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The Relationship of Oral Mucosal Lesions and Removable Prostheses: Quantitative and Qualitative Study

Gökhan Özkan[1], Yağmur Köksal Yasin[2], Pinar Okyay[2]

[1] Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Aydin Adnan Menderes University, Aydin, Turkey
[2] Department of Public Health, Faculty of Medicine, Aydin Adnan Menderes University, Aydin, Turkey

SUMMARY

Background/Aim: *The aim of this study was to determine the development and distribution of denture-related oral mucosal lesions in patients using removable prosthesis by using quantitative and qualitative research methods.* ***Material and Methods:*** *A 21-item structured questionnaire form was used. Then, patients were evaluated for the presence and types of oral lesions. In the qualitative phase of the study, two focus group interviews were conducted with volunteers among participants of the quantitative part. The quantitative data were first evaluated by the Kolmogorov-Smirnov test for normal distribution. Chi-square test, Mann Whitney U test, t-test and logistic regression were used for statistical evaluation. Qualitative data analysis was manually performed by the content analysis method.* ***Results:*** *This study included 171 subjects. When the participants were classified as lesion and non-lesion groups, cigarette use and duration of prosthesis use were higher in patients with lesions. Denture-related lesions occurred in 46.2% of the participants; prosthetic stomatitis in 23.9% of the denture-related lesions, traumatic ulcer in 12.9%, epulis fissuratum in 9.9%, and angular cheilitis in 5.8%. Of the participants with lesions 72% (n=57) had a single lesion, while 28% (n=22) had multiple lesions. The duration of prosthesis use was longer in patients with lesions (p=0.022). The main themes determined in the qualitative stage were identified as "views on prosthesis use", "features related to prosthesis care", "information sources on prosthesis" and "proposals of participants".* ***Conclusions:*** *Current study shows that denture-related lesions are very common. Patients should be informed in detail and adequately by physicians and specialized nurses in this regard at every stage of treatment. A universal protocol will be very helpful to ensure that patients are provided with all necessary information about wearing dentures, their maintenance and the importance of regular check-ups. Informative meetings should be organized for wider patient groups in which patients may also interactively participate in, and studies to increase oral health literacy should be conducted. The cross-sectional assessment is not enough for risk assessment due to its nature and only declaration based assessment might miss the relations. Follow-up studies combined with qualitative studies with different approaches are needed.*

Key words: Mouth Mucosa, Oral Health, Dentures, Oral Hygiene

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Introduction

In patients with missing teeth, rehabilitation of aesthetic and functional problems with removable or fixed prosthesis increases the quality of life. However, removable prostheses especially predispose the oral environment to the development of oral mucosal lesions[1]. The frequency of oral mucosal lesions is higher in patients using removable prostheses than in those who do not use them[1,2]. Oral mucosa coverage, trauma, incompatibility of prostheses, insufficient hygiene, continuous use of prostheses, and duration of prostheses use are the risk factors for oral mucosal lesions[2-4]. These risk factors may also trigger the formation of oral cancers in addition to characteristic oral mucosal lesions[5]. Prosthetic stomatitis, angular cheilitis, epulis fissuratum, and traumatic ulcer are some of these characteristic lesions[1,6].

Understanding the causes of oral mucosa lesion formation in patients using removable prosthesis is important to produce solutions for these causes. In qualitative research, the relationship between disease and human is examined in depth. Qualitative research helps to understand the underlying behaviors, attitudes, perceptions, and culture in a way that quantitative methods alone cannot do[7].

The aim of this study was to determine oral mucosal lesions and their distribution among patients using removable prostheses, and to evaluate the association between these lesions and prosthesis type, care, duration of use and individual features of patients with qualitative and quantitative methods.

Material and Methods

This study was both a quantitative and a qualitative study. The quantitative step was designed as the descriptive and qualitative step was designed as phenomenological research. The study started in June 2017 and completed in June 2018. Aydın Adnan Menderes University (ADU) Clinical Research Ethics Committee approval (Protocol No: ADUDHF2017/09) was obtained for the study.

Table 1. The questionnaire filled by participants and a dentist

Chapter 1: Sociodemographic Features
1) Age: …..
2) Gender: 1.( ) Female 2.( ) Male
3) Education status : 1.( ) Illiterate 2.( ) Literate 3.( ) Primary school 4.( ) Middle School 5.( ) High school 6.( ) University 7.( ) Master and above
5) Income level: 1.( ) Less than the expenditure 2.( ) Equivalent to expenditure 3.( ) Higher than expenditure
6) The place of longest residence: 1.( ) City 2.( ) District 3.( ) Village

Chapter 2: Information on Medical Status
7) How much cigarettes did you consume throughout your life? 1.( ) Never 2.( ) I am currently smoking 3.( ) I used to smoke 4.( ) Other ……..
8) How many packs per day and how many years have you smoked so far? . . . . . pack(s)-year(s)
9) Do you have a regular medication? 1.( ) Yes 2.( ) No
10) If yes, what is your disease? *(Multiple options can be marked)* 1.( ) Diabetes Mellitus 2.( ) Hypertension 3.( ) Cardiovascular diseases 4.( ) Rheumatic diseases 5.( ) Malignant diseases 6.( ) Other……..
11) What are the names of your regular medicines? ……..

Chapter 3: Prosthesis and Prosthesis Use Characteristics
12) How many years have you been using your prosthesis? ……
13) Prosthesis cleaning frequency: 1.( ) Never 2.( ) ≥ 1 time a day 3.( ) <1 time a day
14) Prosthesis cleaning method: *(Multiple options can be marked*) 1.( ) Water 2.( ) Mechanical (Toothbrush) 3.( ) Chemical (Cleansing tablet) 4.( ) Other …….
15) Using prosthesis at night: 1.( ) Always 2.( ) Often 3.( ) Rarely 4.( ) Never
16) Do you think there is a lesion in your mouth related to your prosthesis? 1.( ) Yes 2.( ) No

Chapter 4: Information to be Filled by the Dentist
17) Prosthesis type: 1.( ) Partial prosthesis 2.( ) Total prosthesis
18) Jaw with prosthesis? 1.( ) Lower and upper total prosthesis 2.( ) Lower and upper partial prosthesis 3.( ) Lower partial and upper total prosthesis 4.( ) Lower total and upper partial prosthesis 5.( ) Only lower total prosthesis 6.( ) Only upper total prosthesis 7.( ) Only lower partial prosthesis 8.( ) Only upper partial prosthesis
19) Is there a lesion related to prosthesis? 1.( ) Yes 2.( ) No
20) Type of lesion: *(Multiple options can be marked)* 1.( ) Prosthetic stomatitis 2.( ) Epulis fissuratum 3.( ) Unstable crest 4.( ) Frictional keratosis 5.( ) Traumatic ulcer 6.( ) Angular cheilitis 7.( ) Irritation fibroma 8.( ) Cheek bite 9.( ) Proptosis 10.( ) Other ……
21) Metal framework in prosthesis: 1.( ) Yes 2.( ) No

In this study, a 21-item structured questionnaire (Table 1) form including socio-demographic features, prosthesis type, use, and clinical features and focused group interview technique with a semi-structured interview form including 7 main questions and 23 sub-questions were used. For the quantitative stage of the study, 171 patients who applied to Outpatient Clinic of Aydın Adnan Menderes University Faculty of Dentistry between June 2017 and November 2017 included in the study. The questionnaire was applied with a face-to-face interview method and then the patients were evaluated by a specialist in terms of the type of prosthesis, in which jaw it was, and the presence of a metal infrastructure in the prosthesis. Alveolar crest and surrounding soft tissues were assessed and the presence of denture-related lesions were examined.

In the qualitative phase of the study, two focus group interviews were conducted with eight volunteers among participants participated in the quantitative part. Participants in the groups were selected by an easily accessible and analogous sampling method. Prior to the interview, the participants were verbally informed about the study. Participants gave verbal permission to participate in the study and to use of a voice recorder. The talks were held in a seminar hall with a U-table layout in the ADU Dentistry Faculty with a moderator and a reporter. Each interview was conducted in groups of four persons and lasted 35 and 32 min, respectively. The

citations belonging to participants in the text are given together with age and gender.

The data obtained in the quantitative step were first evaluated with Kolmogorov-Smirnov for normal distribution. Descriptive statistics were a percentage and in normally distributed variables mean and standard deviation; non-normally distributed data were given with median and minimum-maximum values. Chi-square test, Mann Whitney U test, t-test and logistic regression were used for statistical evaluation. Type 1 error level was accepted as 0.05. Qualitative data analysis was manually done by the content analysis method. Interviews were transferred to the text by a researcher and then controlled by the other researcher. Then, a total of 13 pages of data were analyzed by two experienced researchers. The themes determined at the beginning of the study through literature were associated to the themes obtained by the analysis and then the themes were finalized by consensus. Thus, 18 codes and 4 themes were created (Figure 1).

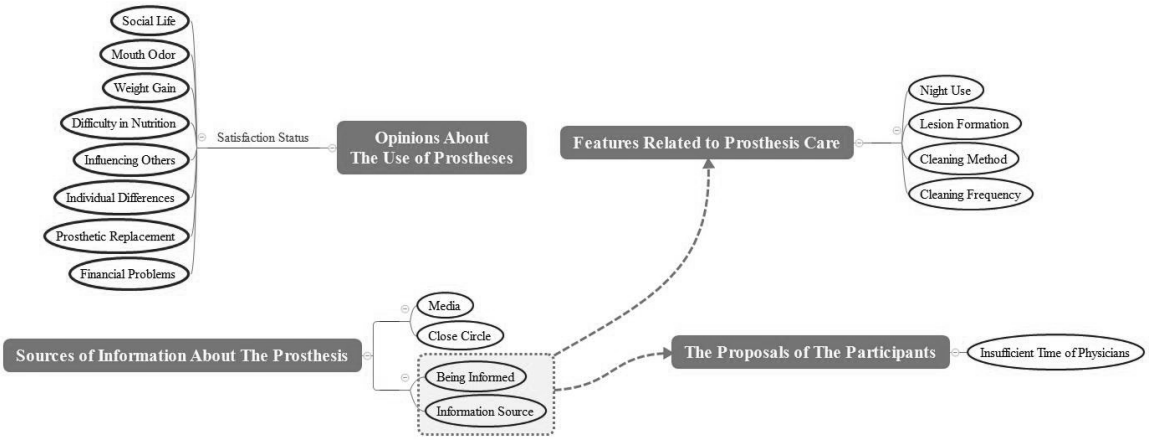

Figure 1. Codes and themes related to qualitative data

Results

Quantitative Findings

This study included 171 subjects. 57.3% of the participants (n=98) were women, and the mean age was 63.07 ± 9.53; 22,2% (n=38) of the participants had high school and above education level. 43.3% (n=74) of the participants were unemployed or were housewives, and the income level of 55.6% (n=95) was "income equivalent to expenditure". 53% (n=89) of participants had a smoking history in the past or now. The median cigarette use of these participants was 20 pack-years (min: 0.5; max: 110). When the participants with and without lesions were compared, cigarette smoking was more frequent in patients with lesions (25 years median via 15 years median) (p: 0.022; u: 511000, df: 75).

Denture-related lesions occurred in 46.2% of the participants (n=79). Prosthetic stomatitis was found in 23.9% (n=41) of the denture-related lesions, traumatic ulcer in 12.9% (n=22), epulis fissuratum in 9.9% (n=17), and angular cheilitis in 5.8% (n=10). Of the participants with lesions 72% (n=57) had a single lesion, while 28% (n=22) had multiple lesions. The lesion distributions of the participants are given in Table 2 and Figure 2.

The mean age of participants with lesions was 63.39 ± 9.64; without lesions was 62.80 ± 9.48 and there was not a statistically significant difference (p: 0.689; t: 0.401, df: 169). Association between the other socio-demographic characteristics of the participants and the lesion are given in Table 3.

The median duration of prosthesis use of the participants was 5 years (min: 1 max: 35). Comparison of the participants with and without lesions demonstrated that duration of prosthesis use was longer in patients with lesions (6 years median via 5 years median) and this difference was statistically significant (p:0.022; u:2898; 500, df: 169). 69,2% (n=117) of the participants cleared their prostheses at least once a day. 20.2% (n= 34) of the participants stated that they only cleaned the prosthesis with water, 47.3% (n= 81) stated that they never removed their prostheses at nights. The relationship between prosthesis use, characteristics of the use and the presence of lesion is given in Table 4. The lesions were more frequent in the participants who thought that they had denture-related oral lesions (p <0.001; χ2nd: 17.574; df: 1).

For risk assessment, two different kinds of logistic regression modeling were performed. First, all of the significant variables determine in the current study and literature based significantly related variables although not significantly related in the current study were entered in the model. And secondly, another model including only all of the significant variables determine in the current study was settled. At the end of both of the models, no significant risk could be determined.

Table 2. Lesion type distribution of the study group

Type of lesion	n	%
Single lesion		
Prosthetic stomatitis	30	17.5
Traumatic ulcer	15	8.8
Epulis fissuratum	7	4.0
Unstable crest	3	1.8
Frictional keratosis	1	0.6
Proptosis	1	0.6
Irritation fibroma	0	0.0
Angular cheilitis	0	0.0
Cheek bite	0	0.0
Total	57	33.3
Multiple lesions		
Prosthetic stomatitis + Epulis fissuratum	4	2.4
Traumatic ulcer + Anguler cheilitis	4	2.4
Epulis fissuratum + Angular cheilitis	3	1.8
Prosthetic stomatitis + Unstable crest	2	1.1
Prosthetic stomatitis + Friction keratosis	2	1.1
Prosthetic stomatitis + Angular cheilitis	2	1.1
Prosthetic stomatitis + Traumatic ulcer	1	0.6
Traumatic ulcer + Epulis fissuratum	1	0.6
Traumatic ulcer + Epulis fissuratum	1	0.6
Epulis fissuratum + Irritation fibroma	1	0.6
Friction keratosis + Angular cheilitis	1	0.6
Total	22	12.9
Allover total	79	46.2

Table 3. Association of the participants' socio-demographic characteristics and lesion

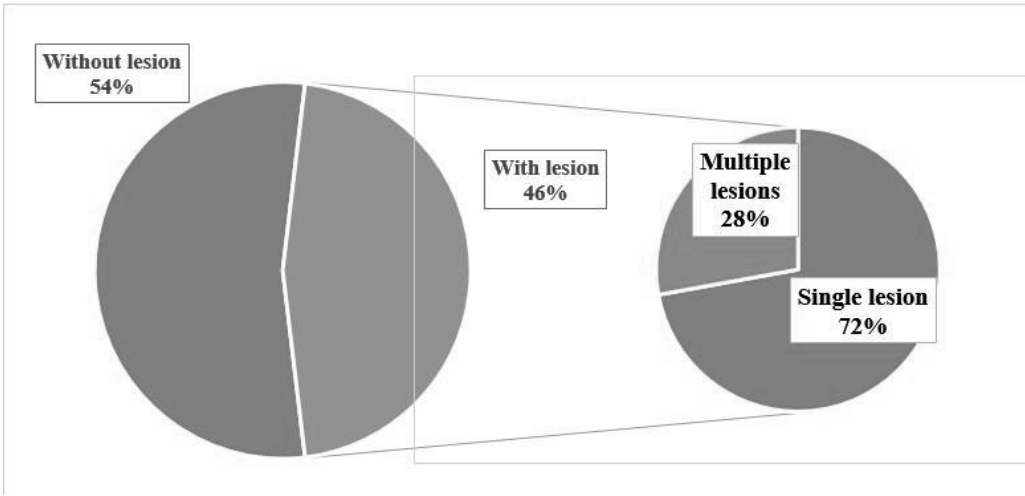

Figure 2. Lesion distribution of the participants

Socio-demographic Characteristics		Total n	Total %	Presence of Lesion: Yes n	Yes %	No n	No %	χ^2	p
Gender (n = 171)	Female	98	57.3	44	44.9	54	55.1	0.156	0.693
	Male	73	42.7	35	47.9	38	52.1		
Education status (n = 171)	Below high school	133	77.8	62	46.6	71	53.4	0.042	0.838
	High school and above	38	22.2	17	44.7	21	55.3		
Current occupation (n = 171)	Unemployed/Housewife	74	43.3	36	48.6	38	51.4	0.315	0.575
	Employed	97	56.7	43	44.3	54	55.7		
Income level (n = 171)	Income is less than the expenditure	66	38.6	33	50.0	33	50.0	1.790	0.409
	Income is equivalent to expenditure	95	55.6	40	42.1	55	57.9		
	Income is higher than expenditure	10	5.8	6	60.0	4	40.0		
So far, the place of longest residence (n = 171)	City	70	40.9	30	42.9	40	57.1	1.689	0.430
	District	55	32.2	24	43.6	31	56.4		
	Village	46	26.9	25	54.3	21	45.7		

Table 4. Association of prosthesis and prosthesis use characteristics of the participants with lesions

Prosthesis and Prosthesis Use Characteristics		Presence of Lesion: Yes n	Yes %	No n	No %	χ^2	p
Prosthesis cleaning frequency (n= 169)	≥ 1 time a day	47	40.2	70	59.8	**5.477**	**0.019**
	<1 time a day	31	59.6	21	40.4		
Prosthesis cleaning method (n= 168)	Only water	22	64.7	12	35.3	**6.115**	**0.013**
	Mechanical and/or chemical	55	41.0	79	59.0		
Using prosthesis at night (n= 169)	Always	45	55.6	36	44.4	**4.850**	**0.028**
	Other	34	38.6	54	61.4		
Prosthesis type * (n= 171)	Partial prosthesis	28	41.2	40	58.8	4.056	0.132
	Total prosthesis	33	56.9	25	43.1		
	Partial and total prosthesis	18	40.0	27	60.0		
Jaw with prosthesis * (n= 171)	Lower jaw	2	25.0	6	75.0	3.639	0.162
	Upper jaw	6	31.6	13	68.4		
	Lower and upper jaw	71	49.3	73	50.7		
Prosthesis type and jaw with prosthesis * (n= 171)	Lower-upper total prosthesis	29	58.0	21	42.0	11.027	0.137
	Lower-upper partial p.	24	49.0	25	51.0		
	Lower partial, upper total p.	13	36.1	23	63.9		
	Lower total, upper partial p.	5	55.6	4	44.4		
	Only upper partial p.	2	16.7	10	83.3		
	Only upper total p.	4	57.1	3	42.9		
	Only lower partial p.	2	28.6	5	71.4		
	Only lower total p.	0	0.0	1	100.0		
Metal framework in prosthesis * (n= 167)	Yes	45	42.1	62	57.9	0.981	0.322
	None	30	50.0	30	50.0		

* Filled by a dentist.

Qualitative Findings

From eight participants five were women, three were men, and the median age was 58 (min: 51, max: 71). The main themes were determined as "*opinions about the use of prosthesis*", "*features related to prosthesis care*", "*information sources on prosthesis*" and "*proposals of participants*".

Opinions about the use of prostheses

Participants stated that they had difficulty depending on the foods, especially while eating small-grain foods or dried nuts. Participants said that satisfaction with prosthesis use was multi-factorial. Individual differences were one of these factors. They expressed that they were grateful for themselves as they saw prosthetic users who were worse than themselves. One participant said that he had to renew his prosthesis, but he could not afford it.

62, M: "I often remove my palate while I eat. I cannot get a taste of the meals and I can't chew what I eat since I got it. When I'm talking it stays in my mouth, but when I try to eat, it is getting out. "

Other reasons disturbing the participants due to prosthesis use were mouth odor, weight gain, and effects on social life. They complained from mouth odor especially when they neglected cleaning of the prosthesis, their family members usually noticed it, and they gained weight because they cannot completely chew the food. One participant stated that he did not want to talk in public because of his prosthesis.

63, F: "I get bothered when I get my prosthesis out. I do not want my daughter to see me when I am washing my prosthesis, I'm ashamed."

Features related to prosthesis care

It was found that most of the participants used a tablet or brush to clean their prosthesis. One of the participants said that he thought a lesion would be formed when he didn't clean his prosthesis so he used to clean after every meal. Another participant said that he would not concern about lesions so he did not care for cleaning. Most of the participants said they did not remove their prosthesis at nights. They said that they removed prosthesis when it causes discomfort and they did not remove it otherwise. Participants stated that they did not know that the prosthesis needed to be removed at night, that they had not heard anything like this and were not informed.

59, K: "My uncle said he removes his prosthesis at nights. I did not know that. They just didn't tell me to remove it. "

Sources of information about the prosthesis

Participants stated physicians, close contacts, and media as sources of information about the prosthesis. Some of them told that their physicians informed and guided about prosthesis selection, while others said that their physicians gave no information to them.

62, E: "...We're listening and learning from television generally. Doctors give information there. We get familiar with it. We learn from the media I mean... "

The proposals of the participants

Participants expressed that they were not informed by their physicians about prosthesis and prosthesis care and that their physicians did not spend enough time with their patients. They offered suggestions on this situation.

51, K: "Please inform patients abundantly. Make them suggestions. Offer good suggestions, but allow the patient to decide. But it's very important to inform. "

Discussion

The rate of oral mucosal lesions due to the removable prosthesis in our study was very high. It is very prevalent, approximately in half of the patents. In patients using a removable prosthesis, Martori *et al.*[1] reported 54%, da Silva *et al*.[4] reported 50%, Mubarak *et al*.[8] reported 20.5%; Taheri *et al*.[9] reported 71.8% rate of lesion formation. In this study, the most common lesions were denture stomatitis (23.9%), traumatic ulcer (12.9%), epulis fissuratum (9.9%) and angular cheilitis (5.8%). In some studies[4,9,10-12], the most commonly seen lesion was denture stomatitis though different results are also available. Martori *et al*.[1] reported the most common lesion as angular cheilitis (34%), Mandali *et al*.[3], Jainkittivong *et al*.[6] and Patil *et al.*[5] as traumatic ulcer (92.2%; 19.5% and 6.1%, respectively), Mubarak *et al*.[8] as epulis fissuratum (41.9%).

According to the results of the study, there was no correlation between denture-related oral mucosal lesions and demographic variables evaluated. Martori *et al*.[1] reported that oral mucosal lesions associated with prosthesis increased significantly with age. Mandali *et al*.[3] reported that the most important factors in lesion formation were age and duration of prosthesis use. da Silva *et al*.[4] reported that lesions were seen more frequently in women over 40 years of age, and they attributed this to hormonal changes. Similar to our study, Mubarak *et al*.[8] reported that there was no significant difference between gender and lesion formation, but that lesion formation increased with age. Turker *et al*.[2] didn't find an association between age and lesion formation but they reported that only in hard palate lesions there was a difference according to gender. Consistent with many studies in the literature we found that as the duration of prosthesis increases, lesion formation also increases[3,8,10,13].

According to the results of this study, fewer lesions were observed in patients who clean their prostheses

at least once a day. Similar to our study, studies have reported that the rate of lesion formation decreases as the number of cleanings increases[4,9]. In our study, more oral mucosal lesions were seen in those who cleaned the prosthesis only with water, compared with patients who used mechanical and chemical cleaning methods. Some of the participants said they cleaned the prosthesis regularly because otherwise, lesions will develop, while others said they did not take care of the cleanliness because they thought the lesion would not occur. The participants could not reach a consensus on this issue.

Yalcinkaya *et al*.[13] noted that the prolonged use of the prosthesis, not removing the prosthesis at nights, and the storage environment when the prosthesis is removed, are more important than the frequency of prosthesis cleaning in lesion formation. In our study, there were more lesions in the participants who did not remove their prostheses at nights. Participants in the interviews often stated that they did not remove their prosthesis at night; they removed rarely when they were uncomfortable. The reasons for not removing the prosthesis at nights were they didn't believe its necessity, they were ashamed when removing and then reinserting the prosthesis, and they lacked information about the use of prosthesis. Patients also addressed the difficulties in using removable prostheses. Social and psychological problems, mastication problems, speech impairments, impaired fit of the prosthesis over time, loss of taste and sensation, reduction in the intake of hard-to-chew foods are various challenges of prosthesis use reported in the literature[10,14,15]. Physicians should inform their patients about the difficulties they may encounter when using prosthesis.

The qualitative findings of the study emphasize some points of prosthetic care that can cause lesions in patients who use prosthesis. The participants stated the major problem about prosthesis care as the lack of adequate information from physicians. Without adequate information, they don't know method and duration of cleaning, and necessity of removal at nights. They do not know that if they do not apply these precautions, they will have lesions in their mouths. Without necessary information from their physicians, they receive unreliable information from media. Efforts should be made to improve oral health literacy so that participants benefit more from the information they receive from physicians. However, given the fact that patients using removable prostheses are at older ages, it would be beneficial to establish a system in which one-to-one counseling service can be provided. In this regard, it seems necessary for a health team member other than a physician to conduct the counseling service. Just like nurses who conduct diabetes or ileostomy counseling, oral dental health and especially prosthetic counseling can be performed by a nurse or health professional that has been specially trained in this area.

The patients did not have sufficient information about the long-term use and care of their prostheses. A combination of mechanical and chemical cleaning yields has been proposed in the literature[4,8,16]. To reduce levels of biofilm and potentially harmful microorganisms Felton *et al*.[17] reported an evidence-based guideline. According to the guideline, prostheses should be cleaned daily by wetting and brushing with a nonabrasive denture cleanser. Before reinsertion of the prostheses into the oral cavity, they should be rinsed after wetting and brushing with denture-cleansing solutions. Prostheses should not be kept for more than 10 min in products containing sodium hypochlorite. In addition, prostheses should be stored in water after cleaning to prevent warping.

To control fungal infections and denture stomatitis, daily manual cleaning is still optimal method. Microwave oven use is not a standard protocol for prosthetic disinfection. However, it can be utilized for long-term care patients[18,19].

One of the most important points of the study is the patients' opinion about whether or not they had a lesion related to prosthesis. This issue has not been discussed much in the literature. da Silva *et al.*[4] also stated that 80.4% of the patients were not aware of denture-related lesions. According to the results of our study, a statistically significant relationship was found between the presence of lesions and the patients' thought that they had oral mucosal lesions due to the prosthesis.

In this study, a significant risk could not be determined by logistic regression modeling. Although in the qualitative part of the study, the participants determined many problems, there was a restriction for risk assessment for the quantitative part. The cross-sectional approach includes a causality problem due to its nature. And without a tool to determine how effective did what they said they had done, the declaration based assessment might miss the relations. This finding also shows the importance of follow-up studies and need of qualitative studies with different approaches.

The study only included patients admitted to the faculty of dentistry. These patients may be insufficient to reflect the entire society. This group of patients can be considered to be the most informed and capable group of the community because they could come to tertiary care institutions.

In conclusion, denture-related lesions are very common in patients using removable prosthesis. Patients using removable prosthesis should be followed up regularly, these intervals should be tightened if necessary according to the duration of the prosthesis used, and structured counseling on prosthesis use and care techniques should be given. Patients should be informed in detail and adequately by physicians and specialized nurses in this regard at every stage of treatment. Informative meetings should be organized for wider patient groups in which patients may also

interactively participate in, and studies to increase oral health literacy should be conducted. There should be a universal protocol, oral with a mandatory written statement, to ensure that patients are provided with all necessary information about wearing dentures, their maintenance and the importance of regular check-ups. Dental curriculum should be revised to provide more time for patients' use of prosthesis, possible lesions related to prosthesis, and maintenance of hygiene. Post graduate vocational courses should be organized in order to update knowledge about these issues.

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Correspondence:

Gökhan Özkan
Department of Oral and Maxillofacial Radiology,
Faculty of Dentistry, Aydin Adnan Menderes University, Aydin, Turkey
e-mail:asgokhanozkanus@hotmail.com