

Assessing the impact of menopause on salivary flow and xerostomia

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ABSTRACT

Background: The aim of this study was to evaluate the symptoms of dry mouth and salivary flow in menarche and menopausal women.

Methods: Objective and subjective assessment of salivary function were analysed by Xerostomia Inventory and Visual Analogue Scale questionnaire in menopausal and menarche women (control group). Salivary flow was evaluated by a chemical absorption stimulation test. Each subject provided three saliva samples: S1, non-stimulated saliva; S2, saliva initially stimulated with two drops of citric acid 2.5%; and S3, saliva super-stimulated with two drops of citric acid 2.5% every 30 seconds for two minutes.

Results: No intergroup association was observed between Xerostomia Inventory and Visual Analogue Scale questionnaire. In both groups, the salivary flow was greatest at S3, followed by S2 and finally S1. Salivary flow was lower in the menopausal group compared to the control group only in S2 and S3.

Conclusions: In the menopausal group, the salivary flow showed reduction but without clinical symptoms of dry mouth. It is important to normalize salivary flow to prevent oral abnormalities and maintain oral health.

Keywords: Hyposalivation, menarche, menopause, salivary flow, xerostomia.

Abbreviations and acronyms: HRT = hormone replacement therapy; VAS = Visual Analogue Scale; XInv = Xerostomia Inventory.

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INTRODUCTION

Saliva is fundamental for maintaining oral health. Xerostomia is the perception of dry mouth and can be associated with diminution of salivary flow.¹ A reduction of salivary flow by 40% to 50% makes the patient symptomatic and prone to develop xerostomia.² Oral dryness can profoundly affect quality of life and interfere with basic daily functions such as chewing, swallowing and speaking. Reduction of salivary volume and subsequent loss of the antibacterial properties of saliva may accelerate infection, tooth decay and periodontal disease.^{2–4}

Xerostomia is more common in middle-aged and elderly people and its principal causes are anxiety, fear, stress, depression and the use of some drugs,⁵ autoimmune disease, viral or bacterial salivary gland infections, salivary gland tumours, radiotherapy and chemotherapy, diabetes mellitus, AIDS, HCV infections,^{2,6,7} and hormonal disturbances such as menopause and climacteric.⁸

Menopause is a physiological process occurring in the fifth decade of life in women,^{9,10} causing the

permanent interruption of menstruation after losing ovarian function for more than 12 months.¹¹ Related to this, climacteric endures for a longer period and involves a series of events such as the loss of female reproductive capacity and important sex hormone changes; it is characterized by decreases in progesterone, and especially oestrogen levels.¹⁰ However, menopause is not synonymous with climacteric.

The reduction of partial or total production of oestrogen during menopause and climacteric causes significant decrease of salivary flow, resulting in hyposalivation and symptoms of xerostomia.⁸

The high frequency of oral symptoms in menopausal women and the paucity of studies correlating xerostomia with hyposalivation were factors that motivated the present study, which aimed to assess xerostomia symptoms and salivary flow in menarche and menopausal women.

MATERIALS AND METHODS

The Research Ethics Committee of the Araraquara Dental School, São Paulo State University, Brazil,

approved the study. Written informed consent was obtained from all subjects included in the study.

A total of 60 female volunteers assisted at the Araquara Dental School and were divided into menopausal and control groups. The menopausal group included 30 subjects aged between 45 and 64 years, with no menstruation and no ovarian function for at least one year; the subjects evaluated in this study reported no disease and were not using any medication that might interfere with salivary gland function. The control group included 30 subjects aged between 20 and 44 years, with a regular menstrual cycle and good general health. All subjects had good oral health with no evidence of cavities, periodontal or oral disease.

All subjects were asked to answer the Xerostomia Inventory (XInv)¹² and Visual Analogue Scale questionnaire (VAS).¹³ The 11 items of the XInv were rated as: (1) never; (2) hardly ever; (3) occasionally; and (4) fairly often, in order to represent the subjective severity of dry-mouth symptoms (Table 1). The VAS questionnaire (0–100 mm) is composed of eight items and was administered to assess xerostomia symptoms (Table 2).

A circadian rhythm has been described for unstimulated whole saliva.¹⁴ The low flow occurs during sleep and early in the morning compared with late in the afternoon, whereas peaks occur during stimulation periods.^{14,15} The resting whole saliva was collected once between 9 am and 11 am because in the morning the variance of salivary flow is smaller, and has been estimated at 0.1 mL/min.¹⁶

Salivary flow was evaluated by chemical absorption stimulation test in accordance with Camargo *et al.*¹⁷ Each subject was advised to fast for two hours before and asked to provide three saliva samples. Prior to testing for each sample, two cotton balls were put in one labelled plastic receptacle and weighed on a digital scale (OHAUS-Scout Electronic Balance Model SC 6010/3 AO). Salivary flow was calculated as the difference between the weight before and after each saliva sample (mL/min). Subjects were asked to swallow any saliva in their mouth before providing each sample. To collect the first sample of unstimulated saliva (S1), two cotton balls were placed under the tongue for two minutes; after this the cotton balls were weighed and the salivary flow calculated. The differences in salivary flows were classified as hypo-flow <0.1 mL/min and normal flow \geq 0.1 mL/min. For the second sample, the first stimulated saliva (S2), two cotton balls were placed under the tongue and two drops of citric acid 2.5% were applied to the dorsal tongue. After two minutes, the cotton balls were weighed and the salivary flow calculated. To collect the third super-stimulated saliva sample (S3), two cotton balls were placed under the tongue and two drops

Table 1. Xerostomia Inventory item scores, percentages and mean scores in menopause group (n = 30) and control group (n = 30)

item	Never		Hardly ever		Occasionally		Very often		Total	
	menopause	control	menopause	control	menopause	control	menopause	control	menopause	control
1 I sip liquids to aid in swallowing food	15 (50%)	21 (70%)	8 (26.7%)	6 (20%)	6 (20%)	3 (10%)	1 (3.3%)	0	0.80 (24)	0.40 (12)
2 My mouth feels dry when eating a meal	17 (56.7%)	13 (43.3%)	6 (20%)	11 (36.7%)	6 (20%)	5 (16.7%)	1 (3.3%)	1 (3.3%)	0.73 (22)	0.83 (25)
3 I get up at night to drink	5 (16.7%)	6 (20%)	6 (20%)	10 (33.3%)	14 (46.7%)	8 (26.7%)	5 (16.6%)	6 (20%)	1.80 (54)	1.66 (50)
4 My mouth feels dry	6 (20%)	8 (26.7%)	8 (26.7%)	13 (43.3%)	13 (43.3%)	8 (26.7%)	3 (10%)	1 (3.3%)	1.53 (46)	1.10 (33)
5 I have difficulty in eating dry foods	13 (43.3%)	12 (40%)	8 (26.7%)	11 (36.7%)	8 (26.7%)	5 (16.7%)	1 (3.3%)	2 (6.6%)	0.93 (28)	0.96 (29)
6 I suck sweets or cough lollies to relieve dry mouth	25 (83.3%)	22 (73.3%)	4 (13.3%)	6 (20%)	0	2 (6.7%)	1 (3.3%)	0	0.26 (8)	0.33 (10)
7 I have difficulties swallowing certain foods	18 (60%)	15 (50%)	4 (13.3%)	9 (30%)	8 (26.7%)	6 (20%)	0	0	0.66 (20)	0.70 (21)
8 The skin of my face feels dry	27 (90%)	23 (76.7%)	3 (10%)	7 (23.3%)	0	0	0	0	0.10 (3)	0.23 (7)
9 My eyes feel dry	24 (80%)	20 (66.7%)	6 (20%)	10 (33.3%)	0	0	0	0	0.20 (6)	0.33 (10)
10 My lips feel dry	15 (50%)	9 (30%)	10 (33.3%)	15 (50%)	5 (16.7%)	6 (20%)	0	0	0.66 (20)	0.90 (27)
11 The inside of my nose feels dry	24 (80%)	26 (86.7%)	6 (20%)	4 (13.3%)	0	0	0	0	0.20 (6)	0.13 (4)

Table 2. Median for VAS questionnaire item in menopause and control groups

		menopause	control
Rate the difficulty you experience in speaking due to dryness		0.00 (0–16)	1.00 (0–12)
Not difficult at all	Very difficult		
Rate the difficulty you experience in swallowing due to dryness		0.00 (0–12)	0.50 (0–12)
Not difficult at all	Very difficult		
Rate how much saliva is in your mouth		4.00 (0–13)	3.00 (0–12)
A lot	None		
Rate the dryness of your mouth		3.00 (0–11)	3.00 (0–12)
Not dry at all	Very dry		
Rate the dryness of your throat		0.00 (0–4)	1.00 (0–5)
Not dry at all	Very dry		
Rate the dryness of your lips		2.00 (0–7)	2.00 (0–4)
Not dry at all	Very dry		
Rate the dryness of your tongue		0.00 (0–5)	0.50 (0–4)
Not dry at all	Very dry		
Rate the level of your thirst		5.00 (1–11)	3.00 (1–8)
Not dry at all	Very dry		

of citric acid 2.5% were applied every 30 seconds for two minutes; after this the cotton balls were weighed and the salivary flow calculated. For the second and third samples, the differences of salivary flows were classified into hypo-flow <0.5 mL/min and normal flow ≥ 0.5 mL/min.

Salivary flow at the three moments (S1, S2, S3) between groups was analysed by a model of generalized estimating equations with gamma probability distribution. The association between xerostomia questionnaires and the groups was tested by chi-square for trend test. The correlation between salivary flow at the three moments and the xerostomia questionnaire responses was assessed by Spearman's rank correlation coefficient. The internal consistency of the subjective xerostomia responses was evaluated by Cronbach's alpha. Data were analysed by IBM SPSS 20 programme. Values of $p < 0.05$ (two-tailed) were considered statistically significant.

RESULTS

The mean ages of the menopausal and control groups were 52.7 and 29.0 years, respectively. In the menopausal group, 16 women were submitted to hormonal replacement therapy (HRT). Oral symptoms and salivary flow were not statistically correlated with HRT.

According to the responses collected from the XInv and the VAS questionnaire, the menopausal and control groups did not differ significantly in relation to dry mouth as a clinical symptom (Tables 1 and 2).

The XInv and the VAS questionnaire were correlated ($p < 0.05$) and internally consistent (Cronbach's alpha >0.85) but were not correlated with salivary flow ($p > 0.1$).

No association was observed between the salivary flow and xerostomia or between the VAS question-

naire and XInv in the two groups, even when corrected by HRT.

In both groups, the salivary flow was greatest at S3, followed by S2 and finally S1 ($p < 0.01$). Menopausal subjects presented lower salivary flow only at S2 and S3 ($p < 0.01$). When the saliva flow was stimulated (S2 and S3), the menopausal group presented a lower salivary response than controls ($p < 0.001$) (Fig. 1).

DISCUSSION

Xerostomia and burning mouth are the principal oral symptoms in menopause.^{7,18,19} The subjective nature of these symptoms hampers their quantification, so that it becomes difficult to establish whether they are related to function of the salivary glands. Questionnaires such as

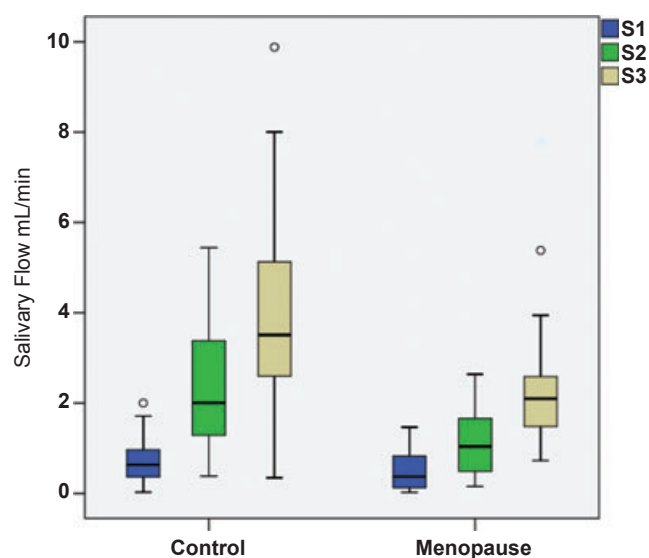


Fig. 1 Salivary flows (mL/min) in the control and menopausal groups in the three samples (S1, S2, S3).

XInv, in association with saliva measurement, have been used to evaluate subjective reports of salivary gland dysfunctions.^{12,13} The VAS questionnaire may be useful for detecting changes in salivary flow rates that permit evaluation of the high risk of such glandular dysfunction, which may result in systemic diseases that require medication, chemotherapy, or head and neck radiotherapy.¹³

We associated the XInv and VAS questionnaires with the salivary flow measures and did not find any association between xerostomia and salivary flow. The menopausal group did not present dry mouth symptoms but its salivary flow was reduced. Nevertheless, there is no consensus in the literature about the correlation between xerostomia and hyposalivation.¹⁹

The fact that salivary flow was greatest at S3 followed by S2 and S1 in both groups is consistent with other studies,²⁰ and suggests that the two groups have the capacity to increase salivary flow when stimulated. However, the menopausal group showed less capacity to produce saliva when stimulated.

Salivary flow was reduced in the menopausal group, suggesting abnormalities or a blocking of salivary gland function which may be caused by age-related physiologic²¹ and/or hormone level changes as shown by the detection of sex hormone receptors in the oral mucosa and salivary glands.²² The diminution of this hormone level in menopause is principally responsible for the oral symptoms.⁸ Although some studies²⁰ indicate that xerostomia might be unrelated to lower salivary flow rates, it may in fact be a process associated with low oestrogen levels. However, the prevalence of oral symptoms, especially xerostomia, has been demonstrated to be greater in menopausal than in premenopausal women.²³ It has been reported that HRT may contribute to decreased oral symptoms during menopause²⁴; but conversely, it has been hypothesized that menopause and the use of HRT do not correlate with oral symptoms.⁷

The reduction of salivary flow should cause abnormalities in saliva quantity and/or quality,²⁵ resulting in a loss of the antibacterial properties of saliva, and may accelerate infection by *Candida albicans*, as well as cavities, tooth decay and periodontal disease. Low salivary flow can profoundly affect quality of life by interfering with basic daily functions such as chewing, swallowing and speaking.^{2,4}

Although menopausal women present no clinical symptoms of dry mouth, they show reduced salivary flow. Therefore, it is important to normalize the salivary flow in order to prevent future oral and periodontal diseases, cavities and generally maintain oral health. We believe that further studies are necessary to identify the relation between salivary

flow and oral symptoms, especially in this group of patients.

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