

## Oral Mucosa Changes Associated with Wearing Removable Acrylic Dentures

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**ABSTRACT:** The main purpose of the study was to highlight the incidence of various changes in the oral mucosa associated with wearing removable acrylic dentures. Materials and method. The study was performed on a total of 45 subjects who presented at the Prosthodontics Clinic and the Oral Rehabilitation Clinic of Craiova Faculty of Dental Medicine during January 2018-May 2020. Results. Of the 45 subjects that were wearing at least one acrylic denture 31,11% presented oral mucosa changes or lesions. The most common mucosal lesion was type 1 according to Newton's classification.

**KEYWORDS:** Oral mucosal lesions, denture stomatitis.

### Introduction

The development of dental materials is growing every year, as well as their use in multiple specialties of dentistry.

Among dental materials, acrylic resins have important applications, mainly for the manufacturing of dentures and maxillofacial prostheses.

Easy handling and use of acrylic resins have increased their fields of applicability [1].

Acrylates are plastic materials that result from the polymerization of monomers represented by acrylic or methacrylic acid.

Dental prosthetic constructions made of acrylates and methacrylates are well known to be strong irritants and allergens [2].

Biologically, acrylic resins have been considered a low risk material.

However, acrylic resins are beginning to raise concerns about their safe use in clinical practice.

An incomplete polymerization process of the acrylic resin can lead to the release of toxic chemical products such as methyl monomer, dibutyl phthalate, methyl methacrylate, phenylbenzoate, formaldehyde and salicylate, which are considered dangerous [3].

As building materials in dentistry, acrylic polymers have different fields of application.

They are used for the manufacturing of the bases of partial and total dentures, for lining and repairs of dentures, removable orthodontic appliances and appliances for maintaining dental space, artificial teeth, temporary bridges, and in the manufacturing of surgical prostheses such as maxillary obturators, prostheses for maxillofacial defects and facial prostheses [4].

As support materials, acrylates are used in making individual ligatures, dental restoration models, bite planes and occlusal templates.

Special types of acrylates are used as part of the structure of permanent cementing materials for fixed prostheses (resin cement, ionomer resin modified cement) [5].

Advantages of clinical use of acrylic resins include a relatively reduced cost, easy handling of the material, adequate polishing capacity and colors compatible with the tissues that they aim to mimic.

However, when they are used over a long period of time, their physical-mechanical properties may change due to the influence of the environment in which they are used [6].

The etiology of oral lesions among removable denture wearers is complex and multifactorial.

The primary predisposing factors mentioned in the literature for such lesions are age, gender, degree of oral hygiene, general health, frequency and duration of prosthesis wear and poor preservation and stability of the prostheses.

This presents a clinical problem that is also contributed by inconsistent data in the literature [7].

Known risk factors for the occurrence of oral lesions associated with wearing a complete or partial denture can be broadly classified and discussed based on the type of denture and factors related to patients.

Denture-related factors include the use of complete dentures (as opposed to partial dentures), the wearing of maxillary dentures (as opposed to mandible dentures), poor hygiene of the denture, wearing the denture at night, continuous use of the denture, and poor denture quality [8].

Patient related risk factors significant in the occurrence of oral mucosal lesions associated with wearing a denture include local and systemic immune deficiencies, such as xerostomia, diabetes, nutritional deficiencies, broad-spectrum antibiotic therapy and overgrowth of *Candida* and bacteria in the oral/dental microbiome [9].

The main mucosal lesions associated with removable dentures are denture-associated stomatitis, angular cheilitis, inflammatory fibrous hyperplasia, and traumatic ulcerations.

*Candida* infections, poor retention of the denture, and mechanical trauma have also been associated with the development of mucosal lesions.

In addition, low salivary pH, low occlusal vertical dimension and residual resorption of the edentulous ridges may also be associated with denture stomatitis, angular cheilitis and traumatic ulcers of the oral mucosa [10].

The present study aims to analyze the prevalence of different forms of oral mucosa changes associated with wearing removable acrylic dentures.

## Materials and Method

The study was performed on 45 subjects who presented at the Clinic of Dental Prosthetics and the Oral Rehabilitation Clinic of Craiova Dental Faculty during January 2018-May 2020.

The study protocol was approved by the Ethics Committee of University of Medicine and Pharmacy of Craiova.

The subjects were included in the present study according to the following inclusion

criteria: adult subjects, wearers of one or two acrylic dentures.

Exclusion criteria of the subjects in the study were: patients who were not wearing acrylic dentures.

Information regarding the study's objectives was given to every participant in the study, follow by each subject's written consent to participate.

Data collection from the study participants was done by interview and clinical examination.

Using questionnaires, anamnesis and clinical examination information about the subjects' age, gender, profession, residence area and systemic illnesses was obtained.

Clinical examination of each study participant was done according to the methods and the criteria described by the WHO in 1997 [11].

Individual medical records were made containing information noted from the subjects included in the study.

The analyzed parameters were: age, gender, place of residence, presence of a general disorder, smoking habit, type of prosthesis worn, denture and oral hygiene habits, the using period of the dentures, pathological aspects of the oral mucosa according to Newton's classification.

Evaluation of denture and oral hygiene was appreciated by using the anamnesis questionnaire regarding frequency of denture and oral cavity cleaning and from visual inspection of the denture.

According to Newton's classification denture-related stomatitis can be divided into three types based on the condition's severity.

Early stages of the condition are represented in type one, whilst usually type two lesions are the most common and type three, being the most severe is generally less common.

Type 1 - Pinpoint hyperemia or localized inflammation.

Type 2 - Diffuse erythema involving part or all of the mucosa which is covered by the denture.

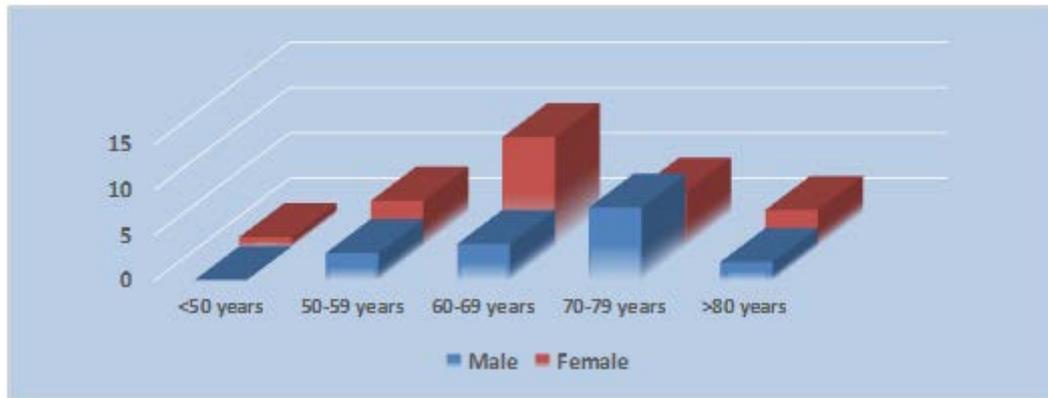
Type 3 - Nodular/papillary inflammatory hyperplasia usually found on the central region of the hard palate and on the alveolar ridge [12].

A Chi-square test, with  $\alpha=5\%$ , the value  $p<0.05\%$  being considered statistically significant was used to statistically examine correlations between the analyzed parameters.

**Results**

The present study showed that of the 45 subjects that were wearing acrylic dentures, only one participant belonged to the age group

of under 50 years while the best represented age group was the 60-69 years old group, with 16 subjects of that age that wore acrylic dentures (Figure 1).



**Figure 1. Distribution of subjects by age.**

Of the 45 participants included in the study, 28 were female, representing 62,2%, and 17 participants were male.

Most participant enrolled in the study resided in urban areas (Table 1).

**Table 1. Distribution of subjects in relation to the place of residence**

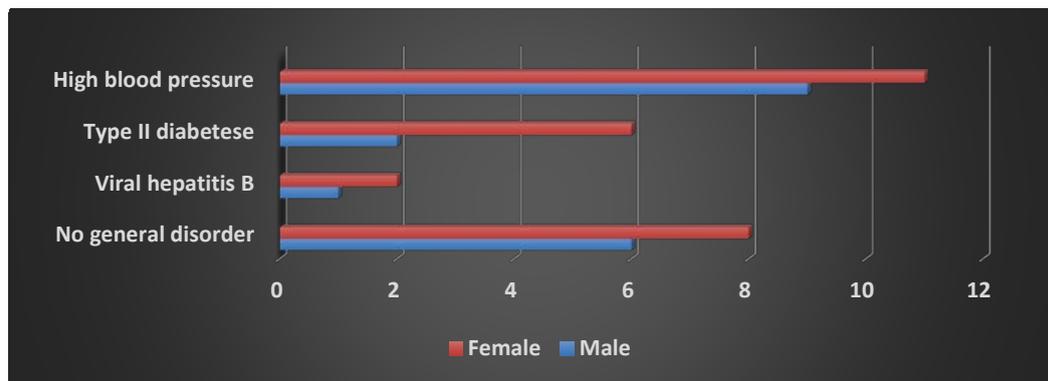
No.	Place of residence	Nr. of subjects	%
1.	Urban residence	31	68,89%
2.	Rural residence	14	31,11%
3.	Total number of subjects	45	100%

The most common general disorder among the 28 female subjects enrolled in the study was high blood pressure followed type diabetes II and type B viral hepatitis.

common general disorder followed by type II diabetes and type B viral hepatitis (Figure 2).

The same results were observed among male subjects, with hypertension being the most

Calculation of a Chi-square test of independence (results  $\chi^2=1.003$ ,  $p=0.60$ ) found no significant interaction between the gender of the subjects and the presence of a systemic disorders.



**Figure 2. Distribution of subjects according to the presence of a systemic disorder.**

The majority of male subjects were smokers (52, 94% of the 17 male subjects), while the majority of female subjects were non-smokers

(67,85% of the 28 female subjects) an only 3 subjects were former smokers (Tables 2-3).

**Table 2. Distribution of subjects in relation to smoking habits.**

Subject gender	Smoker	Non-smoker	Former smoker	Total
Male	9	6	2	17
Female	5	22	1	28
Total	14	28	3	45

**Table 3. Distribution of study participants according to the presence of oral mucosal lesions and smoking habit.**

Presence of oral lesions	Smoker	Non-smoker	Former smoker
With oral lesions	14	9	4
Without oral lesions	31	5	24

A Chi-square test of independence (results  $\chi^2=8.150$ ,  $p=0.0043$ ) proved a significant link between smoking and the presence of oral mucosal lesions.

The most common type of denture worn by the subjects included in this study was the maxillary partial denture (35,55%).

The least common situation was that of a complete maxillary and complete mandible denture (4,44%) (Table 4).

**Table 4. Distribution of subjects in relation to type of prosthesis worn.**

Denture type	Total N (%)	Female N (%)	Male N (%)
Complete upper and lower prosthesis	2 (4,44%)	2 (4,44%)	0 (0%)
Only complete upper prosthesis	8 (17,77%)	5 (11,11%)	3 (6,66%)
Only complete lower prosthesis	3 (6,66%)	2 (4,44%)	1 (2,22%)
Upper total and lower partial prostheses	4 (8,88%)	3 (10,42)	1 (2,22%)
Upper partial and lower total prosthesis	2 (4,44%)	1 (2,22%)	1 (2,22%)
Partial upper and lower prosthesis	3 (6,66%)	2 (4,44%)	1 (2,22%)
Only partial upper prosthesis	16 (35,55%)	9 (20,00%)	7 (15,55%)
Only partial lower prosthesis	7 (15,55%)	4 (8,88%)	3 (6,66%)
<b>Total</b>	<b>45</b>	<b>28</b>	<b>17</b>

Most subjects included in this study performed oral and denture hygiene once a day (48,88% and 46,66%) and visual inspection

revealed that more than half of the dentures worn by participants in the study had accumulated bacterial plaque (Table 5).

**Table 5. Distribution of subject according to dental and oral hygiene.**

Denture hygiene		No	%
Frequency of denture cleaning per day	None	8	17,77%
	1 time	21	46,66%
	2 times	12	26,66%
	3 or more times	4	8,88%
Oral hygiene			
Frequency of oral cavity hygiene per day	None	7	15,55%
	1 time	22	48,88%
	2 times	13	28,88%
	3 or more times	3	6,66%
Visible bacterial plaque on denture	Yes	24	53,33%
	No	21	46,67%

**Table 6. Distribution of study participants according to the presence of oral mucosal lesions and denture cleaning habit.**

Frequency of denture cleaning per day	None	1 time	2 times	3 times	Presence of oral lesions	
	7	5	2	0	14	With oral mucosal lesions
	1	16	10	4	31	Without oral mucosal lesions

By calculating a Chi-square test of independence (results  $\chi^2=10.043$ ,  $p=0.0015$ ) a significant connection was found between the frequency of denture hygiene and the presence of oral mucosal lesions (Table 6).

Only 13,33% of the total number of subjects were wearing the same denture for more than 8 years, while 84,44% of the examined subjects was divided between those with dentures aged 1-4 years old (31,12%) and those with dentures used between 4-8 years (55,55%) (Figure 3).

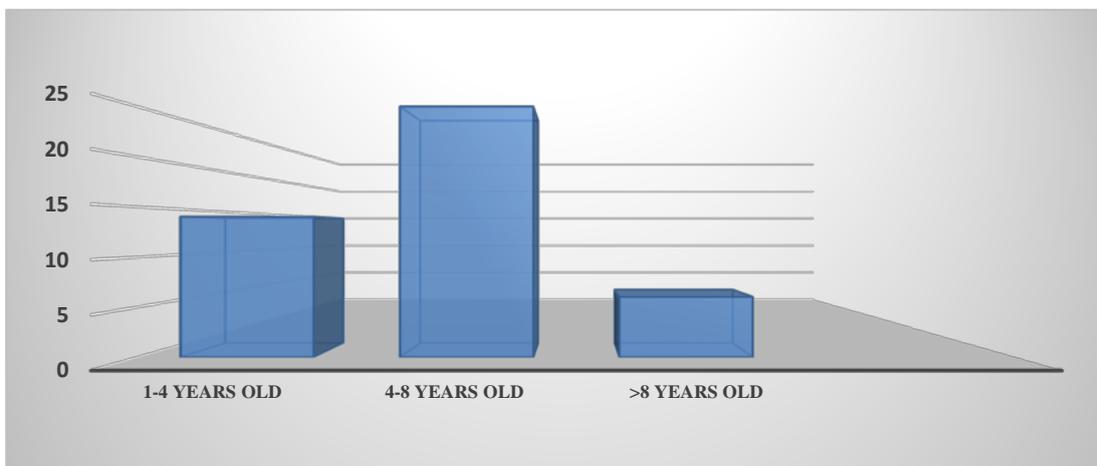


Figure 3. Distribution of subjects in relation to denture age.

The main types of clinical changes of the oral mucosa that were seen in the subjects included in the study were classified according to the Newton classification.

Of the 45 subjects evaluated in this study, 14 (31,11%) showed clinical signs of denture stomatitis, with 6 being classified as type I, 5 as type II and 3 as type 3 (Table 7, Figures 5-8).

No significant relationship between Newton's type oral mucosal lesions and the gender of the subjects was found after performing statistical analysis using the Chi-square test ( $\chi^2=1.07$ ,  $p=0.58$ ).

The majority of subjects that presented oral mucosal lesions belonged to the 60-69 years old group (Figure 4).

Table 7. Distribution of subjects with mucosal lesions according to Newton's classification.

Newton's classification	No. of subjects	Male	Female	%
Type 1	6	3	3	42,87%
Type 2	5	1	4	35,71%
Type 3	3	1	2	21,42%
Total number of subjects with mucosal lesions	14	5	9	100%

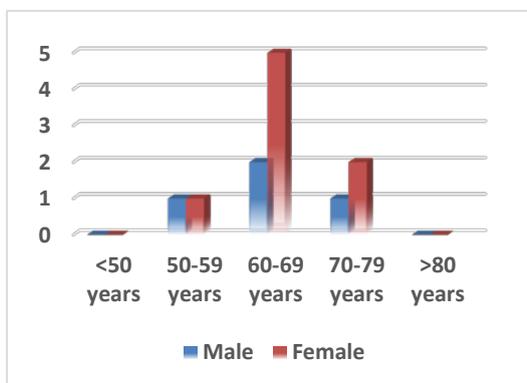
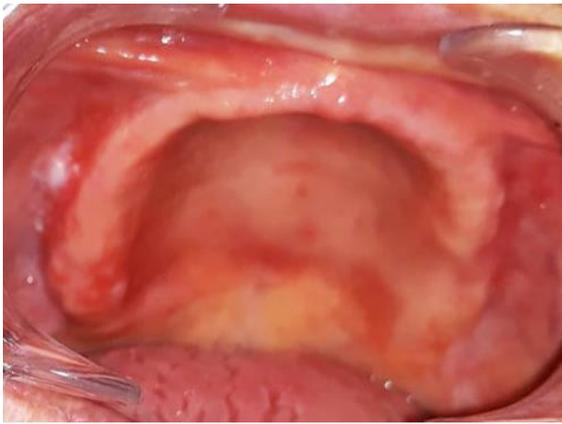


Figure 4. Distribution of subjects with signs of denture stomatitis by age.



Figure 5. Ischemic palatal mucosa with pinpoint hyperemia specific for Newton's type 1 denture stomatitis.



**Figure 6. Diffuse erythema involving the palatal mucosa which is covered by the maxillary complete denture specific for Newton's type 2 denture stomatitis. A white placard can be observed on the vestibular aspect of the right alveolar ridge.**



**Figure 7. Newton's type 3 denture stomatitis-Hyperplasia on the vestibular aspect of the frontal maxillary alveolar ridge.**



**Figure 8. Newton's type 3 denture stomatitis Hyperplasia on the lingual aspect of the left alveolar ridge.**

## Discussions

The occurrence of oral lesions associated with wearing complete or partial acrylic prostheses has a multifactorial etiology including dental trauma, allergy to prosthetic materials, poor oral hygiene, salivary pH, age, smoking, immune system deficiencies and Candida species infections [13].

One of the most important factors that influences the prevalence oral mucosal lesions has been found to be subject age. Lesions of oral mucosa have been showing to have a higher prevalence among older subjects [14].

Regarding the age of the subjects included in this study that showed signs of denture stomatitis, the majority belonged to the 60-69 years old age group.

These results are in accordance with study results of Bozdemir E. et al. who argue that there is an increase in the incidence of oral mucosal lesions as the age of the subjects increased [15].

Aoun G. et al. found that patients older than 61 years of age were predominantly affected by denture stomatitis [16].

Regarding the correlation between gender and presence denture induced stomatitis lesions, of the 45 participants included in this study 14 presented signs of denture stomatitis. Of the 14 subjects with signs of denture stomatitis 8 (57,14%) were female. The link between subject gender and denture stomatitis has been analyzed by other authors as well. The same results were highlighted in studies conducted by Brantes M. et al. and Čanković M et al. These authors found that 70 to 80% of the subjects that presented oral mucosal lesions were women [10,17].

Other studies realized by Mumcu et al. and Dundar et al. showed that males presented with more oral mucosal lesions than females [18,19].

Oral mucosal lesions also can occur within systemic diseases or side effects of medications in the elderly [14]. Data from this study shows that the most common general disorder found was high blood pressure, with 20 (44,44%) out of the 45 subjects in the study suffering of this condition.

Of the 20 subjects diagnosed with high blood pressure 11 were women.

The second most common condition was type II diabetes with 8 out of the 45 subjects suffering of it.

Of the 8 subjects diagnosed with type II diabetes 6 were women.

These findings are in accordance with those shown in a study by Bozdemir E. et al. that found cardiovascular diseases as being the most common general disorder [15].

Another study conducted by Morel L. et al. also found hypertension as being the most common general disorder, closely followed by diabetes as the second most common [20].

Also, smoking can be correlated with the occurrence of oral lesions induced by dentures [21].

In terms of bad habits, of the 45 participant in this study 14 (31,11%) were smokers.

The majority of smokers (64,28%) were male.

The findings are similar to those found by Bozdemir E. et al, and Kaomongkolgit R. et al., their studies revealing a percentage of 33,7 of subjects as being smokers [15,22].

Other studies have highlighted that, beside age, other factors such as oral hygiene could influence the incidence of oral mucosal lesions [14].

Inadequate oral and denture hygiene is a well-known predisposing factor in relation to denture stomatitis.

In the present study almost half of the participant cleaned their denture only once a day (46,66%).

A study performed by Morel L. et al. found that the majority of subjects performed denture hygiene twice or even 3 times per day [20].

In the opinion of Barbachan et al. [23] and Vasconcelos et al., [24] the environment beneath the prosthesis, where the mucosa is not exposed to grooming, plus the presence of plaque, turns the mucosa susceptible to infection, which aggravates the local inflammation.

In a study realized in 2013, Laís César de Vasconcelos et al. [25] demonstrate there is an extremely high degree of patients' misinformation concerning standards of oral and prostheses hygiene.

These results are in agreement with the study of Kossione [26] who observed the abundant presence of biofilm and calculation coating the prosthesis surface characterizing a precarious patients' oral hygiene.

For that reason, Silva-Lovato et al [27] showed that the oral hygiene of denture users is even precarious, requiring greater attention to these patients' oral health.

Freitaj J. et al. concluded that the risk of oral lesions, principally denture stomatitis increases with age, and is also influenced by the quality, integrity and hygiene of the prosthesis [28].

The length of denture age is considered to create a positive correlation with oral mucosa lesions [29].

In this study the majority of subject were wearing dentures with the age between 4-8 years (55,55%), followed by subjects with dentures 1-4 years old (31,12%) and finally subjects wearing the same dentures for more than 8 years (13,33%).

These findings resemble those of a study conducted by Aoun G. et al. where the number subjects wearing the same dentures for 1-4 years was equal with the number of subjects wearing the same denture for 4-8 years (45%).

Also, the authors showed that the subjects who wearing the same dentures for more than 8 years represented 10% [22].

Oral mucosal changes or lesions had a prevalence of 31,11% in the present study, a percentage that was lower than the findings of a study conducted by Patil S. et al. that found that 64% of the subjects presented with one or more oral lesions [14].

Ranked dissenting according to frequency, the denture stomatitis types observed in this study were as follows: type I (42,87% of the 14 subject identified with mucosal lesions), followed by type II (35,71%) and type III (21,42%).

On the contrary, a similar study conducted by Kaomongkolgit R. et al. found the most common type of denture stomatitis to be type III (40 subjects out of 305) followed by type I (39 subjects) and type II (23 subjects) [30].

## Conclusions

The presence of oral mucosal lesions induced by acrylic dentures were highlighted in more than a third of study participants.

The occurrence of these lesions was predominantly associated with the female gender, over 60 years old, smoking habit and lack of denture hygiene.

No correlation was found between the type of lesion and the gender of participants.

## Conflict of interests

None to declare.

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