

## The effect of denture stability, occlusion, oral hygiene and smoking on denture-induced stomatitis

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هدفت الدراسة الى تقييم فعالية المستخلص الكحولي لأوراق الياس في تقليل أعداد العقديات الطافرة في اللعاب بالمقارنة مع كلورهكسيدات في تجارب مختبرية وفي الأشخاص الأصحاء. أجريت الدراسة في فرع الأدوية ، كلية الطب -الجامعة المستنصرية بالتعاون مع فرع وقاية الاسنان في كلية طب الأسنان في جامعة بغداد (بغداد- العراق) خلال عام ٢٠٠٦ . حضر مستحضر الكحول الأثيلي لأوراق الياس (٢٪) وأخضع لمسح مقياس الطيف الضوئي للاشعة فوق البنفسجية والمرئية سعياً للبحث عن ذرات المركبات الفعالة. تم احتساب تراكيز التثبيط الأدنى لنمو العقديات الطافرة المعزولة من اللعاب والمشيخة بكتريولوجيا لكل من مستخلص الياس الأثيلي وكلورهكسيدات . وتم التقصي عن تأثير جرعة واحدة من شطف فموي ، عند الأشخاص الأصحاء، لمستخلص الياس الأثيلي او كلورهكسيدات على اعداد وحدة تكوين مستعمرة العقديات الطافرة في اللعاب عقب تناول الشطف الفموي لفترة ساعتين. أظهرت النتائج وجود ذروة كبيرة عند طول موجي ٢٦٦.٥ نانومتر وأخرى صغيرة عند طول موجي ٦٧٢ نانومتر في رسم مقياس الطيف الضوئي للاشعة فوق البنفسجية والمرئية دالة على وجود مركبات فلافونود. بلغ تركيز التثبيط الأدنى لنمو العقديات الطافرة المعزولة من اللعاب لمستخلص الياس الأثيلي ١٠٦.٦ ميكروغرام / ميليلتر مقابل ٣.٣ ميكروغرام / ميليلتر لكلورهكسيدات. تناول جرعة واحدة بهيئة شطف فموي من مستخلص الياس الأثيلي تسبب في تدني اعداد وحدة تكوين مستعمرة العقديات الطافرة في اللعاب بدلالة نوعية متميزة الا ان تأثيره اقل من كلورهكسيدات بدلالة نوعية متميزة. نستنتج من هذه الدراسة ان تأثير المضاد الميكروبي لأوراق الياس يمتد الى العقديات الطافرة بسبب احتوائه على مركبات فلافونود ، وبهذا التأثير يمكن لمستخلص الياس الأثيلي ان يمنع استعمار العقديات الطافرة وما يترتب عليها من حصول تسوس الاسنان.

**OBJECTIVE:** This longitudinal clinical investigation was undertaken to find out the effect of denture wearing habit (day versus day and night), denture hygiene and cigarette smoking habit on the frequency of denture induced stomatitis.

**METHODS:** Comparisons were made between 240 complete denture wearers, half of whom were asked to wear their dentures at the daytime only and the other half to wear the denture day and night. All these participants were male patients with a mean age of 57.6 years who had received maxillary complete acrylic dentures for the first time. Fifty percent of the samples were smokers. A standard method for examination of the mouth and denture construction, insertion and follow up were employed. Putative risk factors (denture wearing habits, denture hygiene and smoking) were investigated. Subjects were recalled 12 months after insertion to examine the quality of the denture and the condition of the maxillary mucosa. **RESULTS:** No significant correlation was found between deterioration of stability or occlusion and type of habitual use of the dentures ( $P > 0.05$ ). Fourteen percent of the cases reported with inflamed maxillary mucosa. Deterioration of retention or occlusion separately showed no correlation with the condition of the mucosa. However, associated deterioration of both stability and occlusion proved to be significantly correlated with the occurrence of denture stomatitis ( $P < 0.05$ ). Denture stomatitis was significantly more frequently with subjects wearing their dentures overnight compared with those who removed them ( $P < 0.05$ ). A significant correlation was also found between cigarette smoking, poor oral hygiene and the presence of denture induced stomatitis ( $P < 0.05$ ). **CONCLUSION:** Nocturnal denture wearing habit, deficient oral and denture hygiene, and cigarette smoking are all important predisposing factors to denture-induced stomatitis, however, none of these factors was the sole cause of mucosal inflammation.

### INTRODUCTION

Denture-induced stomatitis (DIS) is a term used to describe certain pathologic changes found in the oral mucosa of denture-bearing tissue. These changes are characterized by bright erythematous changes and are usually found under acrylic removable prostheses in both jaws, but more frequently in the maxilla.<sup>1</sup>

The condition is very common and can best be considered multifactorial in etiology with the prosthesis considered a prime factor.<sup>2</sup> Classically, the causes of denture stomatitis have been cited as denture trauma, fungal infection<sup>3</sup> and hypersensitivity to denture base materials.<sup>4</sup> Furthermore, old age, systemic diseases, smoking, wearing denture at night and poor oral hygiene resulting in the accumulation of plaque on dentures have all been proposed as risk factors for this affliction.<sup>5</sup>

Reported effects of many of these risk factors on the frequency of denture stomatitis are controversial and

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contradictory. Many investigators found the frequency of severe inflammation to be significantly higher in patients who wore their dentures at night.<sup>6-9</sup> Other investigators<sup>10-12</sup> found no significant differences in wearing habits between a group with denture stomatitis and a control group. The mucosal inflammatory changes associated with denture stomatitis have been reported to be increased by the presence of poor denture hygiene.<sup>11,12</sup> Tautin<sup>13</sup> reported in 1978 that 44% of the American dental schools do not offer any advice as to whether prostheses should be worn continuously or discontinuously. Current epidemiological researches demonstrated that the presence of yeast on the denture, denture wearing habits (nocturnal), deficient oral and denture hygiene and smoking habit were significantly associated with the most extensive mucosal inflammation.<sup>14,15</sup>

Therefore, the aims of this investigation were to record the prevalence of denture stomatitis in a group of patients wearing complete dentures and to study the relationship between inflammatory changes in the maxillary denture-bearing mucosa and denture wearing habits (nocturnal wear), smoking habits and denture hygiene.

## METHODS

The study was restricted to 240 male patients in order to avoid any influences due to sex hormones on the oral epithelium. All participants were completely edentulous, free from systemic diseases and aged between 50 and 60 years (mean age = 57.6 years) and were patients attending the Department of Prosthetic Dentistry in two military hospitals in Jordan for provision of dentures. The clinical examinations were carried out by one dentist using well-defined criteria of (a) edentulous maxillary and mandibular ridges and (b) healthy oral mucosa

without any clinical signs or symptoms of oral trauma or pathology especially in the mucosa of the future maxillary denture bearing area. The patients were informed about the objective of the study and consent was obtained from all.

After at least three months of the last extraction date, full maxillary and mandibular dentures were constructed to 240 fully edentulous patients who had never worn dentures before and their palatal mucosa was clinically normal. Conventional techniques for constructing complete denture were employed at the prosthetic clinics in the Royal Medical Services group hospitals during the period 2004 to 2007 by the author (prosthodontist). According to the smoking habit (patients who smoke  $\geq 15$  cigarettes per day,<sup>15</sup> the patients were divided into the following groups: (a) patients who were smokers and wear the dentures both day and night, (b) patients who were smokers and who take out the dentures at night, (c) patients who were nonsmokers and who wear the dentures both day and night, and (d) patients who were nonsmokers and who take out the dentures at night. After properly balanced occlusion and articulation had been achieved by selective grinding in the articulator and inside the patient's mouth, the prostheses were handed over to the patients, who were at the same time given instruction on oral and denture hygiene.

At intervals of after about 2 weeks and 3 days, the patients were re-examined by the clinician and any necessary adjustments of occlusion and / or fitting surface of the dentures were made. The patients were not discharged before they declared themselves satisfied with the results of adjustment. The patients were also asked whether they had complied with the instruction given.

About 12 months after denture placement, the patients were re-examined. Two hundred twenty-five patients (94%)

cooperated and 15 patients (6.25%) failed to come. Of the 225 patients, 114 patients belonged to the group that had been wearing the dentures only during the day time and 111 patients to the group that wore the dentures both day and night. Seven patients did not comply with the instructions by wearing their dentures both day and night. Therefore, the day and the day and night group consisted of 107 and 118 patients, respectively. The distribution of the re-examined patients was shown in Table 1.

The following factors were examined: (a) denture stability, (b) occlusion, and (c) clinical condition of the oral mucosa under the fitting surface of the maxillary complete dentures (i.e., from localized pinpoint hyperemia to diffuse erythema confined to the entire mucosa in contact with the maxillary denture).

The clinical classification was performed according to the principles of Bergman *et al.*<sup>16,17</sup> to test the stability of the denture, the examiner pressed the denture gently against its supporting tissue in the maxilla with two fingers placed in the middle of the denture base and then tried to tip, rotate, and/or displace it horizontally. The stability was said to be acceptable if only little or no movement of the denture was observed. Otherwise, the stability was classified as unsatisfactory. Occlusion was recorded as satisfactory if intercuspation was correct without gliding being observed at repeated habitual closing of the mouth from a postural rest position. Firm intercuspation contact could be demonstrated bilaterally and frontally with the aid of the use of articulating paper. Otherwise, occlusion was recorded as unsatisfactory.

For the oral mucosa of the maxillary, denture bearing area was recorded as clinically healthy if it showed no signs of chronic inflammatory reaction. The mucosa was recorded as inflamed if it showed distinct signs of chronic

inflammation, locally or generally in the palate and/ or in the frontal region of the mucosa of the alveolar processes.

After 12 months, re-examination was done again to evaluate the denture stability, occlusion and the entire mucosa in contact with the maxillary denture. Cases of more localized redness of the mucosa that could possibly be ascribed to trauma were not classified as denture stomatitis and were excluded from this study.

At the re-examination appointment, the degree of hygiene of the dentures was assessed using an erythrocin dye and classified as

1. Good hygiene with minimal plaque
2. Half surface area covered with plaque
3. Almost all surfaces of the denture were covered with plaque and calculus deposition.

Statistical analysis was performed using SPSS version 13.00 for windows.  $X^2$  tests were used to identify significant relationships between frequency of denture induced stomatitis and

- a. whether or not the person smoked
- b. whether the denture was worn 24 hours a day or during day time only
- c. whether the denture was cleaned.

*P*-value less than 0.05 were considered statistically significant.

## RESULTS

The stability of the maxillary denture was reduced in 38 cases (16.9 %) 12 months after denture insertion (Table 1). In addition, occlusion was still satisfactory in 180 cases (80%) shown in Table 2. No correlation was found between deterioration of stability or occlusion and type of habitual use of the

**Table 1.** Stability of the maxillary complete dentures 12 months after insertion\*

	Day wearers	Day and night wearers	Total
Satisfactory	90 (84.11%)	97 (82.20%)	187 (83.11%)
Unsatisfactory	17 (15.89%)	21 (17.80%)	38 (16.89%)
Total	107	118	225

\* ( $P > 0.05$ )

**Table 2.** Complete dentures occlusion 12 months after insertion\*

	Day wearers	Day and night wearers	Total
Satisfactory	87 (81.31%)	93 (78.81%)	180 (80%)
Unsatisfactory	20 (18.69%)	25 (21.19%)	45 (20%)
Total	107	118	225

\* ( $P > 0.05$ )

**Table 3.** Condition of the mucosa in relation to denture cleanliness\*

	1#	2#	3#	Total
Healthy mucosa	56 (91.80%)	86 (86.87%)	52 (80.00%)	194
Inflamed mucosa	5 (8.20%)	13 (13.13%)	13 (20.00%)	31
Total	61	99	65	225

#1- Minimal plaque, 2- Half surface area of the denture covered with plaque, 3 - Almost all surfaces of the denture were covered with plaque and calculus deposited.

\* ( $P < 0.05$ )

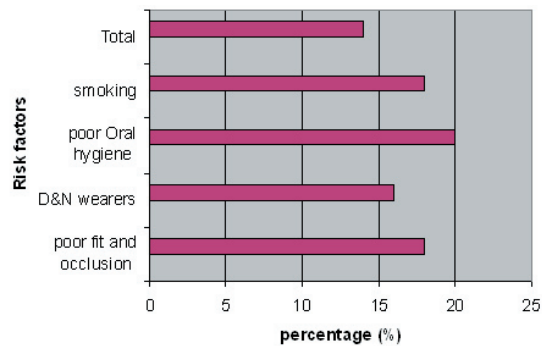
**Table 4.** Condition of the mucosa in relation to smoking habits\*

	Non-smokers	Smokers	Total
Healthy mucosa	89 (79.46%)	95 (84.07%)	194
Inflamed mucosa	13 (11.61%)	18 (15.93%)	31
Total	112	113	225

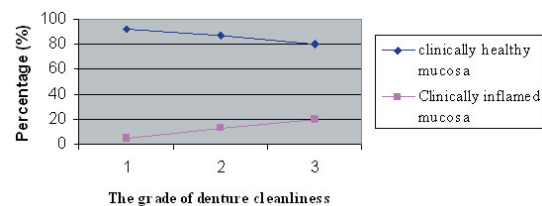
\* ( $P < 0.05$ )

dentures ( $P > 0.05$ ). The re-examination revealed clinically inflamed mucosa in 31 cases (13.8%). A statistically significant correlation was found between nocturnal denture wearing and the condition of the denture supporting mucosa in the maxilla ( $P < 0.05$ ).

The changes in denture stability and in occlusion showed no correlation with the condition of the mucosa when assessing these changes separately. However, changes in stability and occlusion together proved to be correlated



**Fig.1.** Condition of the mucosa in relation to denture cleanliness.



**Fig. 2.** Comparison between the condition of mucosa and the different factors.

with the occurrence of denture stomatitis in the maxilla. A statistically significant difference ( $P < 0.05$ ) was found between the condition of the mucosa and denture hygiene (Table 3). Similar results were also found in relation to cigarette smoking habit (Table 4). There was a direct relationship between the number of cases with clinically inflamed or healthy mucosa and the degree of denture cleanliness (Figure 1). A statistically significant relationship was found between denture stomatitis and denture trauma, denture cleaning, smoking and overnight denture wearing habits ( $P < 0.05$ ) as shown in Figure 2.

## DISCUSSION

The term 'denture-induced stomatitis' is used to describe inflammatory condition that manifest itself as bright erythematous and edematous mucosa confined to a denture-bearing area.

The exact prevalence of denture stomatitis is unknown.<sup>2,15</sup> Several studies<sup>18-20</sup> suggested that denture

stomatitis develop in as many as 10-50% of persons who wear complete dentures. In this study, the prevalence of denture stomatitis 12 months after denture insertion was 13.8% which fell within the range of previous studies on similar populations.<sup>17,21,22</sup> However, the results of the present study was confined to male subjects and the prevalence of DIS has been reported to be higher in females.<sup>2,23</sup>

The results at the one-year re-examination agreed with earlier studies on the deterioration of the stability and occlusion of the denture.<sup>16,17</sup> The deterioration of stability, occlusion or both were approximately 17%, 20% and 18%, respectively which confirmed the importance of regular control examinations so that any deterioration of stability and /or occlusion could be diagnosed and corrected in an early stage. In addition, the results of this study indicated that 15 (11.11%) subjects developed DIS even when the maxillary denture showed satisfactory stability and occlusion. This pointed out that a new complete denture with clinically acceptable stability is not a guarantee against mucosal inflammation with time. It is possible that minor imperfections of the stability and/or occlusion that may escape detection at conventional denture placement play a role in the development and progression of denture stomatitis. In agreement with the previous studies, the result of the present study suggested a relationship between trauma and denture-induced stomatitis.<sup>2,17</sup> In fact, denture trauma has often been cited as a possible contradictory factor and it is true that unstable dentures and occlusal errors could damage the supporting tissue.<sup>4,10</sup>

Removal of dentures during the night might perhaps be recommended to reduce trauma from dentures or heavy denture plaque accumulation in patients with poor oral hygiene. However, merely wearing a removable denture cannot be

considered a cause of DIS if appropriate oral and general health condition is present. A number of investigators<sup>10,24,25</sup> found no statistical significant between nocturnal denture wearing habit and denture stomatitis.

According to Love *et al.*,<sup>7</sup> Budtz-Jorgensen and Bertram,<sup>10</sup> denture replacement and denture hygiene resulted in the resolution of denture stomatitis in most of the patients. Nyquist<sup>6</sup> reported no evidence of such a correlation. Subsequent studies, however, have reported that poor denture hygiene favor colonization of candida on the oral mucosa and denture surfaces which act as initiating local factors in the development of DIS.<sup>12, 25</sup> This study confirmed that insufficient hygienic care seems to be a significant predisposing factor for developing DIS.

Yilmaz *et al.*<sup>12</sup> found a significant relationship between denture hygiene and denture stomatitis, whereas no relation was found between DIS and overnight denture wearing habit. Therefore, the authors concluded that particular attention should be paid to denture hygiene. Every effort should be made to restore the healthy palate, especially if this can be achieved by simple modification to the dentures patients wearing habits and, oral and denture hygiene instructions. The existing dentures should be examined and any obvious faults corrected. This may necessitate using a chair side hard relined material if the dentures do not fit properly or making new dentures, but only after the denture stomatitis has resolved.

In addition to the effect of smoking on the oral hygiene, it is also associated with a variety of changes in the oral cavity and related to DIS in complete denture wearers. Cigarette smoke has effect on saliva, oral commensals and opportunistic fungal infection in the oral cavity.<sup>26,27</sup> Therefore, the results of this study confirmed, as in many previous investigations,<sup>5,25,28,29</sup> that smoking habit is also associated with

extensive inflammation of palatal mucosa in denture wearer.

Management of denture stomatitis should include oral and denture hygiene improvement, discontinuation of denture wearing habit, antiseptic agents (soaking the denture in 2% sodium hypochloride or 0.2 – 2 % chlorohexidine during the night, as it has been conclusively shown that the organisms are harbored within the pores of acrylic), topical or systemic antifungal and eventually, denture adjustment or replacement if necessary.

The results of this study support the studies of other population where the prevalence of DIS was significantly related to poor oral hygiene, denture trauma, smoking and nocturnal denture wearing habit. Further investigation on the effect of gender, systemic diseases, medications, vitamin A level, in addition to the effect of denture stabilization by implant installation on the prevalence of DIS should be considered.

### CONCLUSIONS

Within the limitation of this study in male adult patients, the following conclusions can be made:

1. DIS is a common condition. Its treatment would be successful if only the etiologic factor or factors are understood.
2. Overall prevalence of DIS depended on the presence of the underlying predisposing factors (that is, denture hygiene, smoking and denture wearing habits). However, none of these local causes was the sole cause of mucosal inflammation.
3. Regular professional recall appointments for people who wear denture are essential to prevent the consequence of denture deterioration at an early stage.

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