8.
21. Pai S, Ghezzi EM, Ship JA. Development of a Visual Analogue Scale questionnaire for subjective assessment of salivary dysfunction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001;91:311-6.
22. Thomson WM. Measuring change in dry-mouth symptoms over time using the Xerostomia Inventory. Gerodontology 2007;24:30-5.
23. Osailan SM, Pramanik R, Shirlaw P, Proctor GB, Challacombe SJ. Clinical assessment of oral dryness: Development of a scoring system related to salivary flow and mucosal wetness. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114:597-603.