Xerostomia, Hyposalivation and Oral Microbiota in Patients Using Antihypertensive Medications

Vimonpun Nonzee DDS, MSc*,
Somchai Manopatanakul DDS, MDSc**, Siribang-on Piboonniyom Khovidhunkit DDS, DMSc**

** Dental Unit, Siriraj Hospital, Mahidol University, Bangkok, Thailand*
*** Department of Advanced General Dentistry, Faculty of Dentistry, Mahidol University, Bangkok, Thailand*

Objective: *Oral dryness can contribute to several diseases in the oral cavity. The objective of the present study was to compare the subjective oral dryness, salivary flow rates, the number of oral microbiota, and the dental status between medicated hypertensive patients and control subjects.*
Material and Method: *Four hundred subjects including 200 ambulatory hypertensive patients who were taking antihypertensive medications and 200 control subjects were included. Each subject's medical history was reviewed. The subject's oral health status, salivary flow rate, and the number of oral microbiota were also evaluated.*
Results: *The prevalence rate of xerostomia in the medicated hypertensive group was 50% whereas only 25.5% of the control group had xerostomia ($p < 0.05$). Using modified Schirmer test (MST), the mean unstimulated salivary flow rate of the medicated hypertensive group (23.11 $\pm$ 6.08 mm/3min) was significantly lower than that of the control group (31.30 $\pm$ 3.36 mm/3min) ($p < 0.05$). In addition, the mean stimulated salivary flow rate of the medicated hypertensive group (0.73 $\pm$ 0.30 ml/min) was also significantly lower than that of the control group (1.31 $\pm$ 0.34 ml/min) ($p < 0.05$). The strongest associated factor for dry mouth was the use of antihypertensive medications (OR = 6.28). The mean levels of mutans streptococci, Lactobacilli spp. and Candida spp. in the medicated hypertensive group were significantly higher than in the control group ($p < 0.05$). Furthermore, medicated hypertensive patients were more likely to have missing teeth compared to control subjects.*
Conclusion: *Xerostomia, hyposalivation, and increasing number of oral microbiota were more prevalent in hypertensive patients taking antihypertensive medications.*

Keywords: *Xerostomia, Salivation, Oral microorganism, Antihypertensive drugs, Hypertension*

J Med Assoc Thai 2012; 95 (1): 96-104
Full text. e-Journal: *http://www.jmat.mat.or.th*

Saliva plays an important role in maintaining homeostasis of the oral cavity. It exerts antimicrobial effects, helps maintaining normal oral ecology, pH, tooth and mucosal integrity. It also mediates taste sensations and assists in mastication and deglutition through its lubricative property[1,2]. Xerostomia and hyposalivation are two different words that should not be used interchangeably[3]. Xerostomia is a conventional term used to denote the subjective complaint of mouth dryness. Hyposalivation is an objective reduction in salivary secretion, which may result in increased incidence of candidiasis, caries, periodontal diseases, inflammation of the mucosa and difficulties in speech, mastication and deglutition[4-6]. It has been reported that xerostomia does not equate consistently with hyposalivation[4]. Although most patients with xerostomia have hyposalivation, others may not. On the other hand, patients who had hyposalivation may not complain of xerostomia[4].

In the past, head and neck radiation therapy was considered the most common cause of xerostomia and hyposalivation. In recent years, however, medications have emerged as the most common cause, especially in the geriatric patient population. More than 400 medications are known to be associated with xerostomia and/or hyposalivation[7,8], including antihypertensive medications (α-blockers, β-blockers, diuretics, angiotensin converting enzyme inhibitors, calcium channel blockers), antidepressants, sedatives, central analgesics, anti-Parkinson medications, anti-allergy medications, and antacids[8].

Hypertension is a major health problem. It is one of the strongest risk factors for cardiovascular diseases. In Thailand, approximately 10 million people

Correspondence to:
Khovidhunkit SP, Department of Advanced General Dentistry, Faculty of Dentistry, Mahidol University, 6 Yotee Street, Ratchathewi, Bangkok 10400, Thailand.
Phone & Fax: 0-2203-6530
E-mail: dtspb@mahidol.ac.th

or one out of six people have hypertension and regularly use antihypertensive medications. As the population ages and the number of older people increases, the prevalence rate of hypertension continues to increase. One common side effect associated with antihypertensive medications is the subjective complaint of mouth dryness or xerostomia[9,10]. Several investigators attributed this symptom to the use of certain antihypertensive medications.

Although hypertension as a cardiovascular risk factor has been studied extensively, not much is known about the influence of hypertension and its treatment on objective measurements of salivary secretion and the number of oral microbiota. Therefore, the purpose of the present study was to compare the mean of xerostomia or subjective oral dryness, salivary flow rates and the number of common oral microbial organisms between the control (non-hypertensive) and the medicated hypertensive groups and investigate the possible cause of hyposalivation.

Material and Method

Ethical considerations

The present study was approved by the Committee on Human Rights Related to Human Experimental of the Faculty of Dentistry and Faculty of Medicine Siriraj Hospital, Mahidol University (MU-IRB 2007-089, Si 397/2007). The ethical guidelines of the Declaration of Helsinki were followed throughout the present study. During the screening session, signed informed consent was obtained from each participant.

Subjects

Four hundred ambulatory subjects, 200 hypertensive patients and 200 normotensive control subjects were randomly selected from patients who received ongoing care at the Faculty of Dentistry or the Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok or Bang-ra-gum Hospital, Phitsanulok. The normotensive control group was composed of healthy adult volunteers, with the age of thirty-five years or older, who had no known systemic disease and were not taking any medication. The inclusion criteria for the medicated hypertensive group were ambulatory patients, age 35 years or older, who had a diagnosis of hypertension, were taking antihypertensive medication(s) and were willing to participate in the present study. Patients who had been treated with radiotherapy, or had other systemic diseases that are associated with xerostomia and hyposalivation such as Sjogren's syndrome, anemia, salivary gland disease, encephalitis, brain tumor, diabetes mellitus, stroke and Parkinson's disease were excluded from the present study. Patients with nasal congestion, mouth breathing, or snoring were not excluded from the present study. Any subjects who refused oral examination, did not provide informed consent, or did not have sufficient clinical data were also excluded. Patients were interviewed and examined, and pertinent clinical data were obtained.

Interview

Each participant was questioned by one dentist (VN) who also performed the clinical examination. Age, sex, medical history, family history, and other factors that can induce xerostomia and hyposalivation such as diarrhea, alcohol use and cola drink were documented. In the medicated hypertensive group, the type and duration of treatment of each antihypertensive medication were reviewed thoroughly.

Subjective oral dryness

The xerostomia questionnaire and a visual analog scale (VAS) of xerostomia were used to evaluate xerostomia. The xerostomia questionnaire used in the present study was modified from the xerostomia questions proposed by Fox et al[5]. These questions included 1) Does your mouth usually feel dry? 2) Does your mouth feel dry when eating a meal? 3) Do you have difficulty swallowing dry food? 4) Do you sip liquid to aid in swallowing dry food? and 5) Is the amount of saliva in your mouth too little most of the time? An affirmative response to at least one of the above five questions has been shown to correlate with a decrease in saliva[5,7]. In addition, the VAS of xerostomia was used to assess these subjective items. Each participant was asked to mark the severity of dry mouth on a 10-cm long VAS with the negative and the positive on the left and right, respectively (*e.g.* 0 cm = no feeling of mouth dryness, 10 cm = extreme feeling of mouth dryness)[11].

Salivary flow rate and saliva collection

An unstimulated salivary flow was measured using a modified Schirmer test (MST), which was developed from the Schirmer tear test routinely used by ophthalmologists to measure the tear film wetness. A commercially available 5 x 35 mm ColorBar™ Schirmer tear test strip (Eagle Vision, TN, USA) has a blue color bar that travels with the fluid front and has a millimeter scale (2-35 mm) delineating the distance of

fluid flow. All the tests were performed from 8 am to 12 noon according to Fontana et al[12]. Briefly, all subjects were asked not to eat or drink 2 hours prior to the MST. After a period of a 3-5 minute rest, the patient was asked to swallow all the saliva in the mouth prior to the test and not to swallow anymore during the test. In addition, the patient was asked to rest the tongue on the hard palate so that the test strip would not touch the tongue during the test. The MST strip was held vertically with a cotton plier and the rounded end of the strip was positioned at the floor of mouth. When the round end of the strip contacted moisture, the blue dye traveled up the strip and its distance was read at 1, 2 and 3 minutes and recorded immediately. Hyposalivation was diagnosed if the color moved 25 mm at 3 minutes according to Fontana et al[12].

A stimulated salivary flow rate was additionally evaluated by a spit test. The subjects were asked to chew 4-5 pieces of paraffin for one minute and spit their saliva into a cup every minute for a total of three minutes. According to The Federation Dentaire Internationale (FDI) 1992, stimulated salivary flow rate of 0.5 milliliter per minute or less is diagnostic of hyposalivation[13,14].

Examination of oral microbiota

Mutans streptococci, *Lactobacilli* spp. and *Candida* spp. were examined by the modified dip-slide test. In the present test, the stimulated whole saliva sample was collected and subsequently poured over the surface of a 3-compartment dip-slide containing selective media for these three organisms. All agar plates and plastic tubes containing dip-slides were incubated at 37°C for 48 to 72 hours in a 5% CO_2 incubator. The density of the growth of mutans streptococci, *Lactobacilli* spp. and *Candida* spp. were recorded and scored by comparison with a chart provided with the test[15]. According to the score chart, levels of mutans streptococci were classified as 1, 2, 3, and 4 when the microorganisms were $< 10^3$, $> 10^3$-$< 10^5$, $> 10^5$-$< 10^6$ and $> 10^6$ CFU/ml, respectively. Levels of *Lactobacilli* spp. were classified as 1, 2, 3 and 4 when the microorganisms were $< 10^3$, $> 10^3$-$< 10^4$, $> 10^4$-$< 10^5$, and $> 10^5$ CFU/ml, respectively. Levels of *Candida* spp. were classified as 1, 2, 3 and 4 when the microorganisms were $< 10^2$, $> 10^2$-$< 10^3$, $> 10^3$-$< 10^4$ and $> 10^4$ CFU/ml, respectively.

Oral examination

Dental caries, fillings in all remaining teeth, and loss of teeth were recorded using DMFT index, which represents caries experience as recommended by the World Health Organization (WHO).

Statistical analysis

Statistical analyses of the results were performed using the SPSS for Windows program version 13.0. The mean, standard deviation, frequency and percentage were calculated for descriptive data. The differences between the control and medicated hypertensive groups were compared using the t-test or the Chi-square test. The Spearman rank correlation was used to assess the correlation among variables. Differences in salivary flow rate among each group of antihypertensive medication were analyzed by ANOVA test. Backward logistic regression analyses were performed to test the association of multiple variables with hyposalivation and to explore the strongest associated factors for hyposalivation. All p-values given are based on 2-tailed tests of significance and p-values of less than 0.05 were considered statistically significant.

Results

Clinical characteristics

Four hundred subjects were divided into two groups, the control and the medicated hypertensive groups. Clinical characteristics of the two groups were relatively comparable as shown in Table 1 except that subjects in the medicated hypertensive group were significantly older than those in the control group (Table 1). Moreover, the systolic blood pressure (SBP) and diastolic blood pressure (DBP) were significantly higher in the medicated hypertensive group (Table 1).

Subjective oral dryness

From the xerostomia questionnaire, significantly more subjects in the medicated hypertensive group had xerostomia compared to the control group (50% vs. 25.5%, $p < 0.05$). Similarly, the mean of VAS of xerostomia in the medicated hypertensive group was also significantly higher than that of the control group (3.32 ± 2.72 vs. 1.53 ± 1.89, $p < 0.05$) (Table 1).

Salivary flow rate

The mean unstimulated salivary flow rates at 1, 2 and 3 minutes using MST in the medicated hypertensive group were significantly lower than those in the control group at each time point (Table 1). Using the cut-off MST value of < 25 mm at 3 minutes, the prevalence of hyposalivation in patients with

Table 1. Baseline characteristics of subjects in the control and the medicated hypertensive groups

Characteristics	Control group n = 200	Medicated hypertensive group n = 200
Male (number (%))	82 (41.0%)	96 (48.0%)
Female (number (%))	118 (59.0%)	104 (52%)
Age range (years)	35-76	44-89
Mean age ± SD (years)	58.82 ± 7.84	62.41 ± 8.75*
SBP range (mmHg)	110-139	110-164
Mean SBP ± SD (mmHg)	126.70 ± 7.57	134.74 ± 10.37*
DBP range (mmHg)	70-88	66-98
Mean DBP ± SD (mmHg)	79.71 ± 4.86	83.87 ± 6.90*
Prevalence of xerostomia (number (%))	51 (25.5%)	100 (50%)*
Prevalence of hyposalivation (number (%))	11 (5%)	114 (57%)*
MST		
1 minute: mean ± SD (mm)	13.60 ± 2.15	9.77 ± 3.83*
2 minutes: mean ± SD (mm)	23.60 ± 2.87	16.84 ± 5.31*
3 minutes: mean ± SD (mm)	31.30 ± 3.36	23.11 ± 6.08*
Stimulated salivary flow rate (ml/min)	1.31 ± 0.34	0.73 ± 0.30*
VAS range	0-5	0-8
Mean VAS score ± SD	1.53 ± 1.89	3.32 ± 2.72*
Mean levels of mutans streptococci	2.22 ± 0.58	2.62 ± 0.79*
Mean levels of *Lactobacilli* spp.	1.94 ± 0.60	2.60 ± 0.76*
Mean levels of *Candida* spp.	1.61 ± 0.63	1.82 ± 0.79*
Mean levels of decay teeth	4.80 ± 3.30	4.29 ± 3.45
Mean levels of missing teeth	7.96 ± 7.16	12.51 ± 9.98*
Mean levels of filling teeth	4.12 ± 2.61	4.62 ± 3.35
Mean levels of DMFT	16.89 ± 6.82	21.42 ± 7.40*

SBP = systolic blood pressure; DBP = diastolic blood pressure; MST = modified Schirmer test; DMFT = decay, missing and filling teeth
* $p < 0.05$

hypertension was 57% compared with 5% in the control group ($p < 0.05$). In addition, the stimulated salivary flow rate in the medicated hypertensive group was significantly lower than that in the control group (Table 1). In conclusion, patients with hypertension who were medicated had both lower unstimulated and stimulated salivary flow rates compared to those of the control.

Associated factors for the hyposalivarion

The association of multiple variables with hyposalivation was analyzed using logistic regression analysis. The result of this analysis is given in Table 2. The use of antihypertensive medications was the strongest associated factors for dry mouth (OR = 6.28).

Table 2. Logistic regression analysis on factors relating to hyposalivation in the control and the medicated hypertensive groups

Factors	OR	95% CI
Antihypertensive medications	6.28*	3.68-10.74
Age	1.27*	1.18-1.36
Pulse rate	1.10^{+}	1.01-1.19
Gender	0.14*	0.05-0.43
Diarrhea	0.04*	0.01-0.36
Alcohol	0.32*	0.14-0.74
Cola drink	0.26*	0.14-0.50

* $p < 0.01$, $^{+}$ $p < 0.05$

Antihypertensive medications and salivary flow rate

According to the number of drugs used by the subjects with hypertension, 125 (62.5%) subjects were taking only one type of antihypertensive drug whereas 75 (37.5%) subjects were taking two types of drugs. There was no significant difference of both unstimulated and stimulated salivary flow rates in the subjects taken either one or two types of drug(s)

Table 3. Mean unstimulated and stimulated salivary flow rates according to medication(s)

Medication(s)	Number of patients	Unstimulated salivary flow rate (mean ± SD)	Stimulated salivary flow rate (mean ± SD)
Propanolol	59	22.97 ± 6.00	0.77 ± 0.29
Hydrochlorothiazide (HCTZ)	25	22.20 ± 4.76	0.67 ± 0.24
Atenolol	17	24.82 ± 4.23	0.63 ± 0.22
Amlodipine	8	21.50 ± 4.72	0.55 ± 0.17
Enalapril	16	26.00 ± 4.38	0.66 ± 0.19
Atenolol + amlodipine	2	22.50 ± 0.71	0.70 ± 0.17
Atenolol + HCTZ	3	28.67 ± 3.21	0.60 ± 0.10
Amlodipine + propanolol	9	22.89 ± 1.76	0.73 ± 0.28
Amlodipine + HCTZ	4	25.00 ± 5.77	0.67 ± 0.31
Enalapril + propanolol	23	22.96 ± 5.32	0.73 ± 0.38
Enalapril + HCTZ	3	31.67 ± 3.06	1.23 ± 0.15
Furosamide + HCTZ	9	24.11 ± 7.79	1.12 ± 0.49
Metoprolol + enalapril	2	21.50 ± 0.71	0.55 ± 0.07
Propanolol + HCTZ	18	17.89 ± 9.62	0.67 ± 0.22
Atenolol + enalapril	2	29.50 ± 0.71	0.75 ± 0.21
One medication	125	23.50 ± 4.82	0.65 ± 0.22
Two medications	75	24.67 ± 3.87	0.77 ± 0.23
Total	200	23.11 ± 6.08	0.73 ± 0.30

($p > 0.05$, Table 3). Similarly, regarding antihypertensive drug types, statistical analysis indicated that there was no significant difference of both salivary flow rates between each drug group.

The duration of the use of antihypertensive medications ranged from 1 to 120 months (mean ± SD = 61.04 ± 45.32 months). The duration of the use of antihypertensive medications did not seem to affect the VAS score of xerostomia, unstimulated and stimulated salivary flow rates ($r = 0.49$, -0.46 and -0.57, respectively).

Oral microbiota

The distribution of the number of subjects according to the score of each microflora is presented in Table 1. It was indicated that the mean levels of mutans streptococci, *Lactobacilli* spp. and *Candida* spp. in the medicated hypertensive group were significantly higher than in the control group ($p < 0.05$ in all, Table 1).

Dental caries

The mean number of decay, missing, filled teeth and DMFT in the control and the medicated hypertensive groups are depicted in Table 1. The DMFT and missing teeth in the medicated hypertensive group were significantly higher than that in the control group ($p < 0.05$). However, there was no statistically significant difference in the number of teeth with decay and filling between these groups.

Discussion

Xerostomia and hyposalivation are two words used to describe mouth dryness. Xerostomia is a subjective feeling of dry mouth and can be assessed by asking individuals whether they have such a feeling. To evaluate xerostomia in the present study, an effective xerostomia questionnaire was used[5,7]. The prevalence rate of xerostomia in the medicated hypertensive group of the present study (50%) was higher than those of elderly subjects in the previous study (12-47%)[16-22].

Although it has been reported that dry mouth was associated with the use of cigarettes, alcohol, caffeine drinks, and snacking behavior[23], the authors did not find such association in the present study. However, statistically significant difference between the unstimulated and stimulated salivary flow rates between the medicated hypertensive and the control groups was observed. The present result is also in agreement with other previous reports on older populations that persons with systemic disorders and taking xerogenic medications have significantly lower salivary flow rates than healthy controls[24,25]. Similarly to the present study, salivary alterations were observed between healthy and hypertensive subjects. In a study

of Dodds et al, the unstimulated whole, stimulated parotid, unstimulated submandibular/sublingual and stimulated submandibular/sublingual salivary flow rates were lower in the hypertensive group compared to the healthy group[26]. The concentrations of albumin, lactoferrin, lysozyme, myeloperoxidase, secretory IgA and salivary peroxidase in stimulated parotid saliva were increased in hypertensive subjects compared to healthy subjects. It was explained that since flow rates were decreased, the normal rates of protein synthesis and secretion into the depleted fluid volume might cause such changes in the protein concentrations[26]. The previous result suggested that not only the quantity but also the quality of saliva are altered in hypertensive patients.

There are two distinct views on the salivary flow rate of whole saliva and aging[14]. There were some reports indicated that the flow rate of resting whole saliva decreased with age[14]. On the other hand, some reports suggested that the salivary production remains age-stable in healthy non-medicated adults[14,26]. Therefore, there is still no definite conclusion regarding the reduction of salivary flow rate and age. In the present study, the control group seemed to be slightly younger than the medicated hypertensive group. The authors could not conclude in the present study whether age really affected the salivary flow rate or not. Therefore, if further study is conducted, the selection of the subject to be age-matched should be strongly advocated.

Although many factors can cause xerostomia and hyposalivation, the use of antihypertensive medications was clearly proved to be one of the important xerogenic factors. In agreement with this, the strongest associated factor for dry mouth in the medicated hypertensive group was the use of antihypertensive drugs. It has been reported that hypertension *per se* may have no influence on stimulated parotid salivary gland flow rates in otherwise healthy, elderly unmedicated persons[27]. Previous reports indicated that salivary gland dysfunction and xerostomia in hypertensive patients were possibly induced by specific medications used in the treatment of elevated blood pressure. In a patient treated with lisinopril and subsequently hydrochlorothiazide, the reduction of stimulated whole and stimulated parotid salivary gland flow rates was observed[28]. Nederfors et al found a tendency towards increased whole salivary flow rate in hypertensive patients when the antihypertensive medication was withdrawn[29]. In a previous study assessing parotid gland function, Streckfus and colleagues investigated the effects of hydrochlorothiazide on stimulated parotid salivary gland flow rate. Three groups of patients including normotensive subjects, hypertensive patients taking no medications and hypertensive patients with the use of hydrochlorothiazide were examined[30]. The results showed no difference in stimulated parotid salivary gland flow rates between normotensive and hypertensive subjects without medication. However, a significantly reduced stimulated parotid salivary gland flow rate was found in hypertensive subjects receiving hydrochlorothiazide treatment. Atenolol and propanolol were also found to induce a reduction of total protein concentration and amylase activity in resting and stimulated whole saliva[31]. In the present study, there was no significant difference of salivary flow rates between subjects taking each drug group. However, the authors cannot conclude that each drug group similarly affects the salivary flow rates. This might be due to a small sample size of subjects in each class of antihypertensive medications. Additionally, there was no significant difference between salivary flow rate and the number of antihypertensive medications used by the subjects. The results are in agreement with Navazesh et al who showed that there was no significant difference between groups taking one or more than one xerogenic drugs[25]. However, this is contrast to a study in that the decrease in both parotid and submandibular salivary flow rates was observed with increasing number of medications and systemic diseases[32]. Regarding the duration of the use of xerogenic drugs and hyposalivation, in a previous study by Navanesh et al, it was found that the subjects who had been taking medication for longer than 2 years had significantly lower unstimulated and stimulated salivary flow rates than patients had been taking medication for 1 to 2 years[25]. Contrarily, there was no association between hyposalivation and duration of taking antihypertensive medication in the present study.

The authors also found that the medicated hypertensive group had higher numbers of mutans streptococci, *Lactobacilli* spp. and *Candida* spp. compared to that of the control group. The results of the present study are in accordance with Almstahl et al in that increase of mutans streptococci, *Lactobacilli* spp. and *Candida* spp. was associated with hyposalivation[33]. Furthermore, Khovidhunkit et al found that patients with type II DM with hyposalivation had a higher number of mutans

streptococci, *Lactobacilli* spp. and *Candida* spp. compared to that of patients without hyposalivation[22]. These indicate that hyposalivation may increase the number of oral microbes.

The mean of DMFT and missing teeth in the medicated hypertensive group was significantly higher than that of the control group. However, there was no statistically significant difference in the number of decay and filled teeth between the two groups. This might be explained by the fact that dental caries is a multifactorial disease. The reduction of salivary flow rate is not a single factor that induced dental caries. It may be influenced by other factors such as bacterial plaque, oral hygiene, diet and other variables such as social class, income, education, knowledge, attitudes, and behavior. In addition, the DMFT index is a life-time cumulative index of dental disease and treatment and may have little bearing on caries activity at a specific point in time[34]. Although the cariogenic effect from xerostomia and hyposalivation is still inconclusive, it is unwise to mention that it is not necessary to manage the xerostomia and hyposalivation for the patients taking antihypertensive medications.

In conclusion, the present findings reveal that xerostomia, hyposalivation and the increase number of oral microbiota were prevalent in patients with hypertension who were medicated. The present study also emphasized that the identification of persons at risk and routine longitudinal monitoring of their salivary gland production as a preventive measure are important. Whole saliva evaluations are easy to be obtained in a clinical setup and reliable in identification of persons at risk. Once these persons are identified, available therapeutic modalities should be offered to manage the xerostomia and hyposalivation. Significant emphasis should be placed on preventive oral care in the management of patients with xerostomia and hyposalivation. Management of these conditions may include daily oral hygiene maintenance, frequent professional oral evaluations and care, hydration, lubrication, stimulation of the salivary glands, nutritional counseling, and avoidance of irritants such as alcohol and tobacco. In addition, in cases with severe hyposalivation, fluoride application should be advocated.

Acknowledgement

The authors wish to thank Assist. Prof. Nithima Chaowalit, Department of Medicine, Faculty of Sirisaj Hospital, Mahidol University, Bangkok, Thailand for her guidance and constructive comments.

Potential conflicts of interest

The present study was partly supported by the grant from the Faculty of Dentistry, Mahidol University, Bangkok, Thailand.

References

1. Amerongen AV, Veerman EC. Saliva—the defender of the oral cavity. Oral Dis 2002; 8: 12-22.
2. Mandel ID. The role of saliva in maintaining oral homeostasis. J Am Dent Assoc 1989; 119: 298-304.
3. Nederfors T. Xerostomia and hyposalivation. Adv Dent Res 2000; 14: 48-56.
4. Atkinson JC, Wu AJ. Salivary gland dysfunction: causes, symptoms, treatment. J Am Dent Assoc 1994; 125: 409-16.
5. 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.
6. Sreebny LM, Valdini A. Xerostomia. Part I: Relationship to other oral symptoms and salivary gland hypofunction. Oral Surg Oral Med Oral Pathol 1988; 66: 451-8.
7. Guggenheimer J, Moore PA. Xerostomia: etiology, recognition and treatment. J Am Dent Assoc 2003; 134: 61-9.
8. Sreebny LM, Schwartz SS. A reference guide to drugs and dry mouth—2nd edition. Gerodontology 1997; 14: 33-47.
9. Herman WW, Konzelman JL Jr, Prisant LM. New national guidelines on hypertension: a summary for dentistry. J Am Dent Assoc 2004; 135: 576-84.
10. Muzyka BC, Glick M. The hypertensive dental patient. J Am Dent Assoc 1997; 128: 1109-20.
11. Sung JM, Kuo SC, Guo HR, Chuang SF, Lee SY, Huang JJ. The role of oral dryness in interdialytic weight gain by diabetic and non-diabetic haemodialysis patients. Nephrol Dial Transplant 2006; 21: 2521-8.
12. Fontana M, Zunt S, Eckert GJ, Zero D. A screening test for unstimulated salivary flow measurement. Oper Dent 2005; 30: 3-8.
13. Saliva: its role in health and disease. Working Group 10 of the Commission on Oral Health, Research and Epidemiology (CORE). Int Dent J 1992; 42: 287-304.
14. Sreebny LM. Saliva in health and disease: an appraisal and update. Int Dent J 2000; 50: 140-61.
15. Thaweboon B, Thaweboon S, Sopavanit C, Kasetsuwan R. A modified dip-slide test for microbiological risk in caries assessment.

Southeast Asian J Trop Med Public Health 2006; 37: 400-4.
16. Narhi TO. Prevalence of subjective feelings of dry mouth in the elderly. J Dent Res 1994; 73: 20-5.
17. Nederfors T, Isaksson R, Mornstad H, Dahlof 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.
18. Gilbert GH, Heft MW, Duncan RP. Mouth dryness as reported by older Floridians. Community Dent Oral Epidemiol 1993; 21: 390-7.
19. Locker D. Subjective reports of oral dryness in an older adult population. Community Dent Oral Epidemiol 1993; 21: 165-8.
20. Thomson WM, Chalmers JM, Spencer AJ, Ketabi M. The occurrence of xerostomia and salivary gland hypofunction in a population-based sample of older South Australians. Spec Care Dentist 1999; 19: 20-3.
21. Osterberg T, Landahl S, Hedegard B. Salivary flow, saliva, pH and buffering capacity in 70-year-old men and women. Correlation to dental health, dryness in the mouth, disease and drug treatment. J Oral Rehabil 1984; 11: 157-70.
22. Khovidhunkit SO, Suwantuntula T, Thaweboon S, Mitrirattanakul S, Chomkhakhai U, Khovidhunkit W. Xerostomia, hyposalivation, and oral microbiota in type 2 diabetic patients: a preliminary study. J Med Assoc Thai 2009; 92: 1220-8.
23. Moore PA, Guggenheimer J, Etzel KR, Weyant RJ, Orchard T. Type 1 diabetes mellitus, xerostomia, and salivary flow rates. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001; 92: 281-91.
24. Fox PC. Management of dry mouth. Dent Clin North Am 1997; 41: 863-75.
25. Navazesh M, Brightman VJ, Pogoda JM. Relationship of medical status, medications, and salivary flow rates in adults of different ages. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1996; 81: 172-6.
26. Dodds MW, Yeh CK, Johnson DA. Salivary alterations in type 2 (non-insulin-dependent) diabetes mellitus and hypertension. Community Dent Oral Epidemiol 2000; 28: 373-81.
27. Streckfus CF, Wu AJ, Ship JA, Brown LJ. Comparison of stimulated parotid salivary gland flow rates in normotensive and hypertensive persons. Oral Surg Oral Med Oral Pathol 1994; 77: 615-9.
28. Streckfus CF. Salivary function and hypertension: a review of the literature and a case report. J Am Dent Assoc 1995; 126: 1012-7.
29. Nederfors T, Ericsson T, Twetman S, Dahlof C. Effects of the beta-adrenoceptor antagonists atenolol and propranolol on human parotid and submandibular-sublingual salivary secretion. J Dent Res 1994; 73: 5-10.
30. Streckfus CF, Wu AJ, Ship JA, Brown LJ. Stimulated parotid salivary flow rates in normotensive, hypertensive, and hydrochlo-rothiazide-medicated. J Oral Pathol Med 1994; 23: 280-3.
31. Nederfors T, Dahlof C. Effects of the beta-adrenoceptor antagonists atenolol and propranolol on human whole saliva flow rate and composition. Arch Oral Biol 1992; 37: 579-84.
32. Wu AJ, Ship JA. A characterization of major salivary gland flow rates in the presence of medications and systemic diseases. Oral Surg Oral Med Oral Pathol 1993; 76: 301-6.
33. AlmstahI A, Wikstrom M, Stenberg I, Jakobsson A, Fagerberg-Mohlin B. Oral microbiota associated with hyposalivation of different origins. Oral Microbiol Immunol 2003; 18: 1-8.
34. Dodds MW, Johnson DA, Yeh CK. Health benefits of saliva: a review. J Dent 2005; 33: 223-33.

อาการปากแห้งภาวะการลดลงของการไหลของน้ำลายและระดับเชื้อในช่องปากของผู้ป่วยความดันโลหิตสูงที่ได้รับยา

วิมลพรรณ นนทรี, สมชัย มโนพัฒนกุล, สิริบังอร พิบูลนิยม โชวิฑูรกิจ

วัตถุประสงค์*: การมีปากแห้งเป็นปัญหาหนึ่งที่สามารถทำให้เกิดโรคในช่องปากได้หลายโรค การศึกษานี้มีวัตถุประสงค์เพื่อเปรียบเทียบความรู้สึกว่ามีปากแห้ง อัตราการไหลของน้ำลาย ระดับเชื้อในช่องปาก และสภาวะของฟันในช่องปากระหว่างผู้ป่วยความดันโลหิตสูงที่ได้รับยารักษาโรคความดันโลหิตสูงและกลุ่มควบคุม*

วัสดุและวิธีการ*: ผู้เข้าร่วมการศึกษาจำนวน 400 คน ประกอบด้วยผู้ป่วยความดันโลหิตสูงที่ได้รับยาจำนวน 200 คน และกลุ่มควบคุมจำนวน 200 คน โดยประเมินประวัติทางการแพทย์ ตรวจช่องปาก วัดระดับน้ำลาย และวัดระดับเชื้อในช่องปากผู้ป่วยและกลุ่มควบคุม*

ผลการศึกษา*: ความชุกของความรู้สึกว่ามีปากแห้งในกลุ่มผู้ป่วยความดันโลหิตสูงที่ได้รับยาเป็นร้อยละ 50 ในขณะที่ร้อยละ 25.5 ของกลุ่มควบคุมมีความรู้สึกปากแห้ง (ค่านัยสำคัญทางสถิติน้อยกว่า 0.05) ด้วยวิธีการทดสอบ โมดิไฟด์เชอร์เมอร์ (modified Schirmer test) อัตราการไหลของน้ำลายในภาวะพักของผู้ป่วยความดันโลหิตสูงที่ได้รับยา (23.11 $\pm$ 6.08 มิลลิเมตรใน 3 นาที) มีค่าต่ำกว่าในกลุ่มควบคุม (31.30 $\pm$ 3.36 มิลลิเมตรใน 3 นาที) อย่างมีนัยสำคัญ (ค่านัยสำคัญทางสถิติน้อยกว่า 0.05) นอกจากนี้อัตราการไหลของน้ำลายในภาวะถูกกระตุ้นของผู้ป่วยความดันโลหิตสูงที่ได้รับยา (0.73 $\pm$ 0.30 มิลลิลิตรต่อนาที) ก็มีค่าต่ำกว่าในกลุ่มควบคุม (1.31 $\pm$ 0.34 มิลลิลิตรต่อนาที) อย่างมีนัยสำคัญเช่นเดียวกัน (ค่านัยสำคัญทางสถิติน้อยกว่า 0.05) ปัจจัยที่มีความเกี่ยวข้องที่ทำให้เกิดอาการปากแห้งคือ การใช้ยาต้านความดันโลหิตสูง (ค่าอัตราส่วน odds เท่ากับ 6.28) ค่าเฉลี่ยของจำนวนเชื้อ มิวแทนส์สเตรปโตค็อกซัย แลคโตแบซิลลัย และเชื้อราแคนดิดาในช่องปากกลุ่มผู้ป่วยความดันโลหิตสูงมีค่าสูงกว่ากลุ่มควบคุม (ค่านัยสำคัญทางสถิติน้อยกว่า 0.05) และผู้ป่วยความดันโลหิตสูงมีแนวโน้มของการสูญเสียฟันมากกว่ากลุ่มควบคุม*

สรุป*: อาการปากแห้ง ภาวะการลดลงของการไหลของน้ำลาย และการเพิ่มขึ้นของเชื้อในช่องปากพบได้บ่อยในผู้ป่วยความดันโลหิตสูงที่ได้รับยาต้านความดันโลหิตสูง*