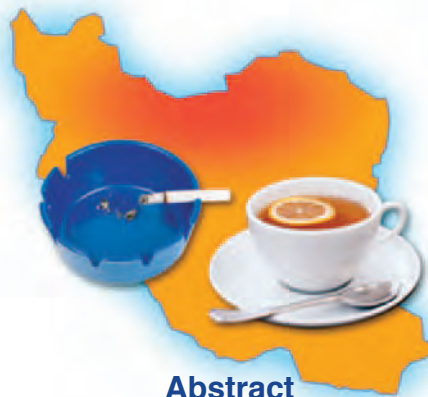


An Epidemiologic Study of Tongue Lesions in 1901 Iranian Dental Outpatients

Mina Motallebnejad, DDS, MS; Neda Babaee, DDS, MS;
Shirin Sakhdari, DDS, MS; Maryam Tavasoli, DDS



Abstract

Aim: The aim of this study was to assess the frequency of nine tongue conditions and evaluate their relationship to oral hygiene status and personal habits in a Northern Iranian population.

Methods and Materials: This descriptive study evaluated 1901 healthy subjects (1142 women, 759 men) >12 years who were referred to the Dental Faculty of Babol University during a period from February 2005 to July 2006. A questionnaire was designed according to the aims of the study. Each subject completed the questionnaire and received a complete dental and oral examination. Statistical analysis was performed using SPSS software and Chi-square and Fisher's exact probability tests.

Results: Six hundred seventy-two (35.3%) of 1901 subjects had tongue lesions with a frequency of 38.6% in women and 47.7% in men which was statistically significant ($P < 0.0001$). A strong association was found between tongue lesions and smoking ($p < 0.0001$), black tea drinking ($p = 0.021$), and poor oral hygiene ($p < 0.0001$). Hairy tongue ($p < 0.0001$), coated tongue ($p < 0.0001$), and fissured tongue ($p = 0.014$) conditions were significantly higher in males, while crenation of the tongue was more frequent in women ($p < 0.0001$).

Conclusion: This epidemiologic survey of adult dental outpatients of Northern Iran assessing tongue conditions and lesions found the frequency of these conditions in 47.7% of males and 38.6% of females in this population. Tongue conditions and lesions were more frequent among smokers, black tea drinkers, and those with poor oral

hygiene. The results of this epidemiological survey can only be interpreted for the population studied and as such cannot be generalized to the wider population of Iran, but future studies should be designed to assess the frequency of these conditions on a countrywide basis.

Clinical Significance: The results of this study suggest efficient oral hygiene programs and encouraging people to drink less tea and quit smoking may reduce tongue lesions in adult dental outpatients in Northern Iran.

Keywords: Tongue, hairy tongue, fissured tongue, geographic tongue

Citation: Motalebnejad M, Babae N, Sakhdari S, Tavasoli M. An Epidemiologic Study of Tongue Lesions in 1901 Iranian Dental Outpatients. *J Contemp Dent Pract* 2008 November; (9)7:073-080.

Introduction

Traditionally, the tongue has been considered a primary indicator of oral and general health. In recent years epidemiologic studies have shown tongue lesions constitute a remarkable proportion of oral mucosal lesions and prevalence rates may vary in different parts of the world.¹⁻⁴ These variations may be due to race, sex, and age differences of the populations as well as differences in diagnostic criteria, methodology, and sampling procedures of the different studies. Few studies of tongue conditions and lesions include details such as the effect of oral hygiene and habits.⁵⁻⁸ Moreover, there is no data on the epidemiologic evaluation of tongue conditions in Northern Iran. This region has certain social and traditional customs that may predispose the population to certain tongue conditions.

The first aim of the present study was to assess the prevalence of nine different tongue lesions and conditions of dental outpatients of a Northern Iranian population. Secondly, the relationship between tongue lesions and oral hygiene or

habits such as smoking and tea drinking was analyzed.

Methods and Materials

In this study 1901 (1142 female and 759 male) healthy dental outpatients of the Dental Faculty of Babol University of Medical Science (Northern Iran) were examined during February 2005 to July 2006. All the patients were >12 years old. Informed consents were obtained from all participants. Data were collected by oral examination and questionnaire. The questionnaire included items such as age, sex, medical and drug history, history of cigarette smoking, black tea drinking, and oral hygiene index (OHI) examinations were carried out with a dental mirror and explorer in the dental clinic. All subjects with a history of systemic diseases and currently taking any medications at the time of study were excluded.

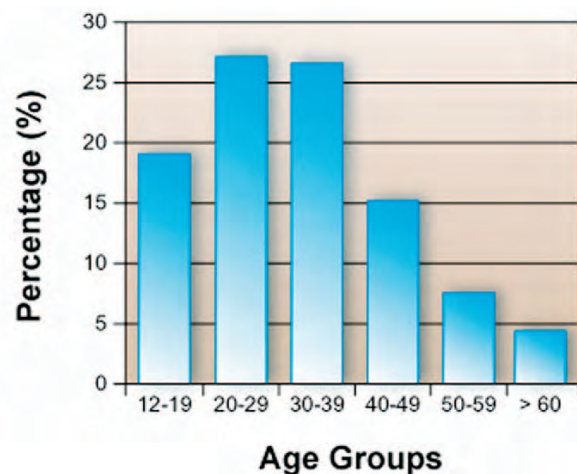
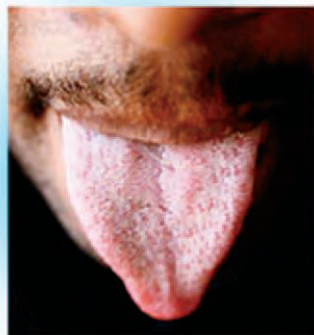




Figure 1. Relative frequency of subjects in age groups.

Patients were examined and divided into six groups according to age (Figure 1). The subjects were divided into three groups: non smokers, smokers who smoke less than one pack per day, and heavy smokers who smoke one pack or more per day. Subjects were further divided into three groups: non tea drinkers, drinkers who drink one to ten cups of tea per day, and heavy drinkers who drink more than ten cups per day. Oral hygiene was assessed according to OHI of Greene and Vermillion.⁹ The clinical levels of oral hygiene according to OHI are: good (0-1.2), fair (1.3-3.0), and poor (3.1-6.0). Edentulous subjects

were not evaluated for OHI and were not included in the analyses of oral hygiene.

The dental and tongue conditions of all subjects were also recorded. Variations in tongue surface and standard descriptions used for their diagnosis are classified and are shown in Table 1. Statistical analyses were performed using SPSS software. *P* values less than 0.05 were considered significant. For other variables, differences between groups were tested by Chi-square and Fisher's exact probability tests.

Table 1. Tongue conditions assessed.

Tongue Pathology	Description
	<p>Hairy Tongue A diagnosis of hairy tongue is appropriate when filiform papillae are elongated more than 3 mm.¹⁰ (Photograph courtesy of Dr. Harvey Kessler, Baylor College of Dentistry at the Texas A&M Health Sciences Center, Dallas, TX, USA)</p>
	<p>Coated Tongue A diagnosis of coated tongue is appropriate when the dorsum of the tongue is covered with debris and the length of the filiform papillae are <3 mm.¹⁰</p>



Fissured Tongue

Numerous grooves or fissures are present on the dorsal tongue surface.¹⁴



Papillary Atrophy

Atrophic lesions of the tongue were diagnosed when a loss of filiform papillae on the dorsum of the tongue was observed. Atrophic changes generally appear first at the tip and lateral borders. In extreme cases the entire dorsum of the tongue becomes smooth and glazed.¹⁰

In the case shown here the atrophy along with focal erythema on the dorsum of the tongue is a result of pernicious anemia.

(Photograph courtesy of Dr. Brad W. Neville, College of Dental Medicine at the Medical University of South Carolina, in Charleston, SC, USA.)



Geographic Tongue

This lesion is characterized by a loss of filiform papillae on the tip or peripheral border of the tongue. This specific lesion seems to appear on the dorsal surface of the anterior two thirds of the tongue.¹⁴



Median Rhomboid Glossitis (MRG)

This lesion is characterized by atrophic changes that are rhomboid or oval-shaped in the dorsal midline just anterior to the foramen cecum.¹⁰

Crenation tongue

Crenation tongue is a condition in which a scalloping or crenation along the lingual periphery of the tongue is present.¹⁰ (See Macroglossia below.)



Macroglossia

Macroglossia refers to an enlargement of the tongue that may be developmental or acquired.¹⁴

The case shown here has a secondary traumatic ulceration along the right lateral border due to the enlarged tongue. Slight crenation is also evident along the lateral tongue borders.

(Photograph courtesy of Dr. Brad W. Neville, College of Dental Medicine at the Medical University of South Carolina, in Charleston, SC, USA)



Ankyloglossia

Ankyloglossia refers to the partial or complete attachment of the tongue floor of the mouth.¹⁴

Note: The images of the tongue lesions shown above are only examples provided to help clarify the descriptions of actual lesions in the study.

Results

Tongue conditions and lesions were found in 672 (35.3%) of the 1901 subjects (32.3% female, 40.1% male, $p < 0.0001$) examined. The frequencies of tongue conditions are shown in Table 2.

Overall tongue conditions were more frequent in men (47.7%) than women (38.6%) ($P < 0.0001$). The frequencies of lesions by sex are shown in Table 3. Frequency of hairy tongue, coated tongue ($P < 0.0001$), and fissured tongue ($p = 0.014$) were significantly more in men, while frequency of crenation of the tongue was significantly greater in women ($P < 0.0001$).

The frequencies of the nine different tongue conditions and lesions according to six different age groups are shown in Table 4. The frequency of tongue conditions and lesions increased with increasing age ($p < 0.0001$). Fissured tongue, papillary atrophy, and median rhomboid glossitis (MRG) showed the highest frequency in the 50-59 year age group ($P < 0.0001$). The highest frequency of geographic tongue and crenation of the tongue were found in the 20-29 year age group ($P < 0.0001$). Macroglossia was more frequent in the 12-19 year age group, and ankyloglossia was more frequent in the 30-39 year group ($P < 0.0001$).

Table 2. The frequencies of tongue conditions.

Condition	n	%
Coated tongue	255	13.4
Fissured tongue	191	10
Crenation tongue	130	6.8
Geographic tongue	68	3.6
Ankyloglossia	51	2.7
MRG	52	2.7
Papillary atrophy	22	1.2
Hairy tongue	23	1.2
Macroglossia	10	0.5

Table 3. The frequencies of tongue conditions according to gender.

Tongue Condition		Sex				P value Fisher's exact test
		Male		Female		
		n	%	n	%	
Hairy tongue	-	741	97.6	1137	99.6	0.000
	+	18	2.4	5	0.4	
Coated tongue	-	632	83.3	1014	88.8	0.000
	+	127	16.7	128	11.2	
Fissured tongue	-	668	88	1042	91.2	0.014
	+	91	12	100	8.8	
Papillary atrophy	-	746	98.3	1133	99.2	0.053
	+	13	1.7	9	0.8	
Geographic tongue	-	733	96.6	1100	96.3	0.438
	+	26	3.4	42	3.7	
MRG	-	733	96.6	1116	97.7	0.88
	+	26	3.4	26	2.3	
Crenation tongue	-	728	95.9	1043	91.3	0.000
	+	31	4.1	99	8.7	
Macroglossia	-	754	99.3	1137	99.6	0.365
	+	5	0.7	5	0.4	
Ankyloglossia	-	734	96.7	1116	97.7	0.116
	+	25	3.3	26	2.3	
At least one lesion	-	455	59.9	774	67.8	0.000
	+	304	40.1	368	32.2	

Table 4. The frequencies of tongue conditions according to age groups.

Tongue Condition		Age												P value
		12-19		20-29		30-39		40-49		50-59		>60		
		n	%	n	%	n	%	n	%	n	%	n	%	
Hairy tongue	-	361	99.2	511	99	502	98.8	284	98.3	141	98.6	79	97.5	-
	+	3	0.8	5	1	6	1.2	5	1.7	2	1.4	2	2.5	
Coated tongue	-	329	90.4	448	86.8	437	86	249	86.2	117	81.8	66	81.5	-
	+	35	9.6	68	13.2	71	14	40	13.8	26	18.2	15	18.5	
Fissured tongue	-	342	94	477	92.4	452	89	248	85.8	119	83.2	72	88.9	0.000
	+	22	6	39	7.6	56	11	41	14.2	24	16.8	9	11.1	
Papillary atrophy	-	362	99.5	512	99.2	502	98.8	284	98.3	139	97.2	80	98.8	0.000
	+	2	0.5	4	0.8	6	1.2	5	1.7	4	2.8	1	1.2	
Geographic tongue	-	350	96.2	493	95.5	492	96.9	279	96.5	140	97.9	79	97.5	0.000
	+	14	3.8	23	4.5	16	3.1	10	3.5	3	2.1	2	2.5	
MRG	-	359	98.6	506	98.1	490	96.5	282	97.6	132	92.3	80	98.8	0.000
	+	5	1.4	10	1.9	18	3.5	7	2.4	11	7.7	1	1.2	
Crenation tongue	-	347	95.3	456	90.1	470	92.5	273	94.5	136	95.1	80	98.8	0.000
	+	17	4.7	51	9.9	38	7.5	16	5.5	7	4.9	1	1.2	
Macroglossia	-	361	99.2	513	99.4	507	99.8	288	99.7	141	98.6	81	100	0.000
	+	3	0.8	3	0.6	1	0.2	1	0.3	2	1.4	-	-	
Ankyloglossia	-	355	97.5	503	97.5	492	96.9	282	97.6	139	97.2	79	97.5	0.000
	+	9	2.5	13	2.5	16	3.1	7	2.4	4	2.8	2	2.5	
At least one lesion	-	267	73.4	341	66.1	316	62.2	176	60.9	77	53.8	52	64.2	0.000
	+	97	26.6	175	33.9	192	37.8	113	39.1	66	46.2	29	35.8	

Table 5. The frequencies of patients according to the smoking, black tea drinking, and OHI.

Habit	Tongue Condition			P value (Chi-square)
	+	-	Total	
	n(%)	n(%)	n(%)	
Non smoker	586 (33.3)	1172 (66.7)	1758 (100)	0.000
Smoker	52 (54.7)	43 (45.3)	95 (100)	
Heavy smoker	34 (70.8)	14 (29.2)	48 (100)	
Non drinker	21 (26.6)	58 (73.4)	79 (100)	0.021
Drinker	624 (35.3)	1144 (64.7)	1768 (100)	
Heavy drinker	27(50)	27 (50)	54 (100)	
Good OHI	173 (35.5)	318 (64.8)	491 (100)	0.000
Fair OHI	268 (31.9)	572 (68.1)	840 (100)	
Poor OHI	151 (43.5)	196 (56.5)	347 (100)	

Tongue conditions and lesions were more frequent among smokers ($p < 0.0001$) (Table 5).

The frequency was determined according to smoking habit (Table 6). The frequency of hairy tongue, coated tongue, fissured tongue, papillary atrophy, and MRG were higher in the heavy smokers than smokers and nonsmokers but only coated tongue was significant ($P < 0.0001$).

Tongue conditions and lesions were more frequent in the black tea drinker group ($P = 0.021$) (Table 5). Hairy tongue, coated tongue, fissured tongue, geographic tongue, and papillary atrophy were more frequent among heavy drinkers and MRG was more prominent among drinkers. The frequency

of coated tongue among heavy drinkers was significant ($P = 0.017\%$) (Table 7).

Tongue conditions and lesions were more frequent in patients with poor oral hygiene ($p < 0.0001$) (Table 5). Frequencies of tongue conditions and lesions according to OHI are shown in Table 8. A total of 223 patients were edentulous with no OHI recorded and were not included in this analysis. Coated tongue was more frequent in the poor OHI group ($p < 0.0001$).

The frequencies of tongue lesions according to a combination of factors are shown in Table 9. As shown previously, hairy tongue and coated tongue were the lesions which were more frequent in subjects who had more than one factor.

Table 6. Comparison of tongue conditions according to smoking.

Tongue Condition		Smoking						P value (Chi-square)
		Non smoker		Smoker		Heavy smoker		
		n	%	n	%	n	%	
Hairy tongue	-	1749	99.5	89	93.7	40	83.3	-
	+	9	0.5	6	6.3	8	16.7	
Coated tongue	-	1553	88.3	63	66.3	30	62.5	0.000
	+	205	11.7	22	33.7	18	37.5	
Fissured tongue	-	1584	90.1	84	88.4	42	87.5	0.737
	+	174	9.9	11	11.6	6	12.5	
Papillary atrophy	-	1740	99	94	98.9	45	93.8	-
	+	18	1	1	1.1	3	6.3	
Geographic tongue	-	1691	96.2	94	98.9	48	100	-
	+	67	3.8	1	1.1	-	-	
MRG	-	1715	97.6	93	97.9	41	85.4	-
	+	43	2.4	2	2.1	7	14.6	
Crenation tongue	-	1632	92.8	92	96.8	47	97.9	0.134
	+	126	7.2	3	3.2	1	2.1	

Table 7. Comparison of tongue conditions according to tea drinking.

Tongue Condition		Tea drinking						P value (Chi-square)
		Non drinker		Drinker		Heavy drinker		
		n	%	n	%	n	%	
Hairy tongue	-	79	100	1747	98.8	52	96.3	0.000
	+	-	-	21	1.2	2	3.7	
Coated tongue	-	71	89.9	1535	86.8	40	74.1	0.017
	+	8	10.1	233	13.2	14	25.9	
Fissured tongue	-	74	93.7	1591	90	45	83.3	0.147
	+	5	6.3	177	10	9	16.7	
Papillary atrophy	-	77	97.5	1750	99	52	96.3	-
	+	2	2.5	18	1	2	3.7	
Geographic tongue	-	78	98.7	1704	96.4	51	94.4	-
	+	1	1.3	64	3.6	3	5.6	
MRG	-	78	98.7	1718	97.2	53	98.1	-
	+	1	1.3	50	2.8	1	1.9	
Crenation tongue	-	70	88.6	1648	93.2	53	98.1	0.096
	+	9	11.4	120	6.8	1	1.9	

Table 8. Comparison of tongue conditions according to OHI.

Tongue Condition		OHI						P value (Chi-square)
		Good		Fair		Poor		
		n	%	n	%	n	%	
Hairy tongue	-	483	98.4	834	99.3	342	98.6	0.261
	+	8	1.6	6	0.7	5	1.4	
Coated tongue	-	426	86.8	754	89.8	280	80.7	0.000
	+	65	13.2	86	10.2	67	19.3	
Fissured tongue	-	448	43	761	90.6	306	88.2	0.309
	+	91	8.8	79	9.4	41	11.8	
Papillary atrophy	-	486	99	833	99.2	343	98.8	-
	+	5	1	7	0.8	4	1.2	
Geographic tongue	-	471	95.9	811	96.5	335	96.5	0.827
	+	20	4.1	29	3.5	12	3.5	
MRG	-	482	98.2	815	97	338	97.4	0.444
	+	9	1.8	25	3	9	2.6	
Crenation tongue	-	447	91	785	93.5	319	91.9	0.254
	+	44	9	55	6.5	28	8.1	

Table 9. Frequency of tongue conditions according to combined factors.

Lesion	Factor			
	Smoke/drink n(%)	Drink/poor OHI n(%)	Smoke/drink/poor OHI n(%)	Smoke/drink (edentulous) n(%)
Hairy tongue	12(11.2)**	5(1.5)	5(10)**	2(5.7)
Coated tongue	35(32.7)**	63(18.8)**	22(44)**	15(42.9)**
Fissured tongue	13(12.1)	38(11.3)	6(12)	4(10.5)
Papillary atrophy	3(2.8)	3(0.9)	2(4)	1(2.6)
Geographic tongue	1(0.9)	12(3.6)	0	0
MRG	5(4.7)	9(2.7)	2(4)	4(11.4)*
Crenated tongue	3(2.8)	27(8)	1(2)	1(2.9)

** P<0.001
* P<0.05

Discussion

This is the first study of the frequency of tongue lesions in a Northern Iranian dental outpatient sample. The frequency of tongue conditions in Babol dental outpatients was 42.1%. This result is similar to a study conducted in Turkey where 5150 dental outpatients between the ages of 13-83 years were examined with a 52.5% prevalence of tongue conditions.¹⁰ Banoczy⁸ studied the prevalence of tongue lesions of 7820 subjects, recalled regularly for radiographic examinations of the lungs in a district population in Budapest. The frequency of fissured tongue, geographic tongue, papillary atrophy, and MRG in that study (18.5%) was lower than the results presented in the present study.⁸ Darwazeh¹ studied 1031 Jordanian dental outpatients and found a prevalence of 23.7% for geographic, fissured, and hairy tongue. These differences may be related to the number of tongue lesions and conditions included in each study and the number of subjects examined. In addition, differences in age, sex, social and economic level, and local customary habits among populations as well as the criteria and method of diagnosis could influence the results.

The frequency of tongue lesions and conditions is higher in men than in women, especially for hairy tongue and coated tongue which was related to smoking. None of the women in this study smoked. The same finding was seen in the Turkish population,¹⁰ in contrast, more lesions were seen in women in the Hungarian population.^{8,11}

Coated tongue was the most common condition found in this study and was significantly more frequent in men, those subjects with poor oral hygiene, heavy tea drinkers, and in older subjects. These findings are compatible with those of previous studies.^{10,12,13} Poor oral hygiene, hyposalivation, and alteration in nutritional patterns among elderly and smokers may explain some of these findings. Since all the smokers in this study are men, tongue coating is more frequent in this gender.

Fissured tongue is a benign condition which has male predilection and is thought to be hereditary.¹⁴ This condition was found in 10% of subjects and was more common in men. This finding is



also compatible with previous studies.^{3,6,7,10,15,16} Prevalence of fissured tongue has been reported from as little as 0.32% in the USA to 30.5% in Israel.^{2,4,6-8,10,11,15-22} These differences may be related to hereditary and prevalence of fissured tongue in different populations. The incidence and severity of fissured tongue increases with age^{6,7,15-18} and the findings of the present study are in agreement. Thus, increases in the prevalence and degree of tongue fissuring with age could explain the higher frequency of the condition in older subjects.²³

The high frequency of crenation of the tongue in women in the present study could indicate a higher stress level in this gender. Contrary to these findings, crenation of the tongue was rare in the Turkish population.¹⁰

The prevalence of geographic tongue ranges from 0.32% (USA) to 12.7% (Israel) in different studies.^{1,2,4,5,7,12,16-22,24-26} In this study, the frequency of geographic tongue was within the range (3.6%). This lesion has been reported to be twice as prevalent in females than males.¹⁴ There was no significant differences found for gender in the present study which is a different finding than reported in previous studies.^{7,10,16} A case control study in Thailand demonstrated a significant co-existence of geographic tongue and fissured tongue,²⁷ but synchronic frequency of geographic tongue and fissured tongue in this study was less than other studies.^{7,10,15}

Prevalences of ankyloglossia have been reported from 0.88% (Hungary) to 7.8% (Iran).^{2-4,15-17,19} In the present study, the frequency was 2.7% and

the lesion was not gender related as reported by Avcu.¹⁰

MRG in this population was found in 2.7% of the population, higher than reported in other studies.^{2,4,5,10-12,15,20-22} The frequency of MRG was the same in both genders in the present study, but the prevalence of MRG in the Turkish population was reported 12 times more in women.¹⁰ A previous study reported MRG decreases with increasing age¹⁸ but this was not found in the present study. Although Gupta²⁸ reported central papillary atrophy of the tongue is related to smoking, no significant relationship between MRG and smoking, age, oral hygiene, and tea drinking was found.

The frequency of papillary atrophy was less than reported in previous studies.^{7,10,17} In the present study, the lesion was found significantly more often in the 50-59 year age group (2.8%), while in the study reported by Avcu¹⁰ papillary atrophy was more common in the 30-39 year age group. The higher prevalence in men could be due to the fact the smoking group consisted of all men. No significant relationship was found between papillary atrophy and oral hygiene or black tea drinking. There were more heavy smokers found in the present study than were found in the Avcu study.¹⁰

The frequency of hairy tongue was 1.2%, higher than reported in previous studies.^{12,19,21} Hairy tongue was significantly more common in men in this study and is in agreement with the results of Darwazeh.¹ While in the Turkish population the lesion was significantly more common in women.¹⁰ Darwazeh¹ and Salonen¹³ found a positive relationship between hairy tongue and consumption of tobacco products. Data analysis for this relationship was not possible in this population in the present study because of the low frequency of the lesion. No significant

relationship was found between hairy tongue and oral hygiene. Whereas in the Turkish population hairy tongue was significantly more prevalent in the poor OHI group. A significant positive correlation was found between hairy tongue and tea drinking in both the present study and in the Turkish population.¹⁰

The frequency of macroglossia was 0.5% in the population of the present study. Low frequency of macroglossia has been reported in many studies.^{4,10,19-21,29} Macroglossia was significantly more common in the ¹²⁻¹⁹ year age group (0.8%) in the present study. Avcu¹⁰ found macroglossia significantly more common in those subjects over 60 years of age (13.3% of females, 7.5% of males). The reason for this difference is unclear.

Conclusion

In conclusion, this epidemiologic survey of adult dental outpatients of Northern Iran assessing tongue conditions and lesions found the frequency of these conditions in 47.7% of males and 38.6% of females in this population. Tongue conditions and lesions were more frequent among smokers, black tea drinkers, and those with poor oral hygiene. Finally, the results of this study suggest efficient oral hygiene programs and encouraging people to drink less tea and quit smoking may reduce tongue lesions in adult dental outpatients in Northern Iran. The results of this epidemiological survey can only be interpreted for the population studied and as such cannot be generalized to the wider population of Iran, but future studies should be designed to assess the frequency of these conditions on a countrywide basis.

Clinical Significance

The results of this study suggest efficient oral hygiene programs and encouraging people to drink less tea and quit smoking may reduce tongue lesions in adult dental outpatients in Northern Iran.

References

1. Darwazeh Am, Pillai K. Prevalence of tongue lesions in 1013 Jordanian dental outpatients. *Community Dent Oral Epidemiol* 1993 Oct; 21(5):323-4.
2. Sedano Ho. Congenital oral anomalies in Argentinean children. *Community Dent Oral Epidemiol* 1975 Mar; 3(2):61-3.
3. Sedano Ho, Carreon Freyer I, Garza de la Garza ML, Gomar Franco CM, Grimaldo Hernandez C, Hernandez Montoya ME, Hipp C, Keenan KM, Martinez Bravo I, Medina Lopez JA. Clinical Orofacial abnormalities in Mexican children. *Oral Surg Oral Med Oral Pathol* 1989 Sep; 68(3): 300-11.
4. Sawyer DR, Taiwo EO, Mosadomi A. Oral anomalies in Nigerian children. *Community Dent Oral Epidemiol* 1984 Aug; 12(4):269-73.
5. Redman RS. Prevalence of geographic tongue, fissured tongue, median rhomboid glossitis, and hairy tongue among 3,611 Minnesota schoolchildren. *Oral Surg Oral Med Oral Pathol*. 1970 Sep; 30(3):390-95.
6. Aboyan V, Ghaemmaghami A. The incidence of fissured tongue among 4009 Iranian dental outpatients. *Oral Surg Oral Med Oral Pathol* 1973 Jul; 36(1):34-8.
7. Kullaa-Mikkonen A, Mikkonen M, Kotilainen R. Prevalence of different morphologic forms of the human tongue in young Finns. *Oral Surg Oral Med Oral Pathol* 1982 Feb; 53(2):152-6.
8. Banoczy J, Rigo O, Albrecht M. Prevalence study of tongue lesions in a Hungarian population. *Community Dent Oral Epidemiol* 1993 Aug; 21(4):224-6.
9. Carranza FA, Newman MG. *Clinical periodontology*. 8th ed; Philadelphia, WB Saunders Company. 1996; pp: 67, 68.
10. Avcu N, Kanli A. The Prevalence of tongue lesions in 5150 Turkish dental outpatients. *Oral Dis* 2003 Jul; 9(4):188-95.
11. Voros-Balog T, Dombi C, Vincze N, Banoczy J. Epidemiologic survey of tongue lesions and analysis of the etiologic factors involved. *Fogorv Sz* 1999 May; 92(5):157-63.
12. Axell T. A prevalence study of oral mucosal lesions in an adult Swedish population. *Odontol Revy* 1976; 27(36):1-103.
13. Salonen L, Axell T, Hellden L. Occurrence of oral mucosal lesions, the influence of tobacco and an estimate of treatment time in an adult Swedish population. *J Oral Pathol Med* 1990 Apr; 19(4):170-6.
14. Neville BW, Damm DD, Allen CM, Bouquet JE. *Oral & Maxillofacial pathology*. Second ed, W.B Saunders Company, 2002. Chapter 1.
15. Voros-Balog T, Vincze N, Banoczy J. Prevalence of tongue lesions in Hungarian children. *Oral Dis*. 2003 Mar; 9(2):84-7.
16. Rabiei M, Mohtashamamiri Z, Amigh Z, Ghotbirad SF, Ahsani Tehrani S. Prevalence of geographic tongue, fissure tongue and partial ankyloglossia among students of three stages of school in Rasht in 2003. *J Islamic Dental Association Iran*. 2006 Spring; 18(1)30-6.
17. Mumcu G, Cimilli H, Sur H, Hayran O, Atalay T. Prevalence and distribution of oral lesions: a cross-sectional study in Turkey. *Oral Dis* 2005 Mar; 11(2):81-7.
18. Yarom N, Contony U, Gorsky M. Prevalence of fissured tongue, geographic tongue and median rhomboid glossitis among Israeli adults of different ethnic origins. *Dermatology* 2004; 209(2):88-94.
19. Ugar-Cankal D, Denizci S, Hocaoglu T. Prevalence of tongue lesions among Turkish schoolchildren. *Saudi Med J* 2005 Dec; 26(12):1962-7.
20. Bouquet JE, Gundlach KK. Odd tongues: the prevalence of common tongue lesions in 23,616 white Americans over 35 years of age. *Quintessence Int*. 1986 Nov; 17(11):719-30.
21. Schaumann BF, Peagler FD, Gorlin RJ. Minor craniofacial anomalies among a Negro population. II. Prevalence of tongue anomalies. *Oral Surg Oral Med Oral Pathol* 1970 May; 29(5):729-34.
22. Halperin V, Kolas S, Jefferis KR, Huddleston SO, Robinson HB. The occurrences of Fordyce spots, benign migratory glossitis, median rhomboid glossitis and fissured tongue in 2,478 dental patients. *Oral Surg Oral Med Oral Pathol* 1953 Sep; 6(9):1072-7.
23. Glenert U, Pindborg JJ, Andreasen JO. Tongue surface conditions of 478 residents of a large Danish rest home. *Gerodontology*. 1986; 2:83

24. Ghos LJ, Baghdady VS. Prevalence of geographic and palicated tongue in 6090 Iraqi schoolchildren. *Community Dent Oral Epidemiol* 1982 Aug; 10(4):214-6.
25. Shulman JD, Carpenter WM. Prevalence and risk factors associated with geographic tongue among US adults. *Oral Dis* 2006 Jul; 12(4):381-6.
26. Garica-Pola MJ, Garcia-Martin JM, Gonzalez-Gartia M. Prevalence of oral lesions in the 6thanks-old pediatric population of Oviedo (Spain). *Med Oral* 2002 May - Jun; 7(3):184-91.
27. Jainkittivong A, Langlais RP. Geographic tongue: Clinical characteristics of 188 Cases. *J Contemp Dent Pract* 2005 Feb 15;6(1):123-35.
28. Gupta PC, Murti PR, Bhonsle RB, Mehta FS, Pindborg JJ. Effect of cessation of tobacco use on the incidence of oral mucosal lesions in 10-year follow-up study of 12,212 users. *Oral Dis* 1995 Mar; 1(1):54-8.
29. Witkop CJ Jr, Barros L. Oral and genetic studies of chileans, 1960. I. Oral anomalies. *Am J Phys Anthropol* 1963 Mar; 21:15-24.

About the Authors

Mina Motalebnejad, DDS, MS



Dr. Motalebnejad is an Assistant Professor in the Department of Oral Medicine of the Dental Faculty at the Babol University of Medical Sciences. She graduated from Tehran University of Medical Sciences in 1991 and received her graduate degree in Oral Medicine from the same University in 1997. She is a member of the European Association of Oral Medicine. Her research interests include ulcerative and vesiculobullous lesions, oral candidiasis, radiation mucositis, and oral biology.

e-mail: mmotalebnejad@yahoo.com

Neda Babaei, DDS, MS



Dr. Babaei is an Assistant Professor in the Department of Oral Medicine of the Dental Faculty at the Babol University of Medical Sciences. She graduated from Azad University in 2000 and received her graduate degree in Oral Medicine from Tehran University of Medical Sciences in 2003.

Shirin Sakhdari, DDS, MS



Dr. Sakhdari is an Assistant Professor in the Department of Oral and Maxillofacial Radiology of the Faculty of Dentistry at the Babol University of Medical Sciences. She graduated from Tehran University of Medical Sciences in 1996. She received her graduate degree in Oral and Maxillofacial Radiology from the same University in 2001.

Maryam Tavassoli, DDS



Dr. Tavassoli is a general dentist. She received her dental degree from Babol University of Medical Science in 2006. She is now in private practice.