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Does the Presence of Anterior Mandibular Teeth Increase the Incidence of Denture Stomatitis?

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Abstract

Purpose: To compare the frequency of denture stomatitis (DS) under maxillary complete dentures (CDs) in patients with opposing mandibular distal extension removable partial dentures (RPDs) and CDs.
Materials and Methods: Participants included 365 maxillary CD wearers (241 women, mean age 70.5 ± 13.2 years; 124 men, mean age 71.5 ± 10.4 years) from 7 rest homes in Istanbul. A total of 268 had mandibular CDs; 97 had mandibular distal extension RPDs. Two independent, calibrated examiners performed oral examinations. Presence of maxillary denture-related stomatitis and the effect of risk factors on DS were evaluated and recorded.
Results: The frequency of palatal DS (Newton I-III) was 45.1% (n = 121) in the mandibular CD group and 49.5% (n = 48) in the mandibular distal extension RPD group, a statistically insignificant difference ($p = 0.4$). Factors significantly associated with palatal DS were maxillary denture age ($p = 0.02$), reduced occlusal vertical dimension ($p = 0.04$), and nocturnal denture wear ($p = 0.03$).
Conclusion: In this study, DS beneath maxillary CDs did not differ between mandibular distal extension RPD and CD wearers. The presence of mandibular anterior teeth did not influence the occurrence of palatal DS.

The palatal mucosa is the most common location for intraoral lesions.[1-4] The most prevalent lesions are those caused by stomatitis,[1,5-9] graded clinically into three types.[10] Although there is presently no consensus on the etiological factors of denture stomatitis (DS), poor oral hygiene, nocturnal denture wear, trauma, smoking, systemic conditions, allergic reactions to denture base materials, and bacterial and fungal infections, particularly *Candida albicans,* have all been proposed as causal or associated factors.[11-22] Immunological aspects have also been added to the multifactorial pathogenesis of DS.[23]

Trauma due to unstable dentures has also been suggested as a factor giving rise to denture irritation and DS.[4,12,24,25] Occlusal relationships are another factor that can alter the pattern of stress distribution under denture bases;[26-35] thus, it would be a reasonable expectation that DS under maxillary complete dentures (CDs) could be affected by mandibular dentures or natural teeth.[17] It has been demonstrated that covering palatal mucosa with a denture base, without mechanical pressure, reduces physiological stimulation without histopathological changes.[36] These changes in denture-supporting tissues have been shown to be dependent on the amount and distribution of occlusal pressure.[37] Similarly, in edentulous patients, denture irritation has been observed ten times more frequently in those patients wearing maxillary and mandibular dentures than in those wearing only maxillary dentures.[4]

Kelly was the first to emphasize the importance of natural mandibular anterior teeth in causing traumatic changes in palatal mucosa under maxillary CDs. Later, these changes were named Kelly's syndrome, or combination syndrome.[38,39] Kelly assumed that attrition of artificial posterior teeth over time resulted in undesirable occlusal contacts between natural and artificial anterior teeth. These premature anterior contacts have been reported to disturb the stability of maxillary CDs and increase the formation of inflammatory papillary hyperplasia of the palate.[38] The frequency of palatal DS was found to be similar in maxillary and mandibular CD wearers compared to maxillary complete and mandibular removable partial denture (RPD) wearers.[21] However, Emami et al found that patients who wore conventional CDs were almost five times more likely to have palatal DS than those who wore mandibular two-implant overdentures. Since dynamic contacts of denture teeth transmit forces to denture-bearing tissues, instability of

mandibular dentures can affect the opposing denture-bearing mucosa.[17]

In a recent study[40] the amount of movement in maxillary CDs during chewing was found to be smaller in mandibular distal extension RPD wearers than in mandibular CD wearers. In light of these data, it is obvious there is a lack of consensus on the occurrence of palatal DS under maxillary CDs with opposing mandibular CDs compared to mandibular distal extension RPDs. The authors of this article did not find any clinical study detecting the presence of all symptoms confirming Kelly's syndrome.

The aim of this study was to compare the presence of palatal DS under maxillary CDs in patients with opposing mandibular distal extension RPDs and CDs. The null hypothesis was that the existence of natural anterior mandibular teeth did not increase the incidence of DS under maxillary CDs.

Materials and methods

From seven rest homes in Istanbul, a total of 410 maxillary CD wearers who were currently using their dentures and agreed to participate in the study were examined. Among this population, 365 people (241 women, mean age 70.5 ± 13.2 years; 124 men, mean age 71.5 ± 10.4 years) had mandibular CDs (n = 268) or distal extension RPDs (n = 97). The study protocol was approved by the ethics committee of Istanbul University, and the patients were enrolled in the study only after providing informed consent.

Two independent, qualified examiners performed the oral examinations. The presence of palatal DS was recorded, and the following risk factors for DS were evaluated: age and gender of participants, smoking, type of lower denture, number of remaining teeth, age of maxillary denture, nocturnal denture wear, adaptation, maxillary denture hygiene, occlusal contacts, and occlusal vertical dimension (OVD). Occlusal contacts were determined with 40-μm articulating paper (Bausch Articulating Papers, Nashua, NH) and were evaluated according to their distribution over the occlusal table as contact between anterior teeth, contact between posterior teeth, and contact between both anterior and posterior teeth.

DS was scored using Newton's classification index[10] as follows: I. Slight inflammation (slight localized hyperaemia); II. Moderate inflammation (generalized erythema); III. Severe inflammation (diffuse and papillary hyperplasia). Pinpoint areas of hyperemia on the palate, distributed under the maxillary denture base, were evaluated as Newton type I (Fig 1), whereas a widespread, red, inflamed mucosal surface was regarded as Newton type II stomatitis (Fig 2). The presence of inflammatory papillary hyperplasia was the reason for including a participant in the Newton type III group (Fig 3).

A denture hygiene index[20] was used to score plaque on the tissue surface as follows: none or very little plaque; less than half the denture base covered by plaque; more than half the denture base covered by plaque. This was evaluated as good, moderate, or poor denture hygiene, respectively.

The dentures were checked for both retention and stability. Dentures displaying enough resistance to vertical movements and lateral forces were classified as "adequate retention." Those that did not resist the forces were simply recorded as "poor retention" group. Evaluation of stability was made according to the amount of rocking of denture bases on supporting structures. The samples were divided into two groups; "adequate stability" (slight or no rocking) and "poor stability" (extreme rocking). Dentures were considered to show a lack of adaptation if they demonstrated either poor retention or poor stability.[28]

Figure 1 Palatal stomatitis Newton type I.

Figure 2 Palatal stomatitis Newton type II.

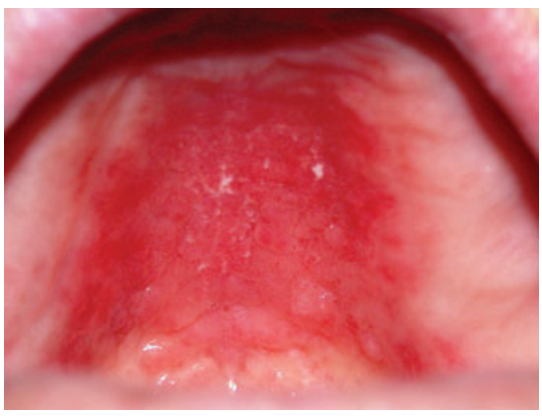

Figure 3 Palatal stomatitis Newton type III—inflammatory papillary hyperplasia.

Table 1 Palatal denture stomatitis severity by mandibular denture type

	Palatal mucosa				
Mandibular denture type	Healthy n (%)	Newton I n (%)	Newton II n (%)	Newton III n (%)	p^*
Complete	147(54.9%)	64(23.9%)	37(13.8%)	20(7.5%)	0.4
Distal extension RPD	49(50.5%)	31(32.0%)	12(12.4%)	5(5.2%)	

*Chi-square and Fisher's exact test; comparison between healthy (without denture stomatitis) and Newton I-III combined.

Table 2 Differences between healthy (without denture stomatitis) and denture stomatitis groups concerning various parameters. (Chi-square and Mann Whithey-U tests)

	n	Healthy	DS	*p*
Age of participants	365	70.7 ± 10.1	70.3 ± 11.1	0.6
Gender (women)	241	51%	49%	0.3
Smoking	57	58%	42%	0.6
Number of remaining teeth	97	4.8 ± 2.3	4.2 ± 2.2	0.2
Adaptation (poor)	194	51.5%	48.5%	0.6
Hygiene (none or very little plaque)	51	52%	48%	0.2
Type of occlusal contact (only anterior)	12	58%	42%	0.5
Vertical dimension (reduced)	214	49%	51%	0.04*
Nocturnal denture wear	76	49%	51%	0.03*
Age of maxillary denture	354	10.2 ± 8.7	12.2 ± 9.4	0.02*

All analyses were carried out using NCSS 2007 and PASS 2008 statistical software (NCSS, Kaysville, UT). Chi-square, Fisher's exact chi-square, and Student's *t*-test were used to compare groups for the frequency of DS and the influence of risk factors on DS. The Mann-Whitney *U* test was used to compare DS and healthy (without DS) mucosa with respect to the maxillary denture age. The differences were considered statistically significant at $p < 0.05$.

Results

The frequency of palatal DS under maxillary CDs for the entire sample was 46.3% (n = 169). Table 1 shows the distribution of palatal DS by mandibular denture type. Inter-observer agreement in diagnosing DS was high (kappa 0.9). The frequency of DS (Newton I-III) was 45.1% (n = 121) in the mandibular CD group, and 49.5% (n = 48) in the mandibular distal extension RPD group. This was not statistically significant ($p = 0.4$).

Age and gender of patients, smoking, number of remaining teeth, adaptation, maxillary denture hygiene, and type of occlusal contact were not significantly associated with DS. Maxillary denture age, reduced OVD, and nocturnal denture wear were significantly associated with DS (Table 2). Participants with DS had maxillary dentures that were, on average, 2 years older than the dentures in healthy (without DS) participants, and this difference was statistically significant (Table 2). Nocturnal denture wear and reduced OVD did not differ significantly between the denture groups ($p = 0.5$ and $p = 0.08$, respectively); however, a difference was seen in the age of maxillary dentures (Table 3), although when the patients were clustered by maxillary denture age, this difference was not statistically significant.

Table 3 Comparison of maxillary denture ages in cases with mandibular complete and removable partial distal extension dentures

		Age of maxillary denture (year)		
	n	Mean	SD	p^*
Mandibular complete denture group	261	12.5	9.6	<0.001
Mandibular distal extension RPD group	93	7.3	6.1	

*Mann-Whitney U test.

Discussion

DS is a common and longstanding problem in removable denture wearers.[15] The prevalence of DS in this study was 46.3%, similar to the 44% prevalence previously reported in a Turkish sample.[14] These results were also within the range of values reported in studies from other countries.[1,9,18]

Epidemiological studies of mucosal changes in denture wearers have reported a low prevalence of papillary hyperplasia of the hard palatal mucosa, also called papillomatous stomatitis,[8,9,16,21,39] or Type III stomatitis (Newton's classification).[10] The technique of pooling Newton's classifications for analysis of DS has previously been used in several studies.[11,17,21,22] In this study, the prevalence of papillomatous stomatitis under maxillary CDs was found in 7.5% of mandibular CD wearers and in 5.2% of mandibular distal extension RPD wearers (nonsignificant difference). Although the types of RPDs were not specified in the study by Shulman et al, they reported the prevalence of papillomatous stomatitis under maxillary CDs was 11.2% in mandibular CD wearers and 6.3% in mandibular RPD wearers.[21] The findings of this study were consistent with these results; however, when Newton's classification was pooled, Shulman et al[21] reported these values as 25.6% for mandibular CD wearers and 29.0% for partial denture wearers, compared to 45.2% and 49.6%, respectively, in this study (Table 1). The corresponding percentages of the two studies were apparently different; Shulman et al did not perform a statistical evaluation. No significant difference was found between the groups in this study, but the differences between the groups were remarkably small in both studies.

Ideas about the etiology of DS have evolved over time. Five to six decades ago the most important etiological factors were thought to be trauma caused by dentures.[2] Later, a multifactorial etiology was embraced.[2] Today, trauma is still noted among the etiological factors.[17] Other reported risk factors differ across studies, mainly due to different sample selection criteria.[1,14,21] In this study, only age of maxillary dentures, nocturnal denture wear, and reduced OVD were found to be significant. Age of patients, gender, smoking, type of mandibular

denture, number of remaining teeth, adaptation, maxillary denture hygiene, and occlusal contacts were not found to be statistically significant relative to DS. The findings in this study were in agreement with the literature with respect to age of patients,[6,16,17,21,22] gender,[16,17,21] smoking,[16,17] nocturnal denture wear,[6,16-18,21,22] occlusal relationships,[16,18] maxillary denture hygiene,[16-18] age of maxillary dentures,[16,18] and adaptation of denture bases to edentulous jaws.[17] Kossioni concluded that denture age may be an etiologic factor for development of DS under maxillary dentures, because dentures become ill-fitting over time.[16] Although retention and stability in this study were found not to be statistically significant with DS, a significant relationship was observed between retention/stability and maxillary denture age. This seemingly controversial finding could be due the multifactorial nature of the etiology of DS.

Mechanical forces are recognized for their important role in tissue changes; they may also be responsible for development and persistence of DS.[24,25] According to Emami et al stable dentures may offer more consistent biting force vectors, thereby reducing trauma to denture-bearing mucosa.[17] A correlation between bone resorption, bite forces, and chewing ability has been described by several authors.[29,30] As far back as the 1940s, investigations demonstrated a decrease in chewing efficiency associated with deterioration and loss of natural teeth. Using fractional sieving as a test method, Helkimo et al[31] reported a clear correlation between dental status and chewing efficiency. Using questionnaires, Agerberg and Carlsson[32] found a gradual decline in masticatory ability correlated with the number of teeth lost; however, bite force and masticatory performance have been reported not to differ between CD wearers and individuals wearing mandibular RPDs in combination with maxillary CDs.[33,34]

de Souza et al[40] concluded that the presence of tooth proprioception may result in smaller movements of maxillary CDs during chewing in patients with mandibular RPDs compared to mandibular CD wearers. Furthermore, Emami et al[17] pointed out that mandibular dentures stabilized with two implants caused less palatal DS than conventional mandibular dentures opposing maxillary CDs. On the other hand, in cases with maxillary CDs and mandibular distal extension RPDs, attrition of the artificial posterior teeth was expected to result in undesirable occlusal contacts between natural and artificial anterior teeth over time. Anterior tooth contacts have been reported to disturb the stability of maxillary CDs and increase the formation of inflammatory papillary hyperplasia of the palate.[38] Thus, it can be expected that severity and emergence of palatal DS under maxillary CDs differs with opposing denture situations; however, in this study it was found that the prevalence of palatal DS did not differ between mandibular conventional dentures and distal extension RPD wearers. While Emami et al[17] examined newly fabricated dentures, de Souza et al's patients[40] had worn their dentures for 6 months to 24 months. In this study, the mean age of maxillary dentures was nearly 10 years. Since the results of this study showed a direct relationship between age of maxillary dentures and DS, it may be expected that the divergence in ages of dentures in the above-mentioned studies from this study might account for the difference in results. Furthermore, Emami et al[17] compared implant-retained overdentures instead of RPDs with conventional CDs. This might also explain the differences between the results in the two studies.

It may be expected that relining, rebasing, or tooth rearrangement of dentures may minimize DS. These factors were not taken into consideration in this study and are a limitation of this research.

This study was the first to examine the relationship between palatal DS and the number of remaining mandibular teeth. In participants who wore maxillary complete and mandibular distal extension RPDs, the number of remaining lower teeth was 4.8 ± 2.3 for healthy (without DS) mucosa and 4.2 ± 2.2 for the DS groups, a statistically nonsignificant difference. Based on the results of this study, it can be concluded that the number of teeth occluding with maxillary dentures was not a risk factor for DS; however, the type of occlusal contact, especially anterior contacts between artificial maxillary and natural mandibular teeth, could be a risk factor.[38] In this study, 66.4% of patients with maxillary and mandibular CDs had both anterior and posterior occlusal contacts, while only 3.0% had anterior occlusal contacts alone. This distribution was nearly the same for patients with mandibular distal extension RPDs (61.4% had both anterior and posterior contacts; 7.1% had anterior contacts only). The type of occlusal contact did not differ between the denture groups and was not statistically associated with DS. In this study, the method used to analyze occlusal contacts might be considered inferior to instrumental occlusal analysis,[35] which could better establish a causal relationship between the type of occlusal contact and DS.

Conclusion

Within the limitations of this clinical study, it was concluded that the occurrence of palatal DS did not differ between mandibular distal extension RPD and CD wearers, and that the presence of anterior mandibular teeth did not increase the incidence of palatal DS.

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