Kerman Oral and Dental diseases research center

Kerman University of Medical Sciences and Health Services

Volume 8, No. 4, Autumn 2019
Quarterly

Original Articles

Case Report

Journal of Oral Health & Oral Epidemiology

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Original Articles

Case Report

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A comparative evaluation of periodontal parameters and oral health in the twins of Khorasan Province, Iran

Kazem Fatemi DDS, MSc[1], Amirhossein Chavoshi[2], Seyed Ahmad Banihashemrad[2], Kazem Ghodsi PhD[3], Mohammad Esmaeel Rezaee DDS[4], Abdollah Javan-Rashidi MSc[5], Seyed Ali Banihashemrad DDS, MSc[1]

Original Article

Abstract

BACKGROUND AND AIM: Several risk factors contribute to periodontal diseases. Studying twins has helped increase our knowledge on the roles of genetic and environmental factors in periodontal diseases. The objective of this study was the evaluation of periodontal parameters in the twins of Khorasan Province, Iran.

METHODS: This study was carried out on 30 pairs of twins between 12-35 years old including 12 pairs of monozygotic (MZ) twins and 18 pairs of dizygotic (DZ) twins with the average age of 18 years old. Periodontal parameters studied consisted of: probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP). Analyses were conducted through SPSS software. T-test was used to examine the differences between MZ and DZ twins also between first twin and second twin. Significance level was set at 0.05.

RESULTS: The amounts of PPD (P = 0.045) and CAL (P = 0.003) were significantly different between MZ and DZ twins, while no significant difference in BOP (P = 0.474) was observed between the two groups. Studying heritability showed that BOP could be affected by environmental factors (h^2 = 0.41), while CAL and PPD were affected by genetic factors (h^2 = -0.70 and h^2 = -0.61, respectively).

CONCLUSION: Our study confirms previous studies which had focused on the role of genetic factors in periodontal diseases. It indicates that in twins, PPD and CAL are mostly affected by genetic factors, while BOP is mainly affected by environmental factors.

KEYWORDS: Bleeding on Probing; Periodontal Disease; Twins

Citation: Fatemi K, Chavoshi A, Banihashemrad SA, Ghodsi K, Rezaee ME, Javan-Rashidi A, et al. **A comparative evaluation of periodontal parameters and oral health in the twins of Khorasan Province, Iran.** J Oral Health Oral Epidemiol 2019; 8(4): 167-72.

People who are biologically similar share common genes and environment with each other. The environment plays a major role in the similarity of those who are not genetically similar but live in the same place like partners. Studying different groups of twins can help us investigate the role of genetic and environmental factors in appearance of different characters.[1]

There are two types of twins: monozygotic (MZ) and dizygotic (DZ) twins. MZ twins are the same in genotype, sex, and all the genetic characters. DZ twins are like common siblings and share half of their genes with each other. If both of twins share the same character, they are called concordant and if MZ twins are discordant for a character, we can say that the

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environment is playing a substantial role in appearance of that character.[2]

Furthermore, if MZ and DZ twins are concordant for a character, environmental factors are playing a major role.[3]

In an attempt to separate the role of genes from the environment in multifactorial characters, the heritability has been invented. It tells us how much genetic factors are involved in a given phenotype.[4]

One of the ways to estimate the heritability is to compare the concordance of MZ and DZ twins in a given character with its prevalence in the whole population. Heritability shows us the diversity caused by genetic differences in a population.

Periodontal diseases are referred to common disorders such as gingivitis and periodontitis caused by subgingival biofilm.[5]

Although bacterial plaque has been accepted as the primary etiologic cause, there is little information about the effects of host genetic factors in the severity of the disease.[6] An investigation on Indonesian young siblings who had not shown severe chronic periodontitis in spite of not getting regular dental care may propose that genetic factors are responsible for milder manifestations of periodontal disease. Family studies may give us useful information, but it cannot differentiate between genetic and environmental factors just as the environmental factors may alter the gene expression.[7]

Schenkein and Van Dyke declared that genetic factors were responsible for prepubertal periodontitis as much as other types of early-onset periodontitis (now called aggressive periodontitis).[8]

Watanabe suggested that there were differences in the prevalence of prepubertal periodontitis based on genetic diversities in the studied populations.[9]

Shapira et al. investigated prepubertal periodontitis in a big family and found that MZ twins were similarly afflicted. They suggested a strong genetic factor for this disease.[10]

In a study of Virginia and Minnesota twins in United States, Newman et al. concluded that there was an important genetic part in adult periodontitis (now called chronic periodontitis).[11]

In two separate studies, Michalowicz et al. investigated the role of genetic and environmental factors in clinical parameters of periodontal disease. They concluded that there was an important genetic part for periodontal disease parameters.[12] In the second study, they investigated 117 twins and showed the role of genetics in development of adult (chronic) periodontitis. They said that almost half of periodontal diseases were caused by genetic factors.[13]

In an investigation done by Moore et al. on genetic and environmental effects on subgingival flora content, it was concluded that the amount and concentration of some bacteria was affected by host genetic factors.[14]

Although there is a lot of information about the effect of systemic and local factors in development of periodontal disease, there is little data about the role of genetic factors. In addition, the exact share of genetic and environmental factors in clinical periodontal parameters has not been identified.[15]

In this study, we aim to investigate three clinical periodontal parameters including probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP) in some of the MZ and DZ twins living in Khorasan Province, Iran, and then determine the share of genetic and environmental factors in these three parameters.

Methods

This cross-sectional study was carried out on 30 pairs of twins between 12-35 years old including 12 pairs of MZ twins and 18 pairs of DZ twins. We used non-probability snowball sampling. We asked the twins who came to dental school in Mashhad, Iran, to recommend us twins with the age range of 12-35 years if they knew any. We determined 30 twin pairs because when sample size exceeds 30, Z values, the area under the normal curve, would not change considerably and it would

approach normal distribution.

For collecting the data, a questionnaire consisting of two major parts was prepared.

In the first part of the questionnaire, the participants were asked to provide information about demographic variables, such as sex and age. They were also asked about their clinical genetic history and the history of any special disease or surgery. One of the students gathered the questionnaires.

The second part consisted of a number of tables for writing down their clinical periodontal parameters such as PPD, CAL, and BOP.

We asked a geneticist to complete the clinical genetic history part of the questionnaire. He investigated whether they were MZ or DZ twins and then examined their history for any probable genetic disorder.

Informed consent was obtained from all the participants. Inclusion criteria included being twins and absence of any special disorder or disease.

Exclusion criteria included drug, alcohol, and tobacco addiction, genetic disease or anomaly, and the history of surgery.

In the second part of the questionnaire, we measured 3 periodontal parameters for each individual as follows:

PPD: We recorded the distance between the gingival margin and the pocket depth in 6 areas of tooth consisting of mesiobuccal, midbuccal, distobuccal, mesiolingual (palatal), midlingual (palatal), and distolingual (palatal) using a periodontal probe.[11]

CAL: We recorded the distance between the pocket depth and a constant point on the crown such as cementoenamel junction (CEJ). Changes in CAL may be due to an attachment loss. Therefore, measuring CAL is a useful way for diagnosis of periodontal diseases.[11]

Measuring CAL: When the gingival margin is on the anatomical crown, CAL is calculated by subtracting the distance between the gingival margin and CEJ from the pocket depth. If they are equal, then CAL will be zero. When the gingival margin is at the same level with CEJ, CAL equals to the pocket depth. When the gingival margin is more apical to CEJ, CAL is larger than the pocket depth. So we should add the distance between CEJ and the gingival margin to the pocket. In this study, we measured CAL in 4 points [mesial, distal, lateral buccal, and lingual (palatal)].[11]

BOP: If there is a swollen or atrophic gingiva and we enter a periodontal probe to the pocket depth, bleeding will be initiated. Non-inflamed areas rarely have bleeding. Most of the times, bleeding occurs during probing.

In order to investigate bleeding, we should enter a probe to the pocket depth carefully and then move it laterally through the length of the pocket depth. Sometimes bleeding occurs immediately after pulling out the probe and sometimes we may see bleeding with a few seconds delay. Thus, we should recheck the probed areas after 30 to 60 seconds. Depending on the degree of inflammation, we may see bleeding in different forms. It may be a red line in the gingival sulcus or a severe bleeding.

We measured BOP in 4 points of the tooth by probing and checking after 10 seconds using the mentioned method.

After collecting the data, we used descriptive and inferential statistics to analyze the data. In descriptive part, we used frequency tables for introducing the population we studied.

In inferential part, we used the mean and the standard deviation (SD) of the data to compare periodontal parameters of the twins. Analyses were conducted through SPSS software (version 22, IBM Corporation, Armonk, NY, USA). T-test was used to examine the differences between MZ and DZ twins also between first twin and second twin. Significance level was set at 0.05.

Results

As we see in table 1, CAL and PPD were significantly different between MZ and DZ twins (P = 0.003 and P = 0.045, respectively), but BOP did not differ significantly between MZ and DZ twins (P = 0.474).

Table 1. Comparing mean and standard deviation (SD) of periodontal parameters in monozygotic (MZ) and dizygotic (DZ) twins

Twin type	n (%)	BOP (mean ± SD)	CAL (mean ± SD)	PPD (mean ± SD)
MZ	24 (40)	48.70 ± 23.32	2.60 ± 0.49	2.41 ± 0.41
DZ	36 (60)	96.63 ± 13.37	2.24 ± 0.29	2.21 ± 0.29
T-test results		t = 0.70, P = 0.474	t = 3.27, P = 0.003	t = 2.10, P = 0.045

MZ: Monozygotic; DZ: Dizygotic; BOP: Bleeding on probing; CAL: Clinical attachment level; PPD: Probing pocket depth; SD: Standard deviation

We can see in tables 2 and 3 that there was also no statistically significant difference for PPD, BOP, and CAL in each of the two independent groups using t-test. We used Kolmogorov-Smirnov test (K-S test) in order to be reassured of t-test results.

We used the data in table 4 to calculate the heritability for each of the three periodontal parameters.

Considering the heritability formula, if the fraction is near 0, it shows the effect of environmental factors rather than genetic factors. If it is near +1 or -1, it means that the character is mostly controlled by genetic factors.

$$h^2 = \frac{variance\ in\ DZ\ twins - variance\ in\ MZ\ twins}{variance\ in\ DZ\ twins}$$

As can be seen in table 5, CAL and PPD were mostly controlled by genetic factors but BOP was mostly affected by the environment.

Discussion

Periodontal diseases are the result of a complicated interaction between the microbial invasion and the host response. Both of them are controlled by the environmental factors.[16] In addition to external factors, there is evidence that genetic factors may play an important role in determination of host response quality. The relative influence of genetic and environmental factors on complex diseases can be estimated using twin data. However, efforts for determining the risk factors of periodontal disease have primarily focused on immunological and bacteriological parameters; few studies have investigated the role of genetic factors in periodontal disease.[17]

One of the researchers (Gunsolley) states that when we count periodontal disease as a multifactorial disease, we mean that it spreads by genetic and environmental factors and the important question is which part of the risk for periodontal disease is due to genetics and which part is due to the environment.[13] In the classic twin study, reared-together MZ and DZ twins are compared to estimate the effects of shared genes.

Studying MZ and DZ twins is a great way to understand the role of genetics and the environment in periodontal disease.[18]

MZ twins originate from a single zygote and consequently have the same sex. They are always genetically the same. DZ twins originate from two separate zygotes and have half of their genes in common; the same as in common siblings. Differences between DZ twins may be the result of different genetics or environment.[19]

Table 2. Comparing mean and standard deviation (SD) of probing pocket depth (PPD) between monozygotic (MZ) and dizygotic (DZ) twins, separated by gender

Twin type	Gender	N	First twin (mean ± SD)	Second twin (mean ± SD)	Paired t-test
MZ	Male	6	2.27 ± 0.71	2.36 ± 0.18	t = 0.300, P = 0818
	Female	6	2.42 ± 0.30	2.58 ± 0.31	t = 0.910, P = 0.387
DZ	Male	3	2.49 ± 0.11	2.52 ± 0.57	t = 0.810, P = 0.867
	Female	10	2.07 ± 0.20	2.05 ± 0.27	t = 1.350, P = 0.311
	Male & female	5	2.23 ± 0.29	2.26 ± 0.02	t = 0.860, P = 0.442

SD: Standard deviation; MZ: Monozygotic; DZ: Dizygotic

Table 3. Comparing mean and standard deviation (SD) of bleeding on probing (BOP) and clinical attachment level (CAL) between monozygotic (MZ) and dizygotic (DZ) twins, separated by gender

Periodontal parameter	Type of twin	Gender	N	First twin (mean ± SD)	Second twin (mean ± SD)	Paired t-test
BOP	MZ	Male	6	72.47 ± 37.43	73.06 ± 17.78	t = 0.035, P = 0.999
		Female	6	68.51 ± 40.21	67.86 ± 37.66	t = 0.029, P = 0.999
	DZ	Male	3	69.34 ± 26.85	72.33 ± 47.94	t = 0.094, P = 0.998
		Female	10	47.60 ± 37.45	64.99 ± 42.26	t = 0.974, P = 0.748
		Male & female	5	80.71 ± 33.63	69.65 ± 33.35	t = 0.552, P = 0.983
CAL	MZ	Male	6	2.63 ± 0.67	2.54 ± 3.55	t = 0.250, P = 0.984
		Female	6	2.54 ± 0.45	2.67 ± 0.60	t = 0.552, P = 0.326
	DZ	Male	3	2.49 ± 0.11	2.52 ± 0.57	t = 0.081, P = 0.867
		Female	10	2.07 ± 0.20	2.05 ± 0.27	t = 1.350, P = 0.311
		Male & female	5	2.23 ± 0.29	2.26 ± 5.02	t = 0.180, P = 0.442

MZ: Monozygotic; DZ: Dizygotic; BOP: Bleeding on probing; CAL: Clinical attachment level; SD: Standard deviation

Therefore, the difference between MZ and DZ twins in the amount of periodontal disease may show the effect of similar genes in MZ twins provided that the environmental factors are the same. In studies in which twins have grown up together, we can suppose that there is a similar environmental factor influencing MZ and DZ twins. If susceptibility to a disease is mainly controlled by host genes but also the environment is partly involved, the similarities between MZ twins will be more than DZ twins. In addition, studying MZ twins which have been separated from each other since birth is another way to determine the phenotypic relations of common genes. So, any similarity in these twins will be exclusively the result of common genes, although these twins are rare and this limits the usage of them in medical researchers.[20]

Regardless of the method of estimation, heritability pertains to populations and not individuals.

We did this research to investigate the periodontal parameters in twins. After analyzing the data, now we discuss about the results.

Our investigations show a statistically significant difference for PPD and CAL in MZ and DZ twins. But BOP is not statistically significant in the twins. Regarding that when MZ and DZ twins are nearly concordant for a character, environment is playing a substantial role, a possible explanation for these results is that BOP is mainly influenced by environmental factors, but PPD and CAL are mostly influenced by genetic factors. This can be seen in table 5 in which heritability is calculated for each parameter.

Furthermore, such estimates describe the impact of genes on specific populations exposed to a particular range of environments. Finally, twin studies alone cannot be used to determine the mode of inheritance of a disorder or the number of location or disease alleles.

Conclusion

Our study produced results which corroborate those results suggesting that genetic is playing a substantial role in periodontal diseases.

Table 4. Means and variances of periodontal parameters in monozygotic (MZ) and dizygotic (DZ) twins

Type of twin	Periodontal parameter	N	Mean	Between-pair variance	within-pair variance	Population variance
MZ	BOP	24	70.49	0.004	1086.074	1087.078
	CAL	24	2.60	0.003	0.251	0.254
	PPD	24	2.41	0.093	0.175	0.268
DZ	BOP	36	63.96	451.832	1406.246	1858.078
	CAL	36	2.24	0.077	0.080	0.157
	PPD	36	2.24	0.077	0.080	0.157

MZ: Monozygotic; DZ: Dizygotic; BOP: Bleeding on probing; CAL: Clinical attachment level; PPD: Probing pocket depth

Table 5. Calculating heritability for periodontal parameters

Periodontal parameter	Variance in DZ twins	Variance in MZ twins	Heritability (h^2)
BOP	1858.078	1086.078	0.41
CAL	0.157	0.254	-0.61
PPD	0.157	0.268	-0.70

MZ: Monozygotic; DZ: Dizygotic; BOP: Bleeding on probing; CAL: Clinical attachment level; PPD: Probing pocket depth

In this research, we aimed to investigate the twins who live in Khorasan Province of Iran in terms of periodontal parameters. The present study is limited in having a small number of participants (n = 30). More research with larger number of participants is needed to elucidate the exact share of genetic factors in periodontal parameters.

Conflict of Interests

Authors have no conflict of interest.

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Comparing salivary level of alpha-amylase in patients with recurrent aphthous stomatitis and healthy individuals

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Original Article

Abstract

BACKGROUND AND AIM: Recurrent aphthous stomatitis (RAS) results due to a multiple of causes, amongst which stress is one of the most important factors. On the other hand, salivary alpha (α)-amylase (SAA) is a secretory protein that increases in stress conditions. This study evaluated SAA level in subjects with RAS.

METHODS: In this case-control (descriptive-analytical) study, unstimulated saliva samples were collected from 27 patients with RAS and 29 healthy controls. SAA activity was determined by spectrophotometric method using commercially available kit according to manufacturer procedure. Data were analyzed using SPSS software with t test ($P < 0.05$ was considered significant).

RESULTS: SAA level in patients with RAS was 80.78 ± 4.69 U/ml and 65.61 ± 27.52 U/ml during recurrence and recovery, respectively ($P = 0.005$). SAA level in control group was 19.99 ± 4.65 U/ml. There was a significant difference in the SAA level between RAS and control groups.

CONCLUSION: SAA level has been increased in patients with aphthous ulcer during recurrence, which may indicate an association between aphthous ulcer and stress.

KEYWORDS: Aphthous Stomatitis; Salivary Alpha-Amylases; Stress

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One of the most common oral ulcers is recurrent aphthous stomatitis (RAS). These ulcers are characterized by a painful ulcer with a yellowish gray pseudomembranous center and an erythematous ulcer halo.[1]

Most patients with aphthous ulcer have multiple episodes of this disease during a year. The accurate mechanism of aphthous ulcer formation is still not clear; the causative agents of aphthous ulceration include trauma, stress, nutritional deficiencies (vitamin deficiency, especially B12, zinc, folic acid, iron), inheritance, and genetic factors.[1,2]

Stress is assumed to be a stimulating factor in the onset of RAS. Previous studies suggest that psychological disorders such as stress and anxiety can contribute to the onset and recurrence of RAS lesions.[3]

Saliva biomarkers are collected quickly and non-invasively compared to blood and urine samples. As a result, the patient is more satisfied.

The salivary alpha (α)-amylase (SAA) enzyme is created by the salivary glands and its primary role is to begin the digestion of carbohydrates. The sympathetic autonomic nervous system (SANS) controls its release and this enzyme plays an important role in psychological-biological stress. Therefore, one of the signs of stress and anxiety is SAA.[4,5]

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RAS is caused by a variety of causes, among which stress is one of the most important factors; also, SAA is a secretory protein that increases under stress conditions. This study evaluated SAA levels in subjects with RAS.

Methods

This case-control study was performed in School of Dentistry, Zahedan University of Medical Sciences, Zahedan, Iran. 27 patients with RAS and 29 healthy controls were enrolled after obtaining informed consent from them. The study protocol was confirmed by the Ethics Committee of Zahedan University of Medical Sciences (code: IR.ZAUMS.REC.1392.6270).

Inclusion criteria included active minor aphthous ulcer (for case group), age of 20-40 years, no other oral ulcers or history of systemic disease, or drug and tobacco use. The control group was matched according to age and sex with the case group.

The recognition of RAS was based on the principles explained by Preeti et al. RAS diagnosis is made when there are four major criteria and one minor. Major criteria include the appearance of the lesion, recurrent history, spontaneous recovery, and painful lesion. Minor criteria include family history, location and duration of the lesion, etc.[6]

People should have avoided eating, drinking, brushing, and exercising 90 minutes before sampling. All samples were collected from 9 to 11 AM. Unstimulated saliva was collected from all subjects in the case and control groups by spitting method. In the spitting method, the individual collects saliva in the mouth and then spits into a pre-weighed tube, frequently once every 60 seconds for 5-15 minutes.[1] Then, collected saliva samples were transferred to test tubes and in order to remove debris, they were centrifuged at 3500 revolutions per minute (rpm) for 20 minutes. Upon transfer to the biochemistry laboratory of Zahedan School of Medicine, supernatants were stored at -20 °C until analysis.

To measure the activity of SAA, the frozen supernatants were melted at laboratory temperature for about half hour and diluted 1:100 with physiological saline solution. SAA activity was determined using commercially-available kit (Pars Azmoon Company, Iran), according to manufacturer procedure. This method detects activity of α-amylase through two reactions using 4,6-ethylidene-(G7)-p-nitrophenyl-(G1)-α-D-maltoheptaoside (EPS-G7) as substrate. A-amylase will cleave the substrate EPS-G7 to produce smaller fragments that are eventually modified by α-glucosidase, causing the release of a p-nitrophenol which can be spectrophotometrically measured at 405 nm. The rate of SAA present in the specimen is directly proportional to the increase in absorbance at 405 nm.

Data analysis was performed utilizing SPSS software (version 20, IBM Corporation, Armonk, NY, USA). Kolmogorov-Smirnov test (K-S test) was utilized to assess normal distribution of the variables. The independent t-test compared SAA levels in the two groups (case and control). Paired-samples t-test was used to compare SAA level during recurrence and recovery in patient group. $P < 0.05$ was considered significant.

Results

In the RAS group, 13 (48.10%) subjects were women and 14 (51.90%) were men. In the healthy group, 13 (44.83%) subjects were women and 16 (55.17%) were men. The mean age of RAS group was 29.11 ± 4.08 years and of healthy group was 27.52 ± 3.70 years. The control group was coordinated according to age and sex with the patient group. The normal distribution of data was assessed by the K-S test. The SAA level had a normal distribution in both groups. SAA level in patients with RAS was 80.78 ± 4.69 U/ml and 65.61 ± 27.52 U/ml during recurrence and recovery, respectively. A significant difference was in the SAA level during recurrence and recovery (Table 1).

SAA level in subjects with RAS was 80.78 ± 4.69 U/ml and at healthy group was 19.99 ± 4.65 U/ml.

Table 1. Comparison of alpha (α)-amylase level in patients with recurrent aphthous stomatitis (RAS) during recurrence and recovery phases

Variable	Patients with RAS		P*
	Recurrence phase (mean ± SD)	Recovery phase (mean ± SD)	
SAA (U/ml)	80.78 ± 4.69	65.61 ± 27.52	0.005

*Paired samples t-test
RAS: Recurrent aphthous stomatitis; SAA: Salivary alpha-amylase; SD: Standard deviation

There was a significant difference in SAA level between RAS and healthy groups (Table 2).

Discussion

The present study investigated SAA activity in subjects with RAS and healthy individuals. SAA level was significantly higher in subjects with RAS than in healthy individuals (P = 0.001).

The predisposing factors related to RAS include genetic agents, hematologic or immunologic abnormalities, heredity, and local factors such as trauma. Although the specific defect remains unknown, there is much research stating that immune dysfunction is related to RAS. Other factors that are associated with RAS include anxiety and periods of psychological stress.[1]

Increase of SAA during psychosocial stress may be explained by physiological reaction to stress. Shirasaki et al. reported the correlation of SAA levels with pain scale in chronic pain of patients.[7] Increased specific activities occur in the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary system (SAM) in reaction to psychosocial stress. Increased SAA secretion can be seen with SAM activity. Many research reported that SAA revealed the adrenergic activity and therefore may be used as an acceptable criteria of the SAM activity during stress.[4,5]

Hormones related to the SAM system are epinephrine and norepinephrine. These hormones have a short half-life; therefore, salivary gland activity is measured as an indirect measurement of SAM system in response to stress. Recently, some studies have used SAA as a reliable biomarker of stress.[8,9] Rashkova et al. showed a two-fold increase in SAA concentration in stress and its reduction in a stress-free condition.[10]

Many studies have reported the association of RAS and stress.

Gallo et al. suggested that psychological stress might play a role in RAS; they pointed out that it might be as a trigger or a modifying aspect instead of being a cause of RAS.[11] Nadendla et al. reported a significant increase in salivary cortisol and anxiety levels in subjects with RAS compared to control group.[3]

Kunikullaya et al. noted that the salivary enzymes when secreted without food in the oral could lead to adverse effect in the mucosa.[12] They believed that even a slight increase of α-amylase along with imbalance in the protective immune mechanisms could trigger the event of RAS initiation. In the study of kunikullaya et al., although the SAA level was not significantly different in patients with RAS compared to the healthy group, it was higher in the patient group.[12]

The results of kunikullaya et al.'s study[12] are contradictory to the present study, which may be due to differences in the sampling method of SAA measurement or the differences in social status of the cases studied.

Similar studies to this study were limited, so comparison with other studies was not possible.

Table 2. Comparison of alpha (α)-amylase level in patients with recurrent aphthous stomatitis (RAS) and control group

Variable	Patients with RAS (mean ± SD)	Control group (mean ± SD)	P*
SAA (U/ml)	80.78 ± 4.69	19.99 ± 4.65	0.001

*Independent samples t-test
RAS: Recurrent aphthous stomatitis; SAA: Salivary alpha-amylase; SD: Standard deviation

Another limitation of our study was the small sample size, which was difficult to find patients who met our inclusion criteria. Also, some patients had no referral after aphthous ulcer healing.

Conclusion

SAA level increased in patients with aphthous ulcer during recurrence, which may indicate an association between aphthous ulcer and stress.

Conflict of Interests

Authors have no conflict of interest.

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The effect of body mass index on blood pressure and heart rate in patients undergoing tooth extraction

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Original Article

Abstract

BACKGROUND AND AIM: Alterations in blood pressure (BP) and variability of heart rate (HR) throughout dental procedures were not clearly understood. The aim of this study is to evaluate the effects of body mass index (BMI) on BP and HR in patients undergoing tooth extraction.

METHODS: Based on BMI, 831 patients who underwent single tooth extraction were divided into two groups; group 1: underweight and normal-weight patients, group 2: overweight and obese patients. BP and HR were monitored before local anesthesia and after tooth extraction. For statistical analysis of the data, Number Cruncher Statistical System (NCSS) 2007 program was used. Mann-Whitney U test and Student's t-test was used for comparing the differences between groups.

RESULTS: The initial and final BP measurements of overweight and obese patients were found to be significantly higher than underweight and normal-weight patients ($P < 0.01$). There was no statistically significant difference between groups in terms of initial and final HR measurements ($P > 0.05$).

CONCLUSION: Overweight and obese patients are more likely to have increased BP; therefore, monitoring of BP and HR during tooth extraction is crucial in this group of patients to prevent possible complications.

KEYWORDS: Body Mass Index; Blood Pressure; Heart Rate; Tooth Extraction

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Hypertension (HTN) is the most frequently encountered systemic disease in patients admitted to dentists.[1] Blood pressure (BP) values are categorized as normal: under 120/80 mmHg, high normal: systolic among 120-129 mmHg and diastolic under 80 mmHg, stage 1 HTN: systolic among 130-139 mmHg or diastolic among 80-89 mmHg, and stage 2 HTN: systolic minimum 140 mmHg or diastolic minimum 90 mmHg.[2] HTN is a risk factor for cardiovascular disorders and renal insufficiency.[2-4]

Heart rate (HR) is an important indicator of individual's health status. It measures the number of heart beats per minute (bpm). The HR in healthy individuals ranges from 60 to 100 bpm while resting.[5,6]

Increases in BP and HR are common during dental treatments especially in the course of tooth extraction. However, the increase is influenced by many factors such as psychological and physical stress, painful stimuli, and the action of catecholamines present in local anesthetic solutions.[6,7] Cheraskin and Prasertsuntarasai[8] reported higher systolic BP (SBP) and diastolic BP (DBP) values prior to oral surgery in comparison with the day after the surgical intervention.

In the literature, articles studied the changes in BP and HR before and after dental procedures (dental extraction, periodontal surgeries, restorative treatments, etc.) by

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means of anxiety, dental fear, and various types of local anesthetic and vasoconstrictor agents with different combinations and concentrations.[9,10] Besides these, personal characteristics like age, gender, and body mass index (BMI) are important factors that can affect the BP and HR of individuals.[11] Studies have demonstrated that obesity is related to SBP and DBP elevation.[12] Therefore, the aim of this study is to evaluate the effects of BMI on BP and HR in healthy individuals undergoing tooth extraction.

Methods

This observational study was conducted on patients who underwent single tooth extraction in Department of Oral and Maxillofacial Surgery, School of Dentistry, Van Yuzuncu Yil University, Van, Turkey from May 2017 to May 2018. The study was approved by Clinical Trials Ethics Committee of Van Yuzuncu Yil University (number: 20171804-01) and conducted in compliance with the ethical standards laid down in the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from all participants. Patients over 18 years old, patients with BP lower than 180/110 mmHg, patients without systemic disease (according to the anamnesis taken from the patient), patients who had tooth extraction, and patients who volunteered to participate in the study were included. Cases in whom we were unable to measure the BP due to a previous operation or an anomaly, pregnant women and breastfeeding mothers, patients who had undergone any medical or dental intervention on the same day, patients who feel pain during extraction despite local anesthesia, patients requiring more than 2 ml anesthesia, any complicated tooth extraction procedure that necessitated separation of the roots, bone removal, or suturing and took more than 5 minutes, and individuals who drank alcohol or smoked cigarettes were excluded. Based on BMI, patients were divided into two groups: group 1: underweight and normal-weight patients, group 2: overweight and obese patients.

Medical and dental histories were obtained from the patients. Clinical examination was accompanied by radiographic evaluation. The patients were asked to complete the anamnesis form containing information about age, gender, carrier status, height, and weight. The BMI of each patient was calculated according to the formula of weight/height^2 (kg/m^2).[12] BP and HR measurements were performed as it was described by Cordeiro et al.[13] The patients were informed that their tooth would be extracted.

In all patients; BP and HR were measured at the same time with digital BP monitor (OMRON M6 Comfort, OMRON Corp., Japan) by the same medical staff while the patient rested in seated position at least ten minutes, the subjected arm was flexed and supported on the chair. The flexed elbow was at the level of the heart, arm cuff was placed over 1 cm to cubital fossa, and tube was in the middle of the fossa. BP was measured from two arms and the higher measurement was accepted as baseline. Also the arm with the higher BP was used for further measurements.

Extraction procedures were performed by the same physician. After that all measurements for BP and HR were completed, local anesthesia with 2 ml of 40 mg/ml articaine + 0.012 mg/ml epinephrine (Maxicaine Fort, VEM ILAC, Turkey) was performed. All tooth extractions were performed under local anesthesia. After negative aspiration for blood, the solution was injected slowly in approximately 30-45 seconds. The clinician waited for 5 minutes for nerve blockage before extraction. The tooth was extracted approximately in 5 minutes. After 5 minutes of rest, re-evaluation of BP and HR was accomplished.

For statistical analysis of the data, Number Cruncher Statistical System (NCSS) 2007 (Kaysville, Utah, USA) program was used. In the evaluation of the data, descriptive statistical methods [mean, standard deviation (SD), median, frequency, ratio, minimum,

maximum] were used. Conformity of the quantitative data to normal distribution was tested with Shapiro-Wilk test and graphical evaluations. Student's t-test was used for two groups' comparisons of the variables with normal distribution. Mann-Whitney U test was used for two groups' comparisons of the variables without normal distribution. Paired samples t-test was used for intra-group comparisons of quantitative variables with normal distribution. Pearson chi-square test was used to compare qualitative data. P-values < 0.05 were considered statistically significant.

Results

The study included 831 patients, 382 (46.0%) men and 449 (54.0%) women. The mean age of the patients was 34.40 ± 11.11 years. It was observed that 51.6% (n = 429) of the cases were underweight and normal-weight whereas 48.4% (n = 402) were overweight and obese. Based on HTN classification, 22.6% (n = 188) of the patients had normal BP, 37.4% (n = 311) had high normal BP, 30.3% (n = 251) had stage 1 HTN, and 9.7% (n = 81) had stage 2 HTN.

Evaluation of descriptive characteristics according to BMI: According to age, there was a statistically significant difference between groups. In overweight and obese patients, the rate of being 50 years of age and over was found to be higher than underweight and normal-weight patients (P < 0.01). There were statistically significant differences between groups according to gender. In overweight and obese patients, the male ratio was found to be higher than underweight and normal-weight patients (P < 0.05). There was a statistically significant difference between the groups based on the HTN classification. In overweight and obese patients, the rate of stage 1 and stage 2 HTN was found to be higher than those in underweight and normal-weight patients (P < 0.01) (Table 1).

Evaluation of SBP measurements according to BMI: The initial and final SBP measurements of overweight and obese patients were found to be significantly higher than underweight and normal-weight patients (P < 0.01). The increase in SBP measurements of underweight and normal-weight patients was found to be significantly higher than those who were overweight and obese (P < 0.01) (Tables 2 and 3).

Evaluation of DBP measurements according to BMI: The initial and final DBP measurements of overweight and obese patients were found to be significantly higher than underweight and normal-weight patients (P < 0.01). In underweight and normal-weight patients, the reduction in the final DBP measurements with respect to initial measurements was found to be statistically significant (P < 0.05). In overweight and obese patients, the change in the final DBP measurements was not statistically significant with respect to initial measurements (P > 0.05) (Tables 2 and 3).

Table 1. Evaluation of descriptive properties according to body mass index (BMI)

Variable		Underweight and normal-weight (n = 429)	Overweight and obese (n = 402)	P (Pearson chi-square test)
Age (year)	< 50	406	332	0.001**
	≥ 50	23	70	
Gender	Male	180	202	0.017*
	Female	249	200	
HTN classification	Normal	113	75	0.001**
	High normal	183	128	
	Stage 1	106	145	
	Stage 2	27	54	

*P < 0.05; **P < 0.01
HTN: Hypertension

Table 2. Evaluation of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) measurements based on body mass index (BMI)

Variable		Underweight and normal-weight (n = 429)	Overweight and obese (n = 402)	P
		Mean ± SD	Mean ± SD	
SBP	Initial measurement	120.76 ± 9.76	124.23 ± 11.63	0.001#**
	Final measurement	120.20 ± 11.70	123.01 ± 12.60	0.001#**
	P***	0.294	0.011¥	
	Initial-final difference (Δ)	-0.56 ± 11.02	-1.22 ± 9.62	0.558**
DBP	Initial measurement	75.20 ± 8.53	77.16 ± 8.32	0.001#**
	Final measurement	74.30 ± 9.45	76.94 ± 9.33	0.001#**
	P***	0.023¥	0.577	
	Initial-final difference (Δ)	-0.90 ± 8.17	-0.22 ± 8.03	0.159**
HR	Initial measurement	74.67 ± 7.77	73.82 ± 7.34	0.106*
	Final measurement	74.59 ± 7.81	73.67 ± 7.26	0.079*
	P***	0.761	0.479	
	Initial-final difference (Δ)	-0.07 ± 5.08	-0.15 ± 4.16	0.834**

*Student's t-test;**Mann-Whitney U test;***Paired samples t-test; ¥P < 0.05; #P < 0.01
SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; SD: Standard deviation

Evaluation of HR measurements according to BMI: There was no statistically significant difference between groups in terms of initial and final HR measurements (P > 0.05). The amount of increase and decrease in HR measurements according to the groups did not show statistically significant difference (P > 0.05) (Tables 2 and 3).

Evaluation of increase in SBP, DBP, and HR measurements based on BMI and according to age, gender, and HTN stage: The amount of increase in SBP measurements was significantly high in underweight and normal-weight patients at the age of 50 and over and in underweight and normal-weight male patients than those in overweight and obese patients (P < 0.01) (Table 3).

Discussion

Cardiovascular responses during tooth extraction are associated with several factors such as treatment-related fear and anxiety, local anesthesia-related fear and anxiety, cardiovascular effects of the local anesthetics as well as age and gender of the patient.[14]

Table 3. Evaluation of the amount of increase in systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) based on body mass index (BMI)

Amount of increase		Underweight and normal-weight	Overweight and obese	P*
		Mean ± SD	Mean ± SD	
Age (year)				
< 50	SBP	12.86 ± 5.06	11.70 ± 3.78	0.100
	DBP	10.33 ± 2.21	10.12 ± 1.08	0.718
	HR	4.56 ± 3.15	3.95 ± 2.23	0.264
≥ 50	SBP	20.00 ± 5.77	11.82 ± 4.04	0.005#
	DBP	10.00 ± 0.00	10.00 ± 0.00	> 0.999
	HR	3.86 ± 0.90	4.23 ± 2.26	0.845
Gender				
Male	SBP	14.45 ± 5.98	10.93 ± 2.94	0.001#
	DBP	10.38 ± 2.37	10.00 ± 0.00	0.522
	HR	4.42± 2.86	4.03 ± 2.03	0.955
Female	SBP	12.32 ± 4.58	12.32 ± 4.26	0.880
	DBP	10.27 ± 2.02	10.18 ± 1.35	0.993
	HR	4.61 ± 3.26	4.00 ± 2.42	0.210

*Mann-Whitney U test; #P < 0.01
SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; SD: Standard deviation

In the literature, there are a few studies evaluating the effects of BMI on SBP, DBP, and HR in patients undergoing oral surgery. In the present study, the prevalence of being overweight and obese was found to be higher in men and in individuals at the age of 50 and over. BP measurements of overweight and obese patients were significantly higher than underweight and normal-weight patients. Marciani et al.[15] investigated the BMI of the subjects applying to oral and maxillofacial surgery clinic without undergoing any surgical procedure. Controversially, the prevalence of being overweight or obese was found to be higher in women. It was reported that BMI did not lead to any change in SBP, DBP, HR, and body temperature of individuals. Studies evaluating the alterations of BP and HR in individuals who underwent tooth extraction generally appear to focus on fear and anxiety before the procedure and on fear and anxiety related to local anesthesia.[14,16] Silvestre et al.[17] reported that the changes in BP and HR measurements after local anesthesia and after extraction were not significantly different with the measurements before local anesthesia. Gungormus and Buyukkurt[18] reported that the changes in BP and HR measurements performed before local anesthesia and 5 minutes before and after the tooth extraction did not differ between normotensive and hypertensive individuals. In the present study, in contrast to the findings of previously-mentioned studies, the increase in SBP measurements of underweight and normal-weight patients was significantly high according to measurements performed before local anesthesia and after tooth extraction. The increase in SBP was also high in male patients at the age of 50 and over. The decrease in DBP measurements of underweight and normal-weight patients was found to be statistically significant.

As it was seen from the findings of various studies, BP and HR increased during the local anesthesia and immediately after the local anesthesia.[19,20] It was reported that this was due to the fear of the injection and the pain created during needle insertion.[21] Intravascular injections may also cause these changes.[18] In addition, the systemic effects of epinephrine in the local anesthetics proceed for about 10 minutes.[22] In this study, in order to minimize the cardiovascular effects of local anesthetic agent, 2 ml anesthetic solution was injected slowly after negative aspiration for blood in individuals without any systemic disease. We included the first 10 patients who referred to our clinic in the morning every day to keep the possible effects of daily physical activities and dietary factors in minimum. In order to minimize the factors associated with tooth extraction, simple and atraumatic single tooth extraction which took a maximum time of 5 minutes was performed after that successful anesthesia of whole soft and hard tissues were achieved.

Conclusion

Within the limitations of this study is that overweight and obese patients are more likely to have increased BP. However, the elevation of SBP throughout the tooth extraction procedure was statistically significant in underweight and normal-weight male patients at the age of 50 and over. As BP increases are considered to be more important clinically, it is suggested to perform BP and HR controls routinely to prevent possible complications during tooth extractions especially in this group of patients. In addition, detection of underdiagnosed high BP in patients who apply for tooth extraction will enable the correct life style and dietary habits and will regulate the BP in early periods.

Conflict of Interests

Authors have no conflict of interest.

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Effective factors on the number of decayed and filled teeth using the Conway-Maxwell-Poisson count model

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Original Article

Abstract

BACKGROUND AND AIM: Recognizing the factors affecting the number of decayed and filled teeth has a major role in oral health. Dental data usually suffer from over-dispersion and excess zero frequencies. The purpose of this study was to use the Conway-Maxwell-Poisson (COM-Poisson) model to determine some of the factors affecting the number of decayed and filled teeth.

METHODS: In this cross-sectional study, a sample of 1000 people from a cohort study in Shahrekord City, Iran, aged 35-70 years, was selected through systematic sampling. The data were analyzed using the Bayesian approach through Markov chain Monte Carlo (MCMC) simulation by OpenBUGS. Zero-inflated Poisson (ZIP), COM-Poisson model, and zero-inflated Com-Poisson (ZICMP) model were fitted on the data and compared using the deviance information criterion (DIC).

RESULTS: The mean numbers of decayed and filled teeth were 0.77 ± 1.63 and 4.37 ± 4.62, respectively. The Com-Poisson and ZICMP showed to be better fit for the number of decayed and filled teeth, respectively. Those people who were younger, male, smokers, diabetics, did not floss, and did not use mouthwash had significantly more number of decayed teeth ($P < 0.05$). Those people who were younger, female, non-diabetics, non-smokers, employed, literate, had less body mass index (BMI), flossed, and got higher score of quality of life had significantly more number of filled teeth ($P < 0.05$).

CONCLUSION: By controlling such factors as education, BMI, flossing, using mouthwash, smoking, diabetes, and quality of life, we could improve the oral health.

KEYWORDS: Bayes' Theorem; Conway-Maxwell-Poisson Distribution; Decayed, Missing, and Filled Teeth; Zero-inflated

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Dental caries in permanent teeth is a multifactorial disease and one of the most common chronic diseases worldwide.[1] Many factors affect the risk of dental caries, including environmental ones such as fluoride and fluoride exposure, behavioral factors including diet, lifestyle, and oral health, and demographic characteristics such as age, gender, race, ethnicity, socioeconomic status, education, occupation, and access to oral health care, which are among the most influential factors.[2] Tooth decay is a localized infectious disease that affects people at any age and in any region of the world. Oral health is part of general health and oral and dental illnesses affect all aspects of the life quality.[3,4] In addition, oral health has been shown to be a risk factor for cardiovascular diseases (CVDs), diabetes, and pneumonia (lung infection).[5,6] The prevalence of dental caries among 28 provinces of Iran was reported to be 37%, and there was a significant relationship between it and socioeconomic status and literacy.[7]

Some methods have been developed in recent years for analyzing dental count data,

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which include the number of decayed, missing, and filled teeth (DMFT). An important feature of these data is the existence of a large number of zero observations and that the distribution is positively skewed. These methods include Poisson model, negative binomial, generalized Poisson, zero-inflated Poisson (ZIP), zero-inflated negative binomial, and hurdle model.[8-10]

Due to the complexity of dental data, sometimes these models do not fit well the data. Recently, another model called the Conway-Maxwell-Poisson (COM-Poisson) model is used in the area of count models that has interesting features. The COM-Poisson distribution was first introduced by Conway and Maxwell in 1962 to model queues.[11] Although the COM-Poisson distribution is not specifically new, until obtaining the initial properties of the distribution in 2005, it has not been widely used.[12] The COM-Poisson distribution is a part of the exponential-family distribution and has two flexible parameters.[13] The distribution can be presented as generalization of Poisson, Bernoulli, and geometric distributions.[12] This distribution has capability to address the extra zero observations and over- or under-dispersion. The COM-Poisson model is expected to be better fit for dental data. The purpose of this study was to use this model to determine some of the factors affecting the number of decayed and filled teeth.

Methods

In this population-based cross-sectional study, a sample of 1000 individuals from Shahrekord Cohort Study (SCS),[14] including 476 men and 524 women aged 35-70 years, were selected through systematic sampling. This study was designed to supplement the centers of the Prospective Epidemiological Research Studies in Iran (PERSIAN) Cohort, which was conducted in Shahrekord, the capital of Chaharmahal and Bakhtiari Province, southwest of Iran.[15,16] The study protocol of SCS was checked and approved by the Ethics Committee of Shahrekord University of Medical Sciences (IR.SKUMS.REC 1394.286) at regional and national scale on PERSIAN Cohort. Details of the SCS protocol have been published elsewhere.[14] Inclusion criteria were eligibility to be included in the cohort study, consisting of both sexes aged 35-70 years, residing in the limited geographic of cohort, and having adequate physical and mental ability to participate in the evaluation program as well as signing the written informed consent. The exclusion criterion was unwillingness to participate in dental examination. The examination of dental health was performed by a trained expert. A dentist also supervised the examination and the demographic questionnaire was completed by the examiner.

The numbers of decayed and filled teeth for each individual were recorded and defined as response variables, and other factors like age, weight, sex, occupational status, educational level, diabetes, smoking, body mass index (BMI), quality of life, mouthwash use, using dental floss, and number of brushing during the day were considered as independent variables.

The frequency distributions of the number of decayed and filled teeth for each individual were positively skewed. The frequency charts showed a huge number of zeros in our data and the mean and standard deviation (SD) showed a very over-dispersion in the frequency distributions. This motivated us to use COM-Poisson distribution to analyze the data. The COM-Poisson distribution is a generalization of Poisson distribution with two parameters, which is flexible enough to handle different levels of dispersion especially over- or under-dispersion. The count variable Y has COM-Poisson distribution with parameters (λ, ν). The λ parameter is a close approximation of the mean and the ν parameter is the dispersion parameter.[17,18]

Analyses of COM-Poisson regression model and zero-inflated COM-Poisson (ZICMP) model were carried out based on Bayesian framework using Markov chain Monte Carlo (MCMC) simulation.

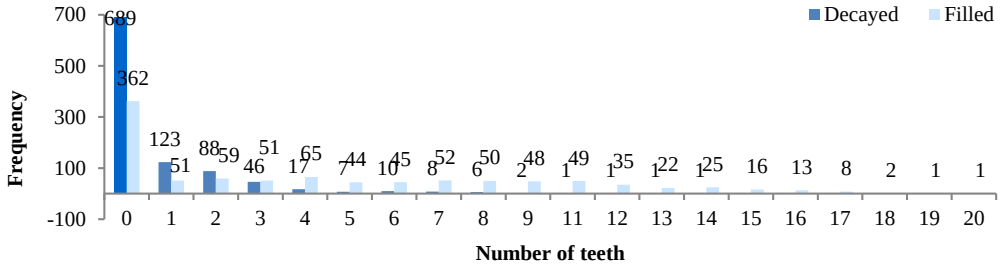

Figure 1. Frequency of the number of decayed and filled teeth per individual

In this method, posterior distribution of the model parameters was obtained based on previous information of the model parameters and available data. This was done with OpenBUGS software. To compare the models, deviance information criteria (DIC) were used.[19] Statistical summaries of the model parameters were obtained based on 20000 samples after the implementation of 5000 samples as burn-in period.

Results

In summary, out of the 1000 samples, 476 (47.6%) were men and 524 (52.4%) were women. The age range of participants was 36 to 72 years with the mean of 52.2 ± 9.4. The number of decayed teeth was from 0 to 14 with the mean of 0.77 ± 1.63, and the number of filled teeth was from 0 to 20 with the mean of 4.37 ± 4.62. Totally, 311 individuals (31.1%) had at least one decayed tooth and 638 individuals (63.8%) had at least one filled tooth. Figure 1 shows the frequency of the number of decayed and filled teeth per individual in the study. Some characteristics and the mean numbers of decayed and filled teeth of participants have been brought in table 1.

Table 1. Some characteristics of participants and mean number of decayed and filled teeth

Variable	Level	n (%)	Number of decayed teeth	Number of filled teeth
			Mean ± SD	Mean ± SD
Gender	Male	476 (47.6)	0.880 ± 1.793	3.470 ± 4.104
	Female	524 (52.4)	0.670 ± 1.470	5.190 ± 4.190
Age (year)	< 40	115 (11.5)	1.050 ± 1.973	6.130 ± 4.749
	40-60	664 (66.4)	0.810 ± 1.674	4.990 ± 4.606
	> 60	221 (22.1)	0.500 ± 1.242	1.600 ± 3.301
Education	Literate	793 (79.3)	0.830 ± 1.708	5.150 ± 4.687
	Illiterate	207 (20.7)	0.550 ± 1.297	1.400 ± 2.826
BMI (kg/m^2)	< 25	260 (26.0)	0.880 ± 1.858	4.380 ± 4.637
	25-35	675 (67.5)	0.700 ± 1.538	4.600 ± 4.666
	> 35	65 (6.5)	1.060 ± 1.619	1.920 ± 3.251
Having job (employee)	Yes	481 (48.1)	0.860 ± 1.753	4.750 ± 4.595
	No	519 (51.9)	0.690 ± 1.513	4.020 ± 4.624
Smoking	Yes	156 (15.6)	1.040 ± 2.063	2.030 ± 3.421
	No	844 (84.4)	0.720 ± 1.538	4.800 ± 4.687
Diabetes	Yes	95 (9.5)	0.910 ± 1.902	2.340 ± 3.913
	No	905 (90.5)	0.760 ± 1.634	4.580 ± 4.641
Brushing (day)	No brushing	398 (39.8)	0.600 ± 1.498	2.340 ± 3.774
	Once	423 (42.3)	0.870 ± 1.756	5.930 ± 4.506
	Twice	151 (15.1)	0.880 ± 1.604	5.520 ± 4.466
	More	28 (2.8)	1.070 ± 1.609	6.750 ± 5.118
Flossing	Yes	358 (35.8)	0.720 ± 1.591	7.721 ± 4.561
	No	642 (64.2)	0.800 ± 1.658	2.790 ± 3.830
Using mouthwash	Yes	79 (7.9)	0.490 ± 1.036	3.720 ± 4.698
	No	921 (92.1)	0.800 ± 1.674	4.430 ± 4.614
Quality of life	< 50	119 (11.9)	0.670 ± 1.513	3.700 ± 3.941
	50-80	797 (79.7)	0.790 ± 1.684	4.170 ± 4.770
	> 80	84 (8.4)	0.790 ± 1.299	2.100 ± 3.020

BMI: Body mass index; SD: Standard deviation

Table 2. Results of deviance information criterion (DIC)

Response variable	Model	$\overline{Dbar}$	P_D	DIC
Number of decayed teeth	ZIP	998400	14.24	998400
	CMP	997400	13.57	997400
	ZICMP	997400	13.69	997400
Number of filled teeth	ZIP	100500	14.69	100500
	CMP	100300	14.98	100300
	ZICMP	100300	14.90	100300

ZIP: Zero-inflated Poisson; CMP: COM-Poisson; ZICMP: Zero-inflated COM-Poisson; DIC: Deviance information criterion

We use the COM-Poisson model and ZICMP to analyze our dental data. The results of DIC were presented in table 2, which show a better fit of the COM-Poisson model for decayed teeth data as well as a better fit of ZICMP for filled teeth data.

Statistical summaries of models' parameters of fitting the COM-Poisson model and ZICMP, including mean, median, SD, and 95% credible intervals, based on 20000 simulated values after considering 5000 samples as burn-in period, were shown in tables 3 and 4, respectively.

Based on the estimate of regression coefficients and their 95% credible intervals that do not contain zero, the independent variables of age, gender, frequency of brushing, diabetes, flossing, using mouthwash, and smoking are significant factors for the number of decayed teeth. In the presence of the above-mentioned variables in the model, other variables including BMI, job, education, and quality of life did not have a significant effect on the number of decayed teeth. Also, the variables of age, sex, BMI, frequency of brushing, diabetes, flossing, job, quality of life, smoking, and education were significant factors for the number of filled teeth. Using mouthwash did not affect the number of filled teeth.

Discussion

Oral health plays a major role in quality of life,[20] so recognizing the factors affecting the number of decayed and filled teeth is very important. In this paper, we used the COM-Poisson and ZICMP for analyzing the number of decayed and filled teeth, respectively.

Based on the results of the COM regression model on the number of decayed teeth, we can conclude that the number of decayed teeth has a negative association with age, so that it was higher in younger subjects.

Table 3. Posterior summaries for the parameters of COM-Poisson regression model for decayed teeth

Parameter	Mean	SD	Median	2.5 percentile	97.5 percentile
Constant	4.879	0.592	4.877	3.656	6.111
Age*	-0.117	0.010	-0.117	-0.137	-0.096
Gender (Female vs. male)*	-1.571	0.214	-1.570	-1.992	-1.152
BMI	0.032	0.018	0.032	-0.002	0.068
Brushing 2 times vs. Once a day*	0.574	0.229	0.576	0.119	1.011
Brushing more than 2 times vs. once*	2.257	0.408	2.279	1.398	2.993
No brushing vs. once a day*	-1.782	0.191	-1.782	-2.162	-1.412
Diabetes*	1.862	0.222	1.860	1.413	2.301
Flossing*	-1.469	0.187	-1.470	-1.838	-1.097
Having job	-0.347	0.193	-0.351	-0.726	0.035
Quality of life	0.006	0.006	0.007	-0.006	0.019
Using mouthwash*	-1.602	0.282	-1.601	-2.162	-1.053
Smoking*	1.555	0.232	1.556	1.104	2.024
Education (illiterate vs. literate)	-0.054	0.228	-0.055	-0.496	0.401
ν	1.09×10^{-4}	6.47×10^{-4}	7.695×10^{-7}	4.420×10^{-21}	0.001

*Significant, $P < 0.05$

BMI: Body mass index; SD: Standard deviation

Table 4. Posterior summaries for the parameters of zero-inflated COM-Poisson (ZICMP) regression model for filled teeth

Parameter	Mean	SD	Median	2.5 percentile	97.5 percentile
Constant	-1.281	0.236	-1.278	-1.759	-0.819
Age*	-0.021	0.002	-0.021	-0.026	-0.015
Gender (Female vs. male)*	0.335	0.053	0.336	0.229	0.437
BMI*	-0.010	0.005	-0.010	-0.020	-0.090
Brushing twice vs. once a day*	-0.127	0.052	-0.126	-0.228	-0.024
Brushing more than twice vs. once a day**	0.444	0.122	0.441	0.212	0.695
No brushing vs. once a day*	-0.415	0.048	-0.415	-0.511	-0.321
Diabetes*	0.256	0.086	0.252	0.088	0.436
Flossing*	0.599	0.041	0.599	0.519	0.680
Having job*	0.194	0.051	0.194	0.092	0.295
Quality of life*	-0.003	0.001	-0.003	-0.007	-0.000
Using mouthwash	-0.069	0.081	-0.069	-0.227	0.093
Smoking*	-0.490	0.073	-0.490	-0.635	-0.347
Education* (illiterate vs. literate)	-0.976	0.092	-0.972	-1.170	-0.802
ν	1.903×10^{-4}	3.403×10^{-4}	6.749×10^{-7}	2.124×10^{-19}	0.001
p	0.034	0.008	0.034	0.020	0.052

*Significant, P < 0.05
BMI: Body mass index; SD: Standard deviation

This number was also associated with gender, so that the mean number of decayed teeth was higher in men than in women. This similarity has been seen in other studies too; it seems that its reason is more attention of women to their health and referring to the dentist for the prevention of oral and dental diseases.[21] Besides, women had greater knowledge, a more positive attitude, and a higher level of oral health behaviors than men.[22] Daily brushing has a complicated effect on decayed and filled teeth. The mean number of decayed teeth was less for those who brush twice or more a day versus those brushing once a day. In addition, the number of decayed teeth was less for those who did not brush a day versus those brushing once a day. The mean number of decayed teeth was less for those who flossed and those who used mouthwash. Diabetes has adverse effects on decayed teeth, so that diabetic people are exp (1.86) = 6.4 times more at risk for increasing dental decay than non-diabetic people.

The results of the zero- inflated COM-Poisson regression model on the number of filled teeth showed that those people who were younger, female, non-diabetic, employed, literate, had less BMI, flossed, and got less score of quality of life had significantly more number of filled teeth. Literate and employed individuals had more filled teeth than others. The mean number of filled teeth in the literate people was exp (1/-0.976) = 2.6 times higher than that in the illiterate ones. Oral health status in retired elderly people in Iran had a direct relationship with literacy levels.[23] Employed and literate people may pay more attention to their oral health because of their more knowledge and financial ability to refer for dental services. This was consistent with Gao et al.'s study too.[24] The younger people had significantly more decayed and filled teeth. In the study of Ahmadi et al.,[23] aging had inverse effects on oral health. Flossing had a direct relationship with the number of filled teeth and inversely with the number of decayed teeth.

Diabetic individuals had more decayed teeth and less filled teeth than non-diabetic ones. In the study of Yonekura et al.,[25] participants with poorly controlled diabetes had more decayed and less filled teeth than the control group.

Smoking has a direct significant relationship with the number of decayed teeth and a

negative significant relationship with the number of filled teeth. The direct relationship between smoking and dental disease has been confirmed in other studies too.[26,27]

Oral health is a major part of the quality of life[24] and good quality of life is a protective factor for dental caries. In this study, participants with higher level of quality of life had less number of filled teeth; showing that the high level of quality of life influences one's oral health.

Conclusion

Many controllable factors such as education, BMI, flossing, using mouthwash, smoking, diabetes, and quality of life affect the number of decayed and filled teeth. Therefore, by planning educational and cultural programs to prevent diabetes and smoking as well as by encouraging people to floss and use mouthwash, we could improve oral health.

Conflict of Interests

Authors have no conflict of interest.

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Clinical presentations and co-morbid factors of patients with myofascial pain or myalgia of masticatory muscles

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Original Article

Abstract

BACKGROUND AND AIM: This study was aimed to investigate the clinical presentations and frequencies of co-morbid factors in patients with myofascial pain or myalgia of masticatory muscles.

METHODS: In this retrospective study, the data were obtained from the documents of the patients with myalgia or myofascial pain of the masticatory muscles who were conceded to Kerman Orofacial Pain Clinic, Kerman, Iran. Their clinical presentations and frequencies of possible related comorbid factors were evaluated. The chi-square test, Fisher's exact test, and t-test were used for comparing the distribution of variables. Analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) test were also used for comparisons between groups. A P-value ≤ 0.05 was considered statistically significant.

RESULTS: Patients with masticatory muscle myalgia or myofascial pain consisted of 296 individuals, 258 women (87.7%) and 38 men (12.3%) with an average age of 34.00 ± 11.75 years (range: 15-75 years). Temporomandibular disorder (TMD) occurred in 259 (87.5%) patients and 262 (88.5%) subjects had headache. A total of 178 individuals (60.1%) reported pain in three parts of the body and 155 subjects (52.4%) had insomnia. Bruxism, other oral parafunctional habits, and poor head and neck postures were found in 156 (52.7%), 167 (56.4%), and 80 (27.0%) subjects, respectively. The frequency of moderate to severe depression and moderate anxiety was 22.0% of our study population.

CONCLUSION: This study stated that the frequency of masticatory muscle pain (MMP) was high in patients with TMD, headache, and psychological disorders and accompanied with insomnia, oral parafunction, and bodily pain.

KEYWORDS: Myofascial Pain; Myalgia; Masticatory Muscles; Temporomandibular Joint Disorders; Headache

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As muscle tenderness and muscle pain are the most frequent signs and symptoms of temporomandibular disorders (TMDs), examination of them is one of the main methods in orofacial pain clinic to establish an appropriate diagnosis and treatment.[1] The total prevalence of myofascial pain is about 46.0%, but it could be as much as 85.0%.[2] Etiology of masticatory myofascial pain (MMP) is complex and poorly understood.[3] The most common type of chronic pain that reffered to dentists is TMD.[4] Concept of chronic pain is different from acute pain. Chronic pains in various parts of the body are related to each others. They are not distinct entities. They

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have common etiologies. TMD is a chronic pain condition that can occur in association with some other chronic pain conditions like headache and pain in the neck, shoulder, and back areas.[5]

Myofascial pain syndrome (MPS) features have not been investigated completely with regard to these associations. This study proposed to describe and analyze the relationship between MPS and TMD, primary headaches, chronic widespread pain, general health and psychological status, sleep, oral habits, and posture in the individuals with myofascial pain or myalgia of masticatory muscles. This study has been conducted to determine the frequency of clinical presentations and comorbid factors in patients with myofascial pain or myalgia of masticatory muscles.

Methods

This retrospective cross-sectional study was approved by the Dental and Oral Diseases Research Center of Kerman University of Medical Sciences, Kerman, Iran (ethics code of this research: IR.KMU.REC.1393.462). The data were gathered from all records of the patients with the main complaint of craniofacial pain who were accepted in the Orofacial Pain Clinic in Kerman School of Dentistry, Kerman University of Medical Sciences from July 2014 to July 2016. The sampling method was census. The evaluation of charts and data collection was done by a 3rd year resident that was trained in this field. We obtained data that were recorded in the charts of patients who had myalgia or myofascial pain of the masticatory muscles. Additionally, the clinical presentations of patients, frequency of related comorbid factors, bodily pain, sleep disturbance, smoking habits, poor postures, oral parafunctional habits, and psychological status were also assessed.[6-8]

The data were recorded by a checklist in a questionnaire format which consisted of 8 main domains including: 1. demographic characteristics and general health status, 2. clinical presentations, 3. bodily pain, 4. sleep disturbance, 5. smoking habits, 6. poor postures, 7. oral parafunctional habits, and 8. psychological status.

The evaluation of TMD and headache problems was based upon documented self-report and clinical examinations. The applied clinical protocol was based on the American Academy of Orofacial Pain (AAOP) classification, using the Diagnostic Criteria for TMDs (DC/TMD).[9,10]

Assessment of headache was based on the International Classification for Headache Disorders-3rd edition (beta version), 2013 (ICHD-3-β).[11] For assessment of bodily pain, we assessed pain from three parts of the body including neck, low back, and abdomen.[6,8]

Insomnia assessment was done based on American Academy of Sleep Medicine (AASM) definition. Insomnia, according to the AASM definition, is a subjective complaint of problem with falling and staying asleep despite ample opportunity for sleep.[12] Patients with bad head and neck position for a long period of time (few hours) during their routine activities were regarded to have bad posture. Oral parafunction was evaluated via a checklist and oral examination. Also, the standardized Persian version of Beck Depression Inventory (BDI)[13] and Beck Anxiety Inventory (BAI)[14] were used for evaluation of psychological status of patients.

Descriptive statistics were used to describe the basic features of the data in this study using SPSS software (version 21, IBM Corporation, Armonk, NY, USA). Chi-square test and Fisher's exact test were used to compare two non-numerical variables and t-test was used for continuous variables. Analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) test were performed to compare the groups. A P-value of < 0.05 was considered statistically significant.

Results

In all, 336 charts were evaluated. 40 patients were excluded from our study because their chief complaints were not related to muscle

pain. These patients were as follows: 14 subjects with trigeminal neuralgia (TN), 17 patients with burning mouth syndrome (BMS), 3 individuals with cluster headache (CH), and 6 patients with trigeminal neuropathy. The final study sample consisted of 296 individuals with myofascial pain or myalgia of the masticatory muscles. Of these individuals, 258 were women (87.7%) and 38 were men (12.3%) with a mean age of 34.00 ± 11.75 years (range: 15-75 years).

TMD occurred in 87.5% (259) of patients. The most common symptom of TMD (93.4%, 242 subjects) was pain in temporomandibular joint (TMJ), jaw, ear, or temporal and preauricular areas. TMJ sounds and limitation of mouth opening were other common symptoms reported by 32.0% (83 subjects) and 26.6% (69 subjects) of patients with TMD, respectively. The majority of patients had two or more symptoms. Most of the patients with TMD (70.5%) had chronic pain (> 3 months), while 29.5% were suffering from acute pain (< 3 months) at the time of their first visit. The most common TMD sign was tenderness of the lateral pole of the condyle (83.0%), clicking (41.0%), deviation (28.1%), deflection (27.4%), and crepitus (8.1%). Among the study population, 69 patients (23.3%) had a history of trauma to the head and TMJ and 3 patients had experienced whiplash trauma.

Arthralgia (71.4%) and myofascial pain (63.7%) were the most prevalent TMDs (Table 1).

Table 1. Frequency of various types of temporomandibular disorders (TMDs)

Disorder	n (%)
Arthralgia	185 (71.4)
Myofascial pain	165 (63.7)
Headache attributed to TMD	105 (40.5)
Disk displacement with reduction	106 (41.0)
Myalgia	97 (37.4)
Subluxation	9 (3.4)
Disk displacement without reduction	6 (2.3)
Muscle splinting	3 (1.1)
Two or more than two diagnoses of TMD	136 (52.5)

TMD: Temporomandibular disorder

Headache was present in 262 (88.5%) subjects of sample (Table 2). Migraine without aura was the most frequent headache among patients. In 176 (67.1%) patients with headache, palpation of masticatory muscles replicated the headache. Palpation of temporalis and sternocleidomastoid muscles replicated the headache in 151 (57.6%) and 126 (48.0%) patients, respectively. Some of the patients (67 subjects) had more than one type of headache. The number of patients with chronic headache was 190 (72.8%) and 27.2% of the patients had acute headache.

Table 2. Types of headache among patients with myofascial pain or myalgia of the masticatory muscles

Diagnosis	n (%)
Migraine	195 (74.4)
Migraine without aura (1.1)	139 (53.0)
Migraine with aura (1.2)	47 (17.9)
Retinal migraine (1.2.4)	8 (3.0)
Abdominal migraine (1.6.1.2)	1 (0.3)
TTH	104 (39.6)
MOH	39 (14.8)
Migraine	29 (11.0)
TTH	10 (3.8)
CDH	9 (3.4)
Migraine	7 (2.6)
TTH	2 (0.7)
CGH	4 (1.5)
Two or more than two diagnoses of headache	67 (25.5)

TTH: Tension-type headache; MOH: Medication overuse headache; CDH: Chronic daily headache; CGH: Cervicogenic headache

A total of 156 (52.7%) patients had a history of different kinds of jaw parafunction, including clenching or bruxism whether it was nocturnal or diurnal. Signs and symptoms of bruxism are shown in table 3. Attrition was the most frequent sign. A total of 167 patients (56.4%) had oral habits other than bruxism.

Table 3. Frequency of signs and symptoms of bruxism in patients with myofascial pain or myalgia of masticatory muscles

Sign and symptom of bruxism	n (%)
Attrition	243 (82.0)
Cheek ridging	221 (74.7)
Tongue ridging	221 (74.7)
Generalized tooth sensitivity	14 (4.7)
Tooth chipping	6 (2.0)
Abfraction	2 (0.7)
Two or more than two signs of bruxism	229 (77.3)

Table 4. Psychological status of patients with myofascial pain or myalgia of masticatory muscles

Depression status		Anxiety status	
BDI score	Frequency of different levels of depression among patients [n (%)]	BAI score	Frequency of different levels of anxiety among patients [n (%)]
0-9	Normal [89 (37.0)]	0-21	Very low anxiety [166 (69.1)]
10-15	Mild depression [52 (21.5)]	22-35	Moderate anxiety [53 (22.0)]
16-19	Mild to moderate depression [25 (10.3)]	> 35	Severe anxiety [20 (8.3)]
20-29	Moderate to severe depression [53 (22.0)]		
30-63	Severe depression [21 (8.7)]		

BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory

The BDI and BAI forms were completed in only 240 patients due to illiteracy, advanced age, or cognitive problems. The scores and interpretations of these inventories are demonstrated in table 4.

A total of 178 individuals (60.1%) reported bodily pain: low back in 41.2% (122), neck in 35.1% (104), and abdomen in 19.9% (59) of the subjects. A total of 27.0% of sample (80 subjects) had poor posture during their daily activities and 155 subjects (52.4%) had insomnia. In this study, 21 individuals (7.1%) were smoker and 7 patients used alcohol. Use of energy drink was reported by 10 patients.

The study sample was further classified into three groups including 225 (76.0%) subjects with TMD and headache, 34 (11.5%) subjects with TMD without headache, and 37 (12.5%) subjects with headache without TMD. This study showed that there was a significantly higher frequency of insomnia in patients who had TMD and headache together compared to patients who had TMD or headache alone (P = 0.010). Analysis of BDI and BAI scores in the three groups of patients showed that the level of anxiety was significantly higher in patients who had only headache (P = 0.020) compared to those who had TMD alone. We evaluated the association of headaches with bodily pain, insomnia, bruxism, oral parafunctional habits, poor posture, trauma, and smoking. There was a statistically significant association between headache with insomnia (P = 0.004). Our study showed a statistically significant high value of anxiety among patients with insomnia. Additionally, the value of depression was significantly high in patients with headache (P = 0.030), insomnia (P = 0.0001), poor posture (P = 0.030), and bruxism and oral habits (P = 0.040). In this study, there was no association between sleep problems with bodily pain, poor posture, and bruxism and oral habits. Our study showed that there was a marginal significant relationship between headache and gender; it is possible that if the number of men was more than this in our study population, the relationship would be significant. We also analyzed the relationship between trauma and clicking and it was statistically insignificant (P = 0.700). There was not also any statistically significant relationship between poor posture and bodily pain (P = 0.600).

The patients' medical histories showed that cardiovascular disease (CVD) was the most frequent health problem (37.0%) and palpitation was the most common cardiovascular complaint (23.3%). Other more frequent health problems were peptic ulcers, anemia, hypertension (HTN), and thyroid diseases.

Discussion

In this study, we assessed the frequency of clinical presentations and co-morbid factors of patients with myofascial pain or myalgia of masticatory muscles. The main finding of study was that patients with myofascial pain or myalgia had significantly more subtypes of TMD, headaches, bodily pain, sleep disturbances, poor posture, oral habits, depression, and anxiety. TMD occurred in 87.5% (259) of patients. Headache occurred in 262 (88.5%) subjects. A total of 178 individuals (60.1%) reported bodily pain.

The sample of the study was populated primarily by women (n = 258, 87.7%), which is

consistent with other studies that report a higher prevalence of TMD and headache disorders in women.[4,15] Interestingly, studies in the general population usually report much smaller differences between men and women compared to studies in clinical samples. It has been suggested that women tend to feel their pain as more intense, frequent, and continuous than men.[16] This suggestion may explain the higher frequency of seeking care for women in the present study.

Many studies evaluated the frequencies of TMD and headache, but the results of these studies are not necessarily comparable to each other because of the different diagnostic criteria, methodology, and study groups. Our results showed a reciprocal relation between headache and TMD, that is compatible with results of papers demonstrating the relationship between TMD and headaches.[4,17,18]

Many studies found a higher prevalence of masticatory muscle tenderness and TMJ pain in patients with headache.[19-21] Several studies have demonstrated that headache and TMD are comorbid diseases, that is, the presence of one increases the frequency of the other.[22] Some studies have shown that the larger the number of signs/symptoms of TMD, the higher the frequency of migraine or tension-type headache (TTH). In addition, they show that the treatment of TMD facilitates the treatment of headaches.[23] Melo et al. suggested that the severity of TMD was higher in patients with headache than general population.[15] Graff-Radford showed that TMD impacted the headache because of the same innervations with the trigeminal nerve.[24] Bevilaqua-Grossi et al. showed that TMD could change the episodic headache to chronic.[25] Goncalves et al. wrote that TMD symptoms were higher in patients with migraine, TTH, and chronic daily headache (CDH), especially for migraine.[17] These findings suggest that at least some of the headaches in the present study may be TMD-related, considering the neck and stomatognathic systems during evaluating and treating patients with headache disorders.

A strong association between TMD pain and other painful conditions has been found. In our study, 60.1% of subjects had bodily pain in at least three other parts of the body. Our results are in line with earlier findings in samples of patients with TMD and population-based studies. Wiesinger et al. showed the associations between back pain and musculoskeletal disorders.[26] Nilsson et al. demonstrated that neck pain and back pain were relevant to TMD pain.[8] Bodily pain has been declared as one of the risk factors for the chronic TMD pain.[27] Lim et al.[6] showed that subjects with TMD experienced more muscle, joint, back, chest, abdominal, and menstrual pain compared to those subjects without TMD.

In our study, 52.4% of the patients had insomnia and there was a significant relationship between headache and insomnia. Human experimental studies have found that pain and sleep disturbance have a reciprocal and bidirectional relation.[28] Sleep disorders are prevalent in patients with TMD[29] and recent studies have concluded that sleep disturbance is a predisposing factor for TMD.[7] Lindroth et al. showed that the sleep status of patients with MMP was poorer, compared to patients with intracapsular pain.[30]

Approximately, one quarter (27.0%) of subjects had poor head and neck posture during daily activities. Studies have shown a correlation between TMDs and poor head and neck posture. Frequently, patients with TMD show changes in the center of gravity of their bodies[31] and anterior displacement of the head.[32] Shortening of the posterior cervical extensor and sternocleidomastoid muscles are seen in patients with TMD.[33]

In the study of Karibe et al., head-forward posture was significantly more frequent in the subjects with TMD than in the controls.[34]

Patients with TMD may improve their symptoms after posture correction via instructions.

In the present study, 52.7% of subjects were conscious of having bruxism. Clinical signs of bruxism were found in most of

patients (82.0%), suggesting that some patients may not be aware of their parafunction. When parafunctional forces are more than the physiologic sufferance of the masticatory system, clinical signs and symptoms of TMD such as pain in TMJ or masticatory muscles are manifested.[35] Methodologically, assessing bruxism is difficult. Only polysomnography (PSG) in a sleep laboratory can confirm sleep bruxism.[36] Several recent studies have revealed significant associations between bruxism and signs and symptoms of TMD.[37-39] Michelotti et al. stated that daytime clenching/grinding was a risk factor for myofascial pain and disc displacement.[40]

We also have considered other oral parafunctional habits including gum chewing, lip, cheek, nail, or pen chewing, unusual jaw or tongue movements, and unilateral chewing in our study. More than half of the patients (54.6%) had oral habits; gum chewing and lip chewing were the most frequent oral habits in our study population. Gavish et al. discovered the associations of intensive gum chewing and crushing ice with muscle sensitivity and joint noises and also found a positive relation between unusual jaw movement, catching the jaw, and joint disturbances.[41] Glaros et al. showed that patients with headache had more oral parafunctional behaviors.[42]

We found that the associations between bruxism, oral habits, and anxiety were statistically significant. Pain is affected by physiological and psychological variables.[7] In our study, 22.0% of the subjects had moderate to severe depression and moderate anxiety. There was a statistically significant relationship between headache and anxiety. Headache had a marginally significant association with depression. We also found a statistically significant association between insomnia, depression, and anxiety. Many studies showed that patients with myofascial pain and different types of headache experienced more intensive symptoms of anxiety.[43,44]

A number of studies have described an association between general health conditions and orofacial pain.[45,46] The most frequent medical conditions among our patients were CVD (37.0%) and palpitation representing 62.7% of these subjects. It is possible that higher level of anxiety in our patients compared to general population made this discrepancy.

There were some limitations in the present study: 1. it was a cross-sectional study with no control group, 2. evaluation of psychological status was not possible for all of the patients, and 3. some data were collected from checklist and data relied on patients' memory and self-reporting.

Conclusion

In the present study, the frequency of masticatory muscles tenderness was high in TMD and headache disorders. Identification of common clinical presentations and comorbid factors of patients with myofascial pain or myalgia of the masticatory muscles may have a major impact on future diagnosis and treatment strategies. In addition, this would help clarify the importance of an interdisciplinary effort between different specialties, e.g., orofacial pain specialists, psychologists, and neurologists.

Conflict of Interests

Authors have no conflict of interest.

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Evaluating the quality of life in patients with ulcerative oral lesions

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Original Article

Abstract

BACKGROUND AND AIM: Oral mucosal lesions can affect patient's quality of life (QOL). In this evaluation, Persian version of Chronic Oral Mucosal Disease Questionnaire (COMDQ) was used to assess participants' QOL.

METHODS: This cross-sectional study was done during 2015-2016 in School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran. 95 participants with pemphigus vulgaris (PV), oral recurrent aphthous stomatitis (RAS), and oral lichen planus (OLP) enrolled is this study. The Persian version of COMDQ with 26 questions and 4 domains was used for assessing QOL. The data were analyzed in SPSS software. P-value less than 0.05 was considered significant. Independent t-test, analysis of variance (ANOVA), and Tukey's test were used to assess scores of QOL.

RESULTS: The final QOL scores were 45.95 ± 16.31, 53.38 ± 17.64, and 50.02 ± 17.36 for men, women, and all patients, respectively. Patients with OLP and RAS had good QOL, but patients with PV reported lower level of QOL (moderate). None of the COMDQ domains showed significant correlation with gender except pain and functional limitation and overall QOL score.

CONCLUSION: The result of this evaluation revealed a good QOL; considering the type of oral disease, QOL ranged between moderate for patients with PV and good for patients with OLP and RAS.

KEYWORDS: Lichen Planus; Stomatitis; Aphthous; Pemphigus; Quality of Life

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Oral mucosal diseases can result in noticeable discomfort, physical, psychological and social impairment, affecting the quality of life (QOL). Some of these oral mucosal diseases such as recurrent aphthous stomatitis (RAS), oral pemphigus vulgaris (PV), pemphigoid lesions, and oral lichen planus (OLP) are the most common examples of oral mucosal diseases.[1-5]

QOL is a personal conception of situation in life in association with culture and rating system, goals, and concerns.[6]

Oral Health Impact Profile-14 (OHIP-14) and the 36-item Short Form Health Survey (SF-36) are some other questionnaires for assessing QOL in patients with oral lesions.[1,7,8]

The Chronic Oral Mucosal Disease Questionnaire (COMDQ) is an oral disease and radiology-specific questionnaire.

Cork University Dental School and Hospital, Ireland, designed the English version of original Oral Health-Related QOL (OHRQOL) questionnaire.[9]

This discipline-specific/condition-specific instrument showed excellent reliability, good validity, and responsiveness.[9,10]

Few researchers have used this new questionnaire in order to assess QOL of participants with oral lesions. Okumus et al.[11] and Rajan et al.[12] evaluated QOL in patients

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with chronic oral mucosal lesions. These studies used COMDQ with their specific version of language. In this study, we aimed to use Persian version of COMDQ in order to assess the QOL in participants with chronic mucosal lesions.

Methods

A cross-sectional study was rendered during 2015-2016 in Department of Oral Maxillofacial Medicine, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran. This study was approved by Ethics Committee of Shiraz University of Medical Science (IR.SUMS.REC.1394.S1188) and was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki. According to Rajan et al.[12] study and the QOL difference of different oral lesions obtained from this study, first degree error (0.05), and the study power (80%), the sample size was deemed 120. Only 95 (79.17%) patients completed the survey and others left the study (20.83%). Some of the participants were in low social level and could not answer the questions and some of them did not complete the questionnaire.

The patients enrolled in this study were referred to this department and their oral diseases including erosive and ulcerative OLP (9 patients), oral PV (without skin involvement) (42 patients), and oral minor RAS (44 patients) were diagnosed by a specialist (the author of this manuscript) with clinical or histopathological confirmation. Enrolling a specific form of oral lesions as mentioned above homogenized the severity of these lesions to have more accurate comparison.

The inclusion criteria were being older than 18 years of age and being under treatment for oral disease. The exclusion criteria were patients who did not receive any treatment, individuals without the ability to understand the questions in the questionnaire, and patients with any history of chemotherapy or radiotherapy, diabetes, disease in relation with salivary glands and xerostomia, and cerebrovascular attack that could cause taste disorders and swallowing disabilities. A written informed consent was taken from each participant. The participants were given a Persian version of COMDQ to complete. The original COMDQ is an English version of OHRQOL questionnaire, developed by the Cork University Dental School and Hospital in Ireland.[8]

The reliability and validity of this Persian version were evaluated in a former evaluation by Shirzad et al.[13] The Cronbach's α coefficient and intraclass correlation coefficient for COMDQ were 0.969 and 0.997, respectively. Persian version of COMDQ has acceptable reliability and validity according to Shirzad et al.'s study.[13]

This questionnaire has 26 items, categorized into 4 domains: pain and functional limitation, medication and treatment, social and emotional status, and patient support. A five-point Likert scale was considered for this questionnaire.

The total score of participants was calculated from 104. Response scale rating code was between 0-4 [not at all (0), slightly (1), moderately (2), considerably (3), and extremely (4)]. Excellent QOL was considered for scores of 0 to 25 of the total score, good QOL for scores of 26-50, moderate QOL for scores of 51-79, and poor QOL for scores of 76 to 100.[12]

The data were analyzed by SPSS software (version 18, SPSS Inc., Chicago, IL, USA). P-value less than 0.05 was considered significant.

Independent t-test was used to compare the total score of QOL and each domain according to sex. Analysis of variance (ANOVA) assessed the relationship between type of diseases and the overall score of QOL and each domain; since the result of this test was significant ($P < 0.001$), post-hoc Tukey's test was used for pairwise comparison of QOL between different types of diseases. Pearson correlation test assessed the correlation between different domains of COMDQ.

Results

In this study, 95 questionnaires were

collected finally (20.83% was missed). The number of men was 43 patients (mean age: 34.0 ± 4.3 years) and the rest were women (mean age: 33.3 ± 4.6 years).

A total of 21.1% of participants had no academic education and 78.9% had high academic education.

The final QOL score of participants from 104 was 45.95 ± 16.31 in men, 53.38 ± 17.64 in women, and 50.02 ± 17.36 in all the participants. Overall scores on COMDQ and their total level in each domain are separately represented in table 1. According to table 1, patients with OLP and RAS had good QOL, but patients with PV reported lower level of QOL (moderate).

Significant differences between the total score and mean value of score for each disease in all domains were defined (Table 1).

Post-hoc analysis (Tukey's test) evaluated the difference of QOL score for each disease in comparison with one another. The results are presented in table 2.

The RAS and OLP scores were not different in all domains except for social and emotional status domain. Otherwise, there were significant differences between PV and OLP scores in all domains except for "social and emotional status" and "patient support" domains.

Table 3 evaluated the correlation between age and scores in different domains of COMDQ. There was a significant correlation between age, pain, functional limitation, and medication and treatment.

The correlation between different domains of COMDQ is shown in table 4, which indicates that all COMDQ domains have correlation with each other. Also, these variables affected patients' QOL. Improvement in each domain showed positive effect on QOL.

Gender correlation with QOL score in each domain is shown in table 5. All COMDQ domains showed no significant correlation with gender except "pain and functional limitation" part and the overall QOL score.

Table 1. Overall scores on Chronic Oral Mucosal Disease Questionnaire (COMDQ) and their comparison based on the domains

Domain	Disease group	Total score (mean ± SD)	Mean percentage of total score	P*	Level
Pain and functional limitation (total: 32)	OLP	14.80 ± 9.27	41.10	< 0.001	Good
	PV	25.06 ± 8.81	69.60		Moderate
	RAS	11.66 ± 8.91	32.30		Good
	Total	19.26 ± 10.49	53.50		Moderate
Medication and treatment (total: 24)	OLP	10.90 ± 4.28	45.40	< 0.001	Good
	PV	14.47 ± 4.39	60.29		Moderate
	RAS	8.00 ± 4.15	33.30		Good
	Total	12.28 ± 4.80	51.16		Moderate
Social and emotional (total: 28)	OLP	10.11 ± 5.38	36.10	< 0.001	Good
	PV	12.00 ± 4.46	42.85		Good
	RAS	5.50 ± 4.30	19.60		Excellent
	Total	10.60 ± 5.59	37.85		Good
Patient support (total: 16)	OLP	7.78 ± 2.31	48.60	< 0.001	Good
	PV	8.50 ± 2.52	53.12		Moderate
	RAS	6.33 ± 2.23	39.50		Good
	Total	7.97 ± 2.46	49.81		Good
Overall QOL (total: 104)	OLP	43.61 ± 14.54	41.90	< 0.001	Good
	PV	60.04 ± 14.09	57.73		Moderate
	RAS	30.88 ± 14.56	29.60		Good
	Total	50.02 ± 17.36	48.09		Good

*ANOVA test was used

OLP: Oral lichen planus; RAS: Recurrent aphthous stomatitis; PV: Pemphigus vulgaris; QOL: Quality of life; SD: Standard deviation

Table 2. Comparison of the Chronic Oral Mucosal Disease Questionnaire (COMDQ) score of different diseases in evaluated domains

Multiple comparisons		Dependent variable, P*				
		Pain and functional limitation	Medication and treatment	Social and emotional status	Patient support	Overall
OLP	PV	< 0.001	< 0.001	0.1070	0.1730	< 0.001
	RAS	0.346	0.071	0.0280	0.1040	0.018
PV	OLP	< 0.001	< 0.001	0.1070	0.1730	< 0.001
	RAS	< 0.001	< 0.001	0.0020	0.0160	< 0.001
RAS	OLP	0.346	0.071	0.0280	0.1040	0.018
	PV	< 0.001	< 0.001	0.0200	0.0160	< 0.001

*Post-hoc Tukey's test was used
OLP: Oral lichen planus; RAS: Recurrent aphthous stomatitis; PV: Pemphigus vulgaris

Table 3. Correlation between age and scores in different domains of Chronic Oral Mucosal Disease Questionnaire (COMDQ)

Correlation coefficient: Age with	Age group (year)	r	P
Pain and functional limitation	> 40	0.255	0.035
	< 40	0.290	0.020
	Overall	0.239	0.030
Medication and treatment	> 40	-0.256	0.010
	< 40	-0.301	0.005
	Overall	-0.216	0.045
Social and emotional status	> 40	-0.101	0.065
	< 40	-0.098	0.132
	Overall	-0.194	0.083
Patient support	> 40	-0.045	0.709
	< 40	-0.010	0.803
	Overall	-0.002	0.989
Overall QOL	> 40	0.087	0.401
	< 40	0.043	0.609
	Overall	0.001	0.991

QOL: Quality of life

Discussion

According to the results of our study, QOL of patients with COMD was good. The QOL was moderate for patients with PV and good for patients with RAS and OLP.

The overall COMDQ score in each domain is an indication of moderate QOL for participants in pain and medication domains and good QOL in social and emotional status and patient support domains.

An overall moderate QOL has been reported by Rajan et al. for patients with chronic oral lesions.[12] Their findings for QOL for different oral lesions were compatible with our study, except for the QOL in patients with OLP. The COMDQ scores in Rajan et al.'s study[12] were the same as our findings in each domain except for participants' QOL in social and emotional domain, which was reported moderate. In another study, Turkish subpopulation QOL was evaluated by the Turkish version of COMDQ. However, Okumus et al. reported their results in a different way, but moderate QOL of Turkish patients with many types of oral lesions was somehow different from our findings. Also, to some extent their reports were different in all domains.[11]

Table 4. Pearson correlation between different domains of Chronic Oral Mucosal Disease Questionnaire (COMDQ)

Correlation coefficient		Pain and functional limitation	Medication and treatment	Social and emotional status	Patient support	Overall
Pain and functional limitation	r	1	0.446	0.219	0.248	0.841
	P	-	< 0.001	0.034	0.016	< 0.001
Medication and treatment	r	0.446	1	0.555	0.316	0.773
	P	< 0.001	-	< 0.001	0.002	< 0.001
Social and emotional status	r	0.219	0.555	1	0.233	0.646
	P	0.034	< 0.001	-	0.024	< 0.001
Patient support	r	0.248	0.316	0.233	1	0.448
	P	0.016	0.002	0.024	-	< 0.001
Overall	r	0.841	0.773	0.646	0.448	1
	P	< 0.001	< 0.001	< 0.001	< 0.001	-

Table 5. Gender correlation with Chronic Oral Mucosal Disease Questionnaire (COMDQ) scores

Questionnaire domain	Gender	Mean ± SD	t	P
Pain and functional limitation	Women	21.34 ± 10.55	2.170	0.033
	Men	16.74 ± 9.95		
Medication and treatment	Women	13.01 ± 5.00	1.651	0.102
	Men	11.39 ± 4.46		
Social and emotional status	Women	11.03 ± 5.63	0.816	0.417
	Men	10.09 ± 5.56		
Patient support	Women	8.19 ± 2.40	0.926	0.357
	Men	7.72 ± 2.54		
Overall	Women	53.38 ± 17.64	2.114	0.037
	Men	45.95 ± 16.31		

SD: Standard deviation

In the present study, there was no significant correlation between overall score on COMDQ, as well as the score of the mentioned domains and the age of participants. This correlation was just positive in the "pain and functional limitation" and "medication and treatment" domains. However, this exception was for the overall aspect and social and emotional domains in the study of Rajan et al.[12] They reported better QOL for the younger participants, while Okumus et al. reported the opposite.[11]

This study showed a significant correlation between COMDQ scores in different domains and overall score, in addition to the significant correlation between different domains with each other. These reports are compatible with the results of Rajan et al.[12] There are some inconsistencies in correlation of "patient support" with "pain and functional limitation" and "medication and treatment" domains which did not show any correlation.

There was significant lower QOL for women in "pain and functional limitation" domain in our study and Rajan et al.'s study,[12] while Okumus et al. showed lower QOL for female participants in "social and emotional status" domain.[11] Overall, the present study showed that male participants had better QOL.

The present study showed significant differences between COMDQ scores of different diseases, while this was significant just for RAS in comparison with PV in Rajan et al.'s study in the overall aspect and all other domains, except for "patient support".[12]

In the present study, the severity of evaluated lesions in each type of them had been homogenized, while this was not pointed in other studies.[11,12] QOL can be affected by population and cultural differences, ethnicity, and medical health services and these can justify some differences.

Patients with RAS and OLP in our study showed no significant difference in "pain and functional limitation", "medication and treatment", and "patient support" domains; however, they had a significant difference in "social and emotional status" domain.

On the other hand, patients with OLP and PV were not different in "social and emotional status" and "patient support" domains.

The sign and symptoms of PV are usually more severe than OLP and RAS, while these two diseases can be irritating too. Also, the medication dose and treatment duration for PV disease are more and longer; hence, lower level of QOL in patients with PV is possible.

On the other hand, OLP and PV lesions in comparison with RAS lesions are more serious autoimmune diseases, which can create a severe psychological pressure on patients and their families that can cause irritating thoughts about the prognosis of their diseases. This assumption is in line with showing no difference between patients with OLP and PV in domains of "social and emotional status" and "patient support".

Overall comparison between the QOL of different populations depends on many socio-

economic, healthcare delivery system, and cross-cultural influences. Heterogeneity of the evaluated oral lesions was another confounding factor, and these diversities can cause differences in some aspects of COMDQ results.

Patients with chronic oral lesions have long-term problems. Patient-reported information about long-standing diseases can provide new concepts for improving their treatment modalities, social interrelation, and finally QOL.

According to the results of a former study, COMDQ Persian version can offer specific, valid, and reliable alternative instead of general instruments.[13]

During data collection, some patients did not cooperate with the researchers. Since, some of the participants were illiterate, the researcher filled out the questionnaire by asking them. These problems caused some limitations. In order to have more accurate QOL assessment, enrolling a heterogeneous group of patients with similar oral lesions, gender, and age should be considered.

Conclusion

The result of this evaluation in Iranian population revealed good QOL in these patients; considering the type of oral diseases, QOL ranged between moderate for patients with PV and good for patients with OLP and RAS.

Conflict of Interests

Authors have no conflict of interest.

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What primary healthcare providers need to know about oral examination in children? A qualitative study

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Original Article

Abstract

BACKGROUND AND AIM: Providing oral examination for children is one of the primary healthcare providers (PHCPs) assigned tasks. Since children's oral and dental health needs can be recognized only through a proper oral examination, this study was conducted to illustrate what PHCPs need to know about pediatric oral screening.

METHODS: This qualitative content analysis study was conducted in Najafabad, Isfahan, Iran, in 2017. Data were gathered through in-depth semi-structured interviews with 21 PHCPs. The sampling began with a purposeful method and continued through the snowball method. Qualitative data were coded and analyzed using MAXQDA software.

RESULTS: The information that PHCPs need to know about children's oral and dental examination was categorized in three major themes and nine subthemes: positioning and controlling the child (positioning for each age group and controlling uncooperative children), performing the oral examination (evaluating child's oral hygiene, identifying teeth series and classes, detecting dental caries, evaluating teeth eruption, and recognizing facial traumas), and working with Integrated Health System (IHS) (answering the IHS' oral health question, using the provided information in IHS, and recording the findings).

CONCLUSION: PHCPs who participated in this study could not perform an acceptable oral screening for children and they wanted to know more about how they could carry out a correct one. By providing proper education to meet all the information needs of PHCPs and discarding irrelevant topics, the health system may facilitate the delivery of standard oral and dental health services for children.

KEYWORDS: Primary Health Care; Oral Health; Oral Examination; Dental Decay; Children; Qualitative Research

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The role of primary healthcare providers (PHCPs) in delivering general health services, as well as oral health services, is well established.[1] PHCPs play a key role in promoting the health of people, especially children, due to their early and continuous interaction with children and parents and assessment of their needs.[2,3] Oral screening is the first and most crucial step in evaluating children's oral health and providing proper care services.[4] Since oral screening is one of the responsibilities of PHCPs, they can decide about the children's oral health needs by performing accurate oral examinations and asking detailed questions from the parents about their children's oral hygiene compliance, nutrition, and nutritional or non-nutritional habits.[5] Therefore, PHCPs must have the ability to perform thorough oral

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examinations and establish effective communication with the parents to gather the necessary information.[6]

In this regard, Kirk et al. attributed the poor quality of oral health screening by primary providers to the lack of basic knowledge, such as identification of the series and classes of teeth.[7] Other researchers blame PHCPs' weaknesses in detecting dental caries.[4,6] Golinveaux et al. emphasized that pediatric nurses and other personnel, who are responsible for oral health screening of children, should receive enough information to enable them to fulfill their responsibilities.[8] On the other hand, some shortcomings in oral health education programs seem to contribute to the low quality of oral health screening by PHCPs.[9]

Since healthcare systems implement training programs for PHCPs and nurses to define their oral health responsibilities, the educational content of these programs must be in line with their job requirements.[10] Numerous studies have shown that the educational needs of PHCPs are not met in educational courses, and instead of them, many unrelated topics are discussed in oral health programs.[11,12] Consequently, providing relevant information in this area may affect the quality and quantity of oral health screening by examiners.[13]

According to multiple studies, one of the important reasons behind the discrepancy between the oral health educational content and practice is the educational planners' inattention to the actual needs of PHCPs concerning their responsibilities.[14,15] To this end, the first step is to identify subjects and topics that PHCPs need to know in order to perform their tasks.[4] Since there is inadequate information about the required knowledge of Iranian PHCPs for performing oral health examinations for children, and there is a scarcity of dental health records in the Integrated Health System (IHS) database of Iran, in this qualitative study, we aimed to fill the existing gaps. Our findings can guide oral health educators and program planners to focus on important issues and encourage PHCPs to increase their knowledge and skills to provide oral health screening services for children.

Methods

This qualitative study was carried out in 2017 in the public health centers of Najafabad County, Isfahan, Iran. Najafabad is one of the four regions included in the pilot study of the "New Well-Child Care Package" in the country. By using a content analysis method, the authors aimed to explore and determine the required knowledge of PHCPs about children's oral and dental health screening. For recruiting the participants, purposeful sampling, followed by snowball sampling, was applied. For maximum diversity, PHCPs' differences in age, educational level, educational field, work experience, and occupational status were considered in the selection of the participants. The inclusion criteria were as follows: working as a PHCP, being a "Well-Child Care Package" provider, and willingness to participate in the survey.

On the other hand, the unwillingness to stay in the study was considered as the exclusion criterion. Data were collected through in-depth, semi-structured interviews. At the beginning of the interviews, to start the conversation, some general open questions were asked about the PHCPs' experience of providing oral health screening for children. The next questions were asked according to the participants' responses. The date and time of the interviews were arranged with participants, and all interviews were conducted in the participants' workplace. The interviews were conducted in one or two sessions (30-45 minutes each) in a relaxed environment concerning the time constraints and tolerance of PHCPs.

The interviews were conducted, recorded, transcribed, reviewed, coded, and immediately analyzed by the researchers. The content analysis method was used for data analysis. In the content analysis process, each interview was read several times carefully to

reach a primary and universal understanding. Afterward, by highlighting the important statements, initial codes or meaning units were identified in the transcribed interviews. Next, by abstracting and labeling similar meaning units, transparency of the meaning units was determined and themes and subthemes were formed.

Data analysis was continuously and concurrently performed with data collection. After conducting ten interviews, the data saturation was occurred. Nevertheless, the data collection process was extended after that. Although the last 11 interviews were not included in the formation of new categories, they were conducted to consider the variety of participants' demographic characteristics, ensure data saturation, and increase the generalizability of our findings. Finally, the main themes were extracted. MAXQDA 12 (VERBI Gmbh, Berlin, Germany) was used for data analysis.

The validity and reliability of the study were examined based on Lincoln and Guba's criteria. Cooperation and interaction between the interviewer and the participants were ensured for the credibility of the study. External supervisors controlled reviews and experts' comments were integrated, as well. Also, to ensure the dependability of the collected data, consulting experts were asked to review the materials. For confirmability and auditing of the study, regardless of all presumptions and biases, the interviewer recorded and reported the steps and processes of the study thoroughly to facilitate follow-up by other researchers. Furthermore, the participants approved the validity of the results. The selection of multiple samples in this study contributed to the maximum diversity of the participants and increased the generalizability of our findings.

The Ethics Committee of Isfahan University of Medical Sciences approved this study (No. 173059). The study's objectives, information confidentiality, and the right to withdraw from the study at any time were explained for participants. Oral consent was also obtained from the participants for recording their voice.

Results

Twenty-one interviews were conducted with 19 women and two men. The participants' mean age was 34.2 ± 7.2 years (range: 24-52 years), and their mean work experience was 8.5 ± 0.8 years (range: 6 months to 29 years). Table 1 summarizes the PHCPs' demographic characteristics. Although the PHCPs had different educational levels and fields, the majority of them had university degrees. Table 2 presents the participants' educational level and field. A total of 870 first-level codes were extracted from the interviews. By merging the overlapped codes, the final ones were turned to 430 codes.

Table 1. Demographic factors of participants (n = 21)

Characteristic	Number of participants
Sex	
Male	2
Female	19
Age (year)	
20-30	6
31-40	6
41-50	7
51-60	2
Work experience (year)	
Under 5	6
5-10	5
10-20	5
20-30	5
Job performance assessment status	
Poor	5
Moderate	8
Good	8

The PHCPs' necessary information about pediatric oral and dental health examination was categorized into three major themes, namely, "positioning and controlling the examinee", "performing oral examination", and "working with the IHS". Figure 1 presents all of the extracted themes and subthemes. According to the participants, some knowledge gaps impaired their ability to perform oral examinations and affected the quality of provided services.

Table 2. Participants' level and field of education (n = 21)

Characteristic	Number of participants
Education level	
Diploma	2
Associate	12
BSc	6
MSc	1
Field	
Public health	4
Family health	12
Midwifery	2
Diseases control	1

BSc: Bachelor of Science; MSc: Master of Science

Positioning and controlling the examinee: The PHCPs stated that they had problems with positioning and controlling children for oral health examinations. They did not have the necessary knowledge for positioning children from different age groups or controlling younger and non-cooperative children. Some of the participants stated:

"I do not know what the right position is to perform a good oral and dental examination for children from different age groups." (p. 13)

"I could not examine very young children. I had several problems with the babies' position and crying." (p. 7)

Performing oral examination: *The* second theme was related to the PHCPs' needs and requirements to perform accurate oral and dental examinations. It consisted of five subthemes: "evaluation of oral hygiene in children", "identification of teeth", "detection of dental caries", "evaluation of tooth eruption", and "recognizing the signs and symptoms of facial traumas".

The participants did not have accurate information on how to evaluate the quality of children's oral hygiene done by the parents. One of the participants asserted:

"Sometimes, I do not know how to figure out if the mother brushes her child's teeth or how she does it." (p. 4)

Also, PHCPs expressed that they had difficulties detecting and distinguishing between dental plaque, dental calculus, and dental stain. In this regard, one of the participants asserted:

"When I see a discolored tooth, I do not know if it is because of improper tooth brushing, iron drop, or tooth decay." (p. 11)

Nearly less than half of PHCPs could not distinguish between healthy and inflamed gums. One of the participants stated:

"In oral screening, I cannot find out if children have healthy gums or inadequate oral hygiene." (p. 7)

Almost all PHCPs wanted to have more knowledge about the differences between primary and permanent teeth. Most of them were unable to distinguish between posterior primary and permanent teeth, especially the first permanent molars. One of the participants expanded on this weakness:

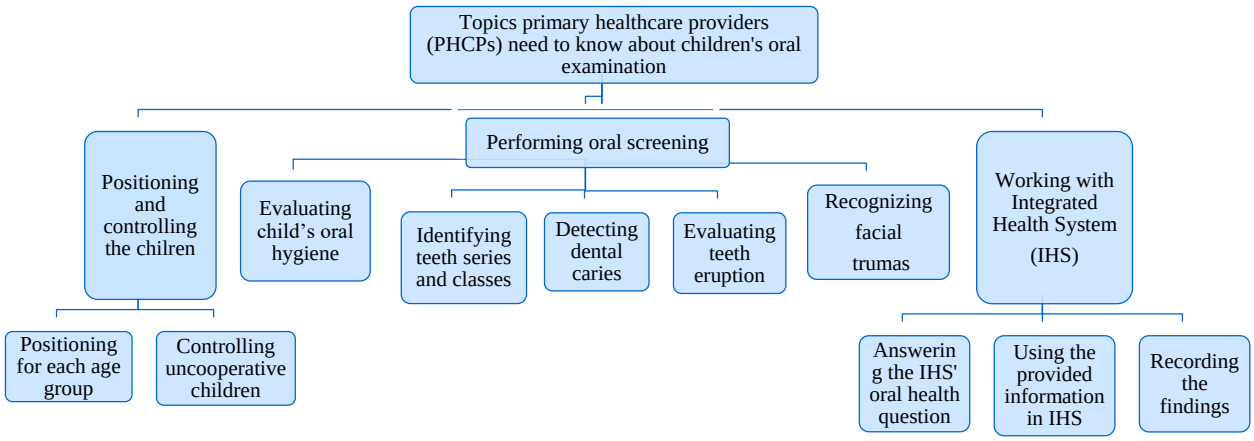

Figure 1. Extracted themes and subthemes that cover what topics which primary healthcare providers (PHCPs) PHCPs need to know about children's oral examination

"I know that the first permanent molar teeth are critical, but I do not know which teeth are primary or permanent." (p. 6)

Another weakness of PHCPs was their inability to identify permanent and primary teeth. In this case, one of the participants, with more than ten years of work experience stated:

"I can determine the number of teeth by counting them from the midline to the posterior portion of the oral cavity, but in children with tooth extraction, I cannot identify the teeth based on their shape." (p. 3)

Detection of dental caries was another problem of PHCPs. One of the interviewees made the following remark about the first signs of dental caries:

"I think the first sign of tooth decay is when we can see the dark black spots." (p. 1)

Another weakness of PHCPs in the pediatric oral examination was the evaluation of caries progression. One of the participants stated:

"I only take a look at the teeth, but I cannot determine if the dental caries is progressive or latent, deep or shallow, or even if tooth discoloration is related to calculus or tooth decay." (p. 17)

The final subtheme was "recognizing the signs and symptoms of facial traumas". The findings showed that PHCPs did not have adequate information in this area. One of the participants said:

"Among the signs and symptoms of facial and dental traumas, I can only detect fractured and avulsed teeth." (p. 2)

Another participant remarked:

"I do not know what the signs and symptoms of injuries are. Are these only referring to bleeding gums and broken teeth?" (p. 9)

Some PHCPs did not have adequate information about the signs and symptoms of tooth eruption. An interviewee stated:

"I do not know how much gum swelling and redness is related to tooth eruption or how much of it is due to decay or trauma." (p. 19)

Moreover, PHCPs were unable to recognize delayed tooth eruption. One of the participants told:

"I cannot memorize the eruption time of all teeth. I have problems in this area." (p. 3)

Working with the HIS: This theme was the final one addressed by PHCPs. Most of the participants did not understand the reasons behind the questions in the oral and dental health part of the IHS. One of the interviewees remarked:

"I do not know why we should ask about the family history of dental caries in children without tooth eruption." (p. 8)

In addition, some of the participants did not know how they could use information, such as a normal tooth eruption timetable, provided by the IHS. In this regard, an interviewee notified:

"This table contains some numbers indicating the range of normal eruption time for each tooth, but I do not know when delayed eruption occurs. After the first number? Between the first one and the second one? Or after the second number only?"

Many participants did not know how to register the clients' data in the IHS database. One of the participants stated:

"I do not know how to work with or complete the oral health section of the IHS. For example, I do not know where I can record the decayed primary teeth." (p. 3).

Discussion

As the oral examination is the first step to determine every child's need for oral health services, the quality of this process is of paramount importance.[4] Generally, PHCPs have constant interaction with children and their parents. Therefore, they can give them proper advice and suggest suitable preventive approaches, based on an accurate oral screening plan for children.[13] In this qualitative study, we categorized PHCPs' oral screening shortcomings and weaknesses into three major themes: "positioning and controlling children", "performing the oral examination", and "working with the IHS".

For an acceptable pediatric oral screening, PHCPs need further information about the

mentioned subjects and themes. Similar to our findings, Pierce et al. found that it was vital to improve the PHCPs' knowledge of accurate oral screening. They identified essential themes, including "identification of tooth series", "caries detection", and "caries risk assessment".[16]

Although PHCPs in this study conducted oral examinations for both children under and above two years of age, they were unfamiliar with the right position of not only children but also themselves. Most of the participants believed that the only way to perform oral screening was to use a dental chair, without which they could not deliver any dental services to children.

Moreover, Ramos-Gomez et al. emphasized that the children's position was important in oral screening and some positions, such as knee-to-knee position, could help care providers perform oral examinations for very young children and uncooperative ones.[17] Furthermore, Shah et al. reported that the child's proper position increased visibility and accessibility and improved the patient's convenience.[18] Other studies have also suggested that all dental providers must be familiar with the proper position for examining children in every age group.[6,19]

Similar to multiple studies on nurses, pediatric care providers, and pediatric residents, in the current study, PHCPs were unable to distinguish between healthy and inflamed gums, dental plaque and stain, and even caries. They also had some difficulties making decisions about the children's oral hygiene.[5,20,21] Through accurate assessment of children's oral hygiene, examiners can advise parents on how to improve their tooth brushing skills.[16] Therefore, PHCPs must gather the required information to determine the oral hygiene of children.[6]

Additionally, tooth identification was one of the most important difficulties of all PHCPs. Because of the lack of knowledge and skills of PHCPs in this area, they were unable to differentiate primary molars from permanent premolars and molars. However, no study has yet evaluated non-dental practitioners' information about the differentiation of primary and permanent teeth.

According to our results, PHCPs were not familiar with white lesions and could not determine the lesion progression. Since dental caries is preventable and treatable, it is vital to detect them at the earliest time possible.[22] PHCPs are usually the first members of the health team to observe the early signs of dental decay.[23] Also, PHCPs refer children with dental caries to dentists; therefore, under- or over-diagnosis can cause problems for both children and parents.[16] To prevent such problems, examiners should be able to distinguish between dental stains and white lesions. In this regard, Mohebbi et al. showed that PHCPs had some problems recognizing dental caries.[13] Pierce et al. also found that nurses and other pediatric care providers had some weaknesses in differentiating dental caries from dental plaques, stains, and calculus.[16]

PHCPs, in this study, did not have adequate information about delayed tooth eruption. Accordingly, the normal primary and permanent teeth eruption timetable was presented to the participants. Nevertheless, some of the participants were unaware of the importance of this table or how to use it. The early detection of delayed tooth eruption necessitates the proper education of examiners due to the possibility of early intervention and prevention of subsequent problems.[16] dela Cruz et al. found that examiners should be familiar with the normal time of tooth eruption so that they could identify delayed cases.[24]

Another topic that PHCPs had inadequate information about was the differentiation of signs and symptoms of tooth eruption in children, such as irritability, pain, diarrhea, and vomiting. Although these signs and symptoms are not severe in many cases, PHCPs should know the actual cause.[25] According to different studies, some care providers reported high fever, diarrhea, and vomiting associated with tooth eruption.[25-27]

Detection of dental and facial trauma was another topic that PHCPs needed to increase their information about since this type of trauma may result in dental and skeletal problems.[28] The IHS emphasizes asking the parents about the children's history of head and face injuries and identifying new and old signs and symptoms in the oral cavity. Similarly, in a study by Keels, nurses and pediatric care providers had some weaknesses in recognizing the late signs and symptoms of dental and temporomandibular joint (TMJ) traumas.[28]

After performing oral and dental examinations, it is important to keep the children's dental health records for future comparisons and refer them to dentists, if needed, for further prevention and treatment.[5,16] For this purpose, PHCPs need to be familiar with the system requirements and know how to record their findings in the IHS database.[29] Based on the present results, the participants wanted more information about the discussed topics, such as identifying tooth series and classes, white lesions, dental caries, and signs and symptoms of dental traumas.

In other studies, similar findings have been reported.[24,30] Golinveaux et al. found that some care providers did not have enough information to complete children's oral health records.[8] Furthermore, the IHS entails several questions about different aspects of children's oral and dental health, and PHCPs are required to answer all of these questions. Although all of the participants had answered these questions, they did not know the reasons for asking these questions. Considering the importance of preventive measures, PHCPs must know the reasons behind questions about the family history of dental decay and children's facial and dental traumas.

In this study, PHCPs with different gender, age, educational field and level, work experience, and job performance assessment status had similar concerns and difficulties in providing oral screening for children. As the majority of them had a university degree, it seems that educational courses in university did not cover necessary information about oral health, especially oral screening. On the other hand, the training provided by the health system was not able to meet the real needs of PHCPs in this subject.

Conclusion

PHCPs participating in this study could not perform acceptable oral screening for children and needed more information on how to conduct oral and dental examinations. By providing proper education to meet all the needs of PHCPs and discarding irrelevant topics, the health system may facilitate the delivery of standard oral and dental health services to children.

Conflict of Interests

Authors have no conflict of interest.

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Fibrous histiocytoma of the tongue: A case report

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Case Report

Abstract

BACKGROUND AND AIM: Benign fibrous histiocytoma (BFH) is a rare lesion in the head and neck with a slow, single, and painless growth that consists of fibroblasts and histiocytes. In this study, a BFH case was reported and examined from clinical, microscopic, and immunohistochemical aspects.

CASE REPORT: A 36-year-old man with a red nodule on the dorsal surface of his tongue was referred to the oral medicine department. The appearance of this nodule was similar to the adjacent tissue in its surface. According to the same microscopic view of this lesion with other soft tissue tumors, immunohistochemistry test confirmed the diagnosis. It was treated with en-bloc surgical resection. In four follow-ups up to one year, there was no recurrence. Considering the results of these cases and comparing them with other cases, although there is a slim chance of recurrence in one year, follow up is recommended.

CONCLUSION: Clinical view of FH is not characteristic and tumors with microscopic spindle-shaped appearance are challenging in diagnosis. IHC is obligatory to reach a prompt diagnosis and due to recurrence, follow-up is recommended.

KEYWORDS: Histiocytoma; Benign Fibrous; Tumors; Tongue Disease; Oral Cavity

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Fibrous histiocytoma (FH) is a tumor with mesenchymal origin.[1] FH is divided into benign and malignant categories.[2] The malignant type describes a soft tissue sarcoma known as a histiocytic tumor and fibroblasts with malignant potential, most of which being in the upper and lower limbs, orbit, pelvis, knee, head, and neck.[3-5] Through electronic microscopes and immunohistochemistry (IHC) experiments, the benign type is easily distinguished from the malignant one.[6]

Some of the assumptions about cellular origin are considered as fibroblastic and histiocytic, and others have considered a dendrocyte origin of the cell based on the presence of factor XIIIa.[7,8]

Benign fibrous histiocytoma (BFH) may be cutaneous or non-cutaneous, with the cutaneous type usually found in the skin exposed to sunlight. However, the non-cutaneous BFH only contains 1% of benign lesions that are commonly found in the tissues of the lower extremities (50%) and less in the upper extremities (20%).[9] BFH is divided into superficial and deep forms, with the deep form being very rare and involving subcutaneous tissues. This type of BFH is most common in lower extremities and less in the head and neck.[3,10] BFH is rare in the oral cavity and it was reported in buccal mucosa, tongue, gingiva, alveolar mandibular ridge, maxilla, upper and lower lip, soft palate, and floor of the mouth.[9]

BFH is a painless tumor with a slow growth between 2-3 to 10 cm over a period of

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several months.[2] The symptoms of this lesion occur due to the interference with normal anatomy and physiological functions, for example, difficulty in speech due to masses on the tongue.[11,12]

Its treatment is en-bloc surgical resection. Its prognosis is good and there is no possibility of recurrence in the mouth unless the resection is incomplete and no metastasis has been reported. However, follow-up is recommended for these patients.[3,7,13-15] The purpose of this study is to report a case of BFH in the tongue of the 36-year-old man.

Case Report

The 36-year-old male patient, visited by an otorhinolaryngologist with a feeling of discomfort and firmness in the central region of the dorsum of his tongue. He had a history of about 20 days accompanied by discomfort and interference with speech, without any pain or burning sensation. At the time of examination, a firm well circumscribed red nodule was observed in the dorsum of the tongue with a smooth surface (Figure 1). There was no history of systemic illness and the patient was a non-smoker with no history of alcohol consumption.

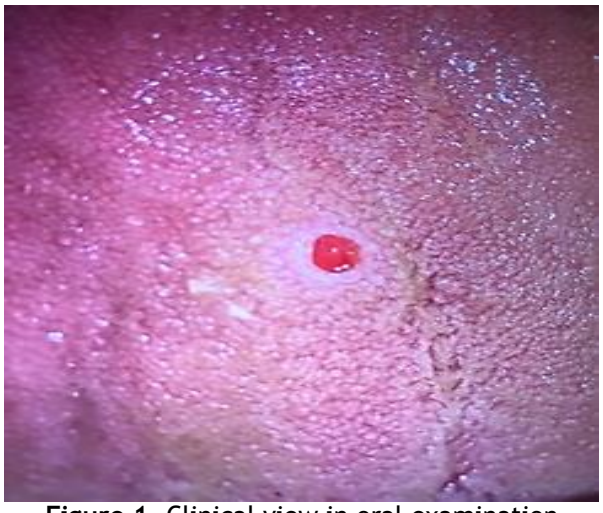

Figure 1. Clinical view in oral examination

The clinical diagnosis of mesenchymal tumor was confirmed. Excisional sampling was performed and histopathologic diagnosis of HF was approved. For further evaluation, the patient was referred to an oral and maxillofacial medicine specialist and was examined about 1 week after the sampling.

A slight firmness in the examination was felt which was diagnosed as to be associated with the scar of the biopsy. A histopathologic review was requested for the second time. Microscopic evaluation of hematoxylin and eosin (H&E) stained slides showed stratified squamous mucosa with a flat-topped subepithelial nodular proliferation of bland-looking spindle or polygonal cells with oval and occasional elongated reniform vesicular nuclei and inconspicuous nucleoli with clear, foamy, or pale eosinophilic cytoplasm filled subjacent connective tissue (Figure 2).

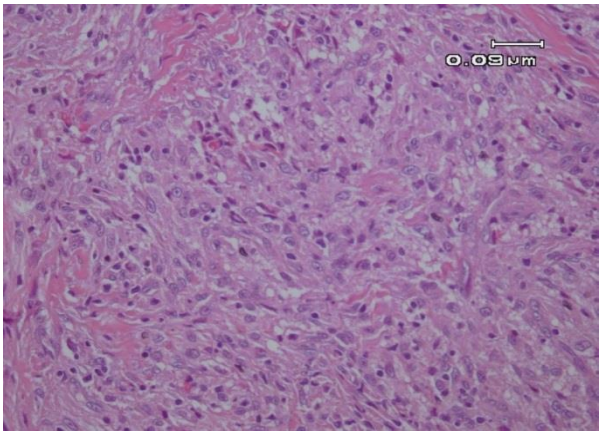

Figure 2. Haphazardly arranged, bland looking spindle cells with no evidence of mitotic figures or cellular atypia, H&E ×100

No abnormal mitosis or necrosis was seen among the neoplastic cells. The immunohistochemical study of tumor cells showed diffuse positivity for CD68. In addition, the tumor cells were negative for both CD1a (Figure 3) and S100 markers (Figure 4). However, S100 marker can be used in determining neural tumors, ki67 (Figure 5) commonly shows proliferative activity, CD1a demonstrates langerhans cells (LC), and CD68 (Figure 6) is positive in cells with fibrohistiocytic origin.

Finally, BFH was rendered as the definite diagnosis. In the four follow-ups up to one year, there was no recurrence. Therefore, the patient was asked to come back in a year.

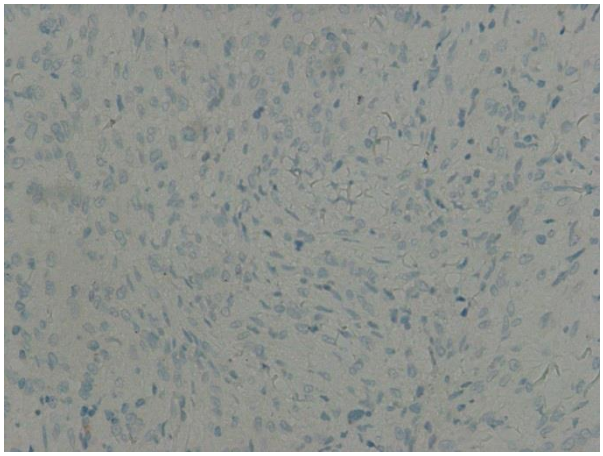

Figure 3. Negative immunohistochemistry (IHC) for CD1a, × 400

Discussion

The cause of BFH has not been detected yet. It can be a proliferative reaction to the source of inflammatory response or a neoplastic process.

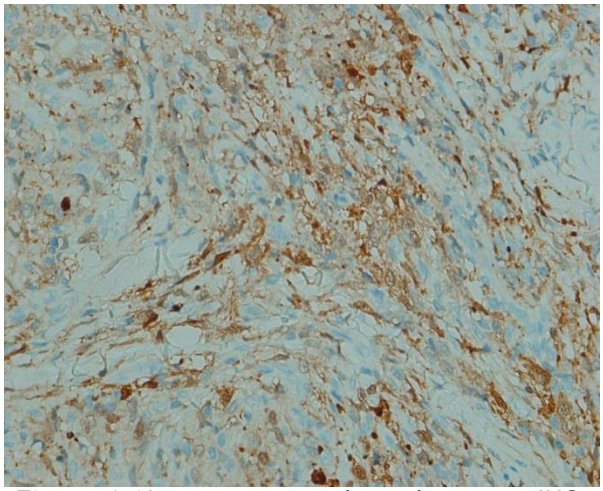

Figure 4. Negative immunohistochemistry (IHC) for S100, × 400

Several cases were created after local injury such as trauma or insect bite or folliculitis that support the inflammatory response theory and other cases support the idea of clonal expulsion associated with the neoplastic process.[7] Clinical diagnosis of oral BFH has features such as slow well-circumscribed enlargement and non-invasive behaviors with intact mucous membranes, and it should be noted that at the clinical level, the disease is not differentiated with other soft tissue neoplasms.[2,7]

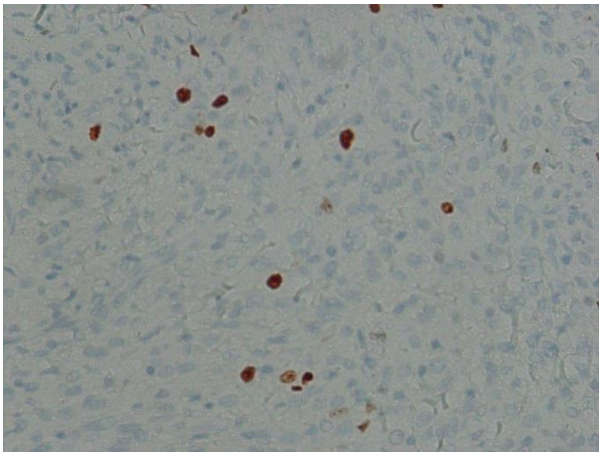

Figure 5. Positive immunohistochemistry (IHC) for Ki67, × 400

There are a few reports on oral BFH mostly indicating a painless nodule on the surface of different parts of the oral cavity like the anterior dorsum of the tongue in subjects under 50 years old, especially in the male patients. It usually takes no longer than six months from presence to diagnosis with discomfort or pain as the most reported complaint.[16-19]

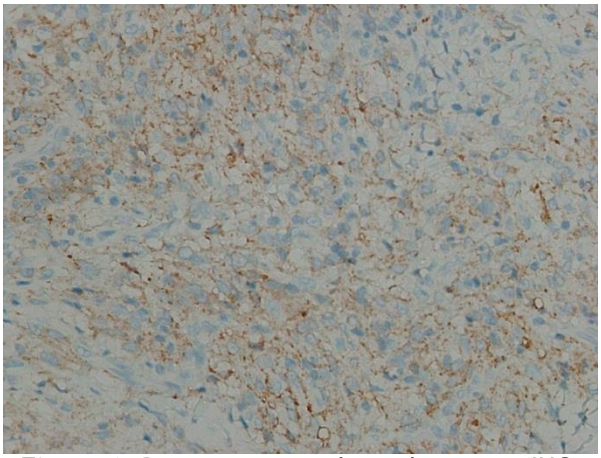

Figure 6. Positive immunohistochemistry (IHC) for CD68, × 400

The present case is the same as other reports in terms of gender and age without any special discomfort due to its slow growth and size.[16,17]

In a review study,[18] the histopathologic view usually showed a non-infiltrating fibrohistiocytic lesion composed of spindle cells. They had vesicular nucleus arranged in

a typical storiform pattern. Oral BFH contained proliferated histiocytes, spindle shaped tumor cells or round histiocyte-like cells, multinucleated giant cells, lipid-containing xanthoma cells, and scattered lymphocytes.[17,20]

Tumors with microscopic spindle-shaped appearance are challenging diagnosis including a spectrum of neoplasms originated from neural tissue (neurofibroma), fibroblastic tissue (fibromatosis), and fibrohistiocytic tissue. In spite of several microscopic findings including wavy-appearance and haphazardly-arranged cellular pattern, IHC staining is necessary to confirm final diagnosis. S100 marker can be used in determining neural tumors, ki67 commonly shows proliferative activity, CD1a demonstrates LC, and CD68 is positive in cells with fibrohistiocytic origin.[16,17]

Today, there is no specific marker for BFH,[9] but with immunohistochemical tests that include low mitosis, atypical cells, vimentin positive, CD68(+), S100(-), CD117(-), LEU7 (-), desmin (-), and SMA (-) can be detected from neurofibroma, leiomyosarcoma, and dermatofibroma.[16,17]

Diagnoses of BFH from malignant fibrous histiocytoma (MFH) is conducted with high cellular polymorphism, high mitotic activation, capsule penetration into the tissue, and revealing hemorrhage and necrosis.[17,21]

Prisse et al. reported BFH to develop in late adulthood and cutaneous form in younger adults since 1975.[22] Recently, most of the lesions in tongue occurred between 20-40-year-old patients and the average age for BFH is 28.5[20,22,23] taken place since 1975. BFH occurs more often in middle age or older years of life, while the cutaneous type occurs in young adults.[7] Moreover, in some studies, considering problems associated with the tongue and by constraining time (from 2000 to date), the dominant age was 20-40 years old,[20,22,23] and the mean of BFH age in the oral mucosa was reported as 28.8 years old.[20,22]

BFH occurs in the oral mucosa more often in women,[22] but in some studies in different populations, the disease is reported to vary in both sexes.[2]

In the study by Kumar conducted on 66 cases of BFH in the period of 1964 to 2016, there were only 7 cases with tongue lesions with 4 male patients. This study showed that 40% and 20% of the lesions occurred respectively in the dorsum and in the anterior part of the tongue.[20]

In a review study, all the BFH patients were treated with local surgical resection or CO_2 laser. Application of the CO_2 laser showed a recurrence which was treated with hemiglossectomy and those with surgical treatment were without recurrence.[23] In another review,[20] the surgical en-bloc treatment was used to treat BFH with a three-year regular following-up period. Since excellent prognosis secondary to a good resection was reported by many authors,[20,22] in the present case, after precise resection and 1,3 ,6, and 12 month follow-ups, no problem emerged.

Conclusion

In this study, a BFH case was reported and examined from clinical, microscopic, and immunohistochemical aspects. Given that BFH is a rare tumor in the mouth, it is essential to perform IHC tests to rule out other lesions. Considering the results of these cases and comparing them with other cases, although there is a slim chance of recurrence in one year, follow up is recommended.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

None.

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