

# Prevalence of Oral Mucosal Lesions Among the Institutionalized Elderly Population in Lebanon

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## Abstract

This study aimed to determine the prevalence of oral mucosal lesions and risk factors among the institutionalized elderly Lebanese population. A representative sample of 526 individuals (49% males and 61% females) aged 65 years and above was examined. A questionnaire and clinical examination were administered. Bivariate and multivariate regressions were carried out. The frequency of oral mucosal lesions was 22.8% and it was associated to the use, integrity ( $p < .002$ ), and hygiene level ( $p < .047$ ) of removable mandibular and maxillary prosthesis. Multiple regression analysis also predicted the relationship between the mandibular prosthesis hygiene level and the occurrence of mucosal lesions. The factors controlling the occurrence of oral mucosal lesion were mainly related to the level of oral care given to the individuals. Therefore, a proper oral health care system should be implemented in the Lebanese residential homes to ensure the well-being of the residing population.

## Keywords

denture hygiene, elderly, institutionalized population, oral mucosal lesion

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## Introduction

The aged population has been increasing in number worldwide (United Nations, 2015). The same trend is observed in Lebanon, where the elderly population has increased from 4.9% in 1970 to 10% in 2007 (El Osta et al., 2015).

Chronic diseases, physical and mental disabilities, and other comorbidities are highly prevalent in the elderly population (Atramont et al., 2017). In this context, the oral health of this population has steered a lot of attention in dentistry (Miyazaki et al., 2017). More specifically, the oral mucosal health is essential for the well-being of the elderly as a poor oral mucosa status increases permeability to chemicals, carcinogens, and pathogens. The oral mucosa becomes vulnerable to lesions with age because of the decrease in collagen synthesis and slow regenerative rate (Abu Eid et al., 2012). In addition, weakening of the immune defense against pathogens with age increases the risk of developing lesions in the oral cavity (Dundar & Ilhan Kal, 2007; Martori et al., 2014). Various factors influence the oral mucosal health such as habits (smoking, alcohol drinking, etc.), prosthesis use, hygiene level, systematic diseases, and medication usage.

According to Wood and Goaz (1997), the normal oral mucosa in Caucasians ranges from dark to pale pink, and changes in color reflects an altered integrity. Mucosal lesions vary between white, red, yellow, brown, blue, and black; each color indicating a condition that could range from an insignificant anomaly to a life-threatening disease. For example, red mucosal lesions may be caused by mechanical, thermal, chemical trauma, infection, or auto-immune diseases. These conditions may cause the thinning of the epithelial and an increased vascularity, resulting in a red mucosal lesion. On the contrary, factors such as caustic chemicals, fungal infections, and malignant transformations may cause white oral lesions, because of accumulation of nonkeratotic material or to

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the thickening of the keratotic layer. In this context, the classification of the oral mucosal lesions according to the color helps at the first step of diagnosis.

Oral health is imperative to the well-being and the prevention against mucosal lesion can improve the welfare of elderly people. In fact, several studies have reported a poor oral health of elderly living institutions compared with those living with their families (Baumgartner et al., 2015; Kumara Raja et al., 2015). In Lebanon, the prevalence rate of oral mucosal lesion in elderly individuals living in nursing homes is not known, due to limited number of studies. This parameter could be a good indicator of the importance of a proper dental care implementation in these institutions.

The aim of this study was to assess the prevalence of oral mucosal lesions in Lebanese elderly individuals living in residential homes along with the risk factors including age, sex, medical condition, medication, prosthesis wearing, and oral hygiene.

## Materials and Methods

### Sample

The present cross-sectional study was approved by the ethical committee of our University (ID# 146/242018).

All the participants were informed about the objectives and details of the study. After reading the consent form, they were asked to sign as acceptance of participation. In case of illiteracy, the examiner would read and explain the information to get their approval. As for the individuals with cognitive impairment, the nurses in charge were asked to contact the parents and get their consent, and the nurses would sign the agreement.

Elderly individuals were approached at 23 nursing homes distributed all over the five districts of Lebanon: Beirut, South, North, Mount Lebanon, and Bekaa. One to three institutions were selected in each geographical area following a stratified, proportional, and random sampling technique, as previously described by Adebola and Ajayi (2014). Participants who could not be examined because of a terminal illness or a severe cognitive impairment were excluded. A total of 526 residents were finally selected for the study.

### Data Collection and Intraoral Examination

The medical, demographic, daily habits, and social characteristics including age, gender, district, smoking habits, frequency of family or friends visits, degree of autonomy regarding toilet and nutrition, medical condition, medication consumption, dry mouth sensation, tooth brushing frequency, and denture use (partial/complete removable mandibular/maxillary prosthesis) were collected using a questionnaire administered by one investigator in each district. In addition, participants were asked about their access to oral health in the last 12 months and the reasons of their dental visits. The nurse

in charge was present during the exam and confirmed the answers of the respondents, when needed.

The questionnaire was developed by two contributors and five examiners, each in one district, underwent the data collection. The pilot study was undertaken on 10 participants by each one of them. Therefore, the questionnaire was pilot tested on a total of 50 residents, in all five Lebanese districts.

The five examiners were also calibrated according to World Health Organization (WHO) guidelines to ensure that they follow a standardized plan and to minimize the disparities between the different examiners.

After having filled the questionnaire, participants were then subjected to a clinical oral examination respecting the biosafety standards of the WHO using sterilized mirror and probe, gloves, mask, and gauze pads. This visual examination was conducted in the morning (10:00 a.m.–12:30 p.m.) for two reasons: (a) to benefit from better daylight for the visual exam, and (b) to ensure that participants are in good state of mood and energy for an optimal participation.

The hygiene level of removable prosthesis was assessed and coded according to the presence and absence of food deposits: “0” for the absence of food deposits, “1” for recent food deposits, “2” for old food deposits, and “3” for calculus (Cohen et al., 2006).

### Statistical Analyses

The statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS®, version 24.0, IBM®) and Stata/SE™ 11.1 statistical softwares. Descriptive analysis was performed to detail the distribution of the oral mucosal lesions across the sociodemographic characteristics of participants (origin, age, gender, visitors, and smoking), maxillary and mandibular removable dentures use and condition, oral hygiene practice, autonomy, chronic diseases, and medications.

Bivariate regressions were applied to establish the relationship between the variables and the development of oral mucosal lesion. Multivariate regressions were finally used to estimate regression coefficients, standard errors, 95% confidence intervals (CI) and two-sided *p* values. Statistical significance was set at .05.

## Results

Among the total sample of 526 examined institutionalized geriatric individuals, 156 were 65- to 74-year old and 370 were older. Around 61% were women. The participants were mostly located in Mount Lebanon (286), followed by Beirut (106), Bekaa (57), North (48), and then South (29). In terms of habits, the majority were did not smoke for the last 5 years (84%) and 7.4% reported smoking more than 15 cigarettes per day. They were moderately visited by family members and friends (Table 1).

**Table 1.** Bivariate Associations Between Selected Background Characteristics and the Presence of Mucosal Lesions ( $n = 526$ ).

Associated background characteristics	No lesions	Localized lesions	Generalized lesions	<i>p</i> value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Age (years)				
65–74	128 (82.1)	20 (12.8)	8 (5.1)	.207
≥75	278 (75.1)	68 (18.4)	24 (6.5)	
Sex				
Males	157 (77.3)	36 (17.7)	10 (4.9)	.623
Females	249 (77.1)	52 (16.1)	22 (6.8)	
Districts				
Beirut	92 (86.8)	8 (7.5)	6 (5.7)	<.001**
South	6 (20.7)	17 (58.6)	6 (20.7)	
North	46 (95.8)	2 (4.2)	0 (0.0)	
Mount Lebanon	218 (76.2)	48 (16.8)	20 (7.0)	
Bekaa	44 (77.2)	13 (22.8)	0 (0.0)	
Smoking status				
0 cigarettes for the last 5 years	341 (77.0)	75 (16.9)	27 (6.1)	.987
<5 cigarettes/day	13 (76.5)	3 (17.6)	1 (5.9)	
5–15 cigarettes/day	21 (84.0)	3 (12.0)	1 (4.0)	
>15 cigarettes/day	29 (74.4)	7 (17.9)	3 (7.7)	
Main visitor				
None				.721
Family	303 (76.3)	66 (16.6)	28 (7.1)	
Neighbor	19 (76.0)	5 (20.0)	1 (4.0)	
Caretaker	4 (100.0)	0 (0.0)	0 (0.0)	
Other	17 (77.3)	4 (18.2)	1 (4.5)	
Frequency of visits				
<1/week	152 (79.2)	30 (15.6)	10 (5.2)	.159
1/week	126 (78.8)	21 (13.1)	13 (8.1)	
>1/week	65 (68.4)	23 (24.2)	7 (7.4)	

\* $p < .05$ . \*\* $p < .01$ .

The majority suffered from at least one chronic disease, including arterial hypertension (HTA) (311), behavioral disorders (150), and diabetes (141) (Table 2) and consumed at least one antihypertensive medication (310) and anticoagulants (246) (Table 2).

Around half (47%) of the examined subjects experienced a dry mouth sensation and 22.8% presented with oral mucosal lesions visible to the naked eye. The majority of these lesions were localized (74.2%) and were red in color (16%) (Table 3).

At the bivariate level, the presence of mucosal lesions was related to 10 major factors including district, number of teeth remaining, tooth brushing autonomy, brushing at least once per day, mandibular prosthesis worn during the exam, maxillary and mandibular prosthesis hygiene level, owns a maxillary or a mandibular removable prosthesis, and unmet need for prosthesis (Tables 1, 4, and 5). Factors such as age, sex, medical condition, and consumed medicines could not be associated with the presence of mucosal lesions (Tables 1 and 3).

The south governorate showed the highest percentage of mucosal lesion (79.3%) and the north governorate (4.2%) the lowest rate (Table 1).

Of the entire examined geriatric sample, 294 subjects were edentulous (55.6%) and only around 10% had 21

or more teeth (Table 4). As for the removable prosthesis use, 195 participants had a complete removable one (20 maxillary and 162 mandibular) and 19 presented with a partial removable mandibular prosthesis. However, 453 had an unmet need for prosthesis (Table 5). Only a minority maintained a good hygiene of their prosthesis, with 84.2% of maxillary and 82.1% of mandibular dentures having deposits (recent, old, or calculus).

Among the edentulous (295) population, 30% presented with either a generalized or a localized mucosal lesion (Table 4). Individuals with greater number of teeth presented mucosal lesions to a lesser extent ( $p < .001$ ; Table 4). However, an enormous neglect was noticed for people with remaining teeth as the majority did not perform the tooth brushing activity, leaving only 33 participants with regular tooth brushing activity, among which the majority were independent in performing the activity. These individuals showed a lower percentage of mucosal lesion occurrence compared with those who did not brush their teeth on daily basis ( $p < .001$ ; Table 4).

Wearing a removable prosthesis during the exam and its hygiene level affected significantly the status of the mucosa (Tables 4 and 5). Mucosal lesions were less prevalent in individuals with high maxillary ( $p = .047$ )

**Table 2.** Bivariate Associations Between Medical Background and the Presence of Mucosal Lesions (n = 526).

Associated background characteristics	No lesions	Localized lesions	Generalized lesions	p value
	n (%)	n (%)	n (%)	
Diabetes				
Yes	112 (79.4)	21 (14.9)	8 (5.7)	.749
No	294 (79.4)	67 (17.4)	24 (6.2)	
HTA				
Yes	241 (77.5)	52 (16.7)	18 (5.8)	.943
No	165 (76.7)	36 (16.7)	14 (6.5)	
Vasculo cerebral accident				
Yes	53 (74.6)	15 (21.1)	3 (4.2)	.480
No	294 (79.4)	67 (17.4)	24 (6.2)	
Dementia				
Yes	89 (77.4)	20 (17.4)	6 (5.2)	.893
No	317 (77.1)	68 (16.5)	26 (6.3)	
Behavioral disorders				
Yes	113 (75.3)	31 (20.7)	6 (4.0)	.167
No	293 (77.9)	57 (15.2)	26 (6.9)	
Cancer				
Yes	13 (81.3)	1 (6.3)	2 (12.5)	.315
No	393 (77.1)	87 (17.1)	30 (5.9)	
Respiratory failure				
Yes	17 (63.0)	7 (25.9)	3 (11.1)	.224
No	389 (78.0)	81 (16.2)	29 (5.8)	
Parkinson disease				
Yes	28 (82.4)	3 (8.8)	3 (8.8)	.342
No	378 (76.8)	85 (17.3)	29 (5.9)	
Other				
Yes	86 (71.7)	25 (20.8)	9 (7.5)	.273
No	320 (78.8)	63 (15.5)	23 (5.7)	
Antidepressants				
Yes	170 (80.2)	32 (15.1)	10 (4.7)	.348
No	236 (75.2)	56 (17.8)	22 (7.0)	
Corticoids				
Yes	15 (93.8)	1 (6.3)	0 (0.0)	.138
No	390 (76.6)	87 (17.1)	32 (6.3)	
Antibiotics				
Yes	8 (88.9)	0 (0.0)	1 (11.1)	.174
No	398 (77.0)	88 (17.0)	31 (6.0)	
Neuroleptics				
Yes	97 (74.6)	24 (18.5)	9 (6.9)	.724
No	309 (78.0)	64 (16.2)	23 (5.8)	
Anticoagulants				
Yes	189 (76.8)	46 (18.7)	11 (4.5)	.213
No	217 (77.5)	42 (15.0)	21 (7.5)	
Antihypertensives				
Yes	238 (76.8)	54 (17.4)	18 (5.8)	.849
No	168 (77.8)	34 (15.7)	14 (6.5)	
Antiglycemics				
Yes	111 (78.7)	22 (15.6)	8 (5.7)	.878
No	295 (76.6)	66 (17.1)	24 (6.2)	
Other				
Yes	76 (71.0)	23 (21.5)	8 (7.5)	.248
No	330 (78.8)	65 (15.5)	24 (5.7)	
Toilet use autonomy				
Autonomic	145 (81.0)	28 (15.6)	6 (3.4)	.213
Partially dependent	86 (78.9)	17 (15.6)	6 (5.5)	
Totally dependent	175 (73.5)	43 (18.1)	20 (8.4)	
Feeding autonomy				
Autonomic	294 (77.2)	62 (16.3)	25 (6.6)	.863
Partially dependent	42 (79.2)	8 (15.1)	3 (5.7)	
Totally dependent	69 (75.8)	18 (19.8)	4 (4.4)	

HTA = arterial hypertension.

**Table 3.** Percent Distribution of Institutionalized Geriatric Persons by Selected Oral Health Signs and Symptoms ( $n = 526$ ).

Variable	<i>n</i>	%
Dry mouth sensation		
Yes	247	47.0
No	258	49.0
Not indicated	21	4.0
Mucosal lesions visible to the naked eye		
Yes	120	22.8
No	406	77.2
Localized mucosal lesions <sup>a,b</sup>		
Yes	89	74.2
No	31	25.8
Generalized mucosal lesions <sup>a,b</sup>		
Yes	32	26.7
No	88	73.3
Color		
Red	84	16.0
White	15	2.9
Yellow	1	0.2
Black	5	1.0
Blue	19	3.6
Rose	1	0.2

Note. Four Individuals exhibited combination of two lesions (red and white, red and black, red and blue, black and blue).

<sup>a</sup>Total sample is 120—only those with mucosal lesions visible. <sup>b</sup>One subject exhibited both localized and generalized mucosal lesions and is counted in both.

and mandibular ( $p = .007$ ) prosthesis hygiene level (Table 4). Furthermore, the presence of mandibular prosthesis increased the prevalence of oral lesions ( $p = .031$ ). A statistically significant association was also noted between owning a mandibular prosthesis and the development of dry mouth sensation (data not shown). However, the prosthodontic neglect was noted again as the majority of the population presented an unmet need for prosthesis (Table 5). Independent individuals and those who brushed their teeth more frequently showed the lowest percentage of unmet need for prosthesis. This unmet need also increased the occurrence of localized and generalized mucosal lesions ( $p < .001$ ; Table 6).

Four variables were incorporated into the final model predicting the presence of mucosal lesions,  $\chi^2(10) = 32.26$ ;  $p = .004$ ; pseudo- $R^2 = 12.33\%$  (Table 7). Age group and sex were not associated with the presence of mucosal lesions, when controlling for all remaining variables, but were intentionally maintained in the model. Frequency of visits and mandibular prosthesis hygiene level were the only statistically significant predictors of mucosal lesions occurrence. Mandibular prosthesis hygiene level predicted only the presence of localized lesions whereas frequency of visits predicted only the presence of generalized lesions.

Controlling for all other variables in the model, individuals with all types of deposits on their mandibular

prosthesis were more likely to present with localized mucosal lesions (recent deposit: odds ratio (OR) = 2.74,  $p = .015$ ; old deposits: OR = 2.34,  $p = .034$ ; calculus: OR = 2.76,  $p = .012$ ). On the contrary, individuals receiving one visit per week were less likely to present with generalized lesions (OR = 0.69,  $p = .047$ ) (Table 7).

## Discussion

Oral mucosal lesions are related to the patient oral habits such as hygiene (Ercalik-Yalcinkaya & Özcan, 2015), smoking, chewing tobacco (Bozdemir et al., 2019; Campisi & Margiotta, 2001), and alcohol drinking (Campisi & Margiotta, 2001), in addition to the quality and integrity of prosthesis (Freitas et al., 2008). Other factors such as age (Bozdemir et al., 2019), sex (Al-Maweri et al., 2015), medical conditions (Bozdemir et al., 2019), and trauma (Campisi & Margiotta, 2001) were also found to affect the integrity of the oral mucosa.

In our study, the prevalence of oral mucosal lesions among institutionalized elderly Lebanese was 22.8%. This percentage is relatively low compared with other developing countries, such as Brazil (79.9%) (Ferreira et al., 2010), Thailand (61.6%) (Wongviriyaya et al., 2018), and Yemen (77.1%) (Al-Maweri et al., 2015).

The lesions were identified in terms of color (red, white, blue, yellow, black, and rose), the red mucosal lesion being the most common type (16%) and only four people exhibited a combination of two lesions (Table 1). However, each color has a broad prognostic spectrum and may be a sign of reactive, infectious, autoimmune, benign, or malignant condition (Gómez et al., 2007; Gondak et al., 2012; Jessri et al., 2017; Mortazavi et al., 2019). A red lesion, for instance, may include epithelial atrophy, inflammation, or erosion, while a white lesion could include epithelial edema or abnormal keratinization of the mucosa (Jessri et al., 2017). On the contrary, hypercarotenemia, lipid proteinosis, lymphoepithelial cysts, in addition to various other clinical conditions are associated with yellow lesions (Gómez et al., 2007). An increased production of melanin lead to the formation of brown, black, or blue mucosa (Gondak et al., 2012). This could be caused by different factors including vesicular and melanocytic lesions (Gondak et al., 2012). Therefore, further investigation should be performed to reach a definitive diagnosis.

In the present study, we could not find an association between the development of oral mucosal lesion and age, similarly to what was reported by Wongviriyaya et al. (2018) and in contrast to the findings of Bozdemir et al. (2019) and Al Maweri et al. (2015). The absence of association with age might be due to the fact that habits, such as smoking and alcohol drinking, usually decrease with the individual getting older, which decreases the risk of oral mucosal development.

In accordance to the findings reported by Patil et al. (2013), our results contradicted the relationship between

**Table 4.** Bivariate Associations Between Oral Hygiene Factors and the Presence of Mucosal Lesions ( $n = 526$ ).

Associated background characteristics	No lesions	Localized lesions	Generalized lesions	<i>p</i> value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Dry mouth sensation				
No	69 (75.8)	18 (19.8)	4 (4.4)	.512
Yes				
No. of teeth remaining				
Edentulous	206 (70.0)	64 (21.8)	24 (8.2)	<.001**
≤20	158 (84.0)	22 (11.7)	8 (4.3)	
>20	42 (95.5)	2 (4.5)	0 (0.0)	
Tooth brushing autonomy				
Independent	42 (87.5)	4 (8.3)	2 (4.2)	.004**
Partially dependent	6 (100.0)	0 (0.0)	0 (0.0)	
Totally dependent	2 (100.0)	0 (0.0)	0 (0.0)	
Not performed	149 (85.2)	20 (11.4)	6 (3.4)	
N/A (edentulous)	207 (70.2)	64 (21.7)	24 (8.1)	
Brushing at least 1/day				
Yes	29 (87.9)	2 (6.1)	2 (6.1)	<.001**
No	170 (85.9)	22 (11.1)	6 (3.0)	
N/A (edentulous)	207 (70.2)	64 (21.7)	24 (8.1)	
Maxillary prosthesis worn during exam				
Yes	129 (62.9)	53 (25.9)	23 (11.2)	.201
No	9 (81.8)	2 (18.2)	0 (0.0)	
Mandibular prosthesis worn during exam				
Yes	98 (60.5)	43 (26.5)	21 (13)	.031*
No	16 (84.2)	3 (15.8)	0 (0.0)	
Maxillary prosthesis hygiene level				
No deposits	25 (73.5)	4 (11.8)	5 (14.7)	.047*
Recent deposits	29 (65.9)	13 (29.5)	2 (4.5)	
Old deposits	46 (67.6)	16 (23.5)	6 (8.8)	
Calculus	28 (48.3)	20 (34.5)	10 (17.2)	
Mandibular prosthesis hygiene level				
No deposits	22 (75.9)	3 (10.3)	4 (13.8)	.007**
Recent deposits	24 (66.7)	11 (30.6)	1 (2.8)	
Old deposits	26 (63.4)	12 (29.3)	3 (7.3)	
Calculus	25 (44.6)	18 (32.1)	13 (23.2)	

\* $p < .05$ . \*\* $p < .01$ .**Table 5.** Bivariate Associations Between Oral Health Care Accessibility Factors and the Presence of Mucosal Lesions ( $n = 526$ ).

Associated background characteristics	No lesions	Localized lesions	Generalized lesions	<i>p</i> value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Owns a removable maxillary prosthesis				
Complete	120 (61.5)	53 (27.2)	22 (11.3)	<.001**
Partial	17 (85.0)	2 (10.0)	1 (5.0)	
None	269 (86.5)	33 (10.6)	9 (2.9)	
Owns a removable mandibular prosthesis				
Complete	97 (59.9)	46 (28.4)	19 (11.7)	<.002**
Partial	17 (89.5)	0 (0.0)	2 (10.5)	
None	292 (84.6)	42 (12.2)	11 (3.2)	
Unmet need for prosthesis				
Yes	355 (78.4)	70 (15.5)	28 (6.2)	.002**
No	27 (73.0)	7 (18.9)	3 (8.1)	

\*\* $p < .01$ .

**Table 6.** Bivariate Associations Between Oral Hygiene Factors and the Presence of an Unmet Prosthodontic Need ( $n = 487$ ).

Associated background characteristics	No unmet need	Unmet need	<i>p</i> value
	<i>n</i> (%)	<i>n</i> (%)	
Tooth brushing autonomy			
Independent	27 (61.4)	17 (38.6)	<.001**
Partially dependent	2 (40.0)	3 (60.0)	
Totally dependent	0 (0.0)	2 (100.0)	
Not performed	44 (27.2)	118 (72.8)	
N/A (edentulous)	154 (56.2)	120 (43.8)	
Brushing at least 1/day			
Yes	20 (66.7)	10 (33.3)	<.001**
No	53 (29.0)	130 (71.0)	
N/A (edentulous)	154 (56.2)	120 (43.8)	
Presence of mucosal lesions			
None	157 (41.8)	219 (58.2)	<.001**
Localized	49 (60.5)	32 (39.5)	
Generalized	21 (70.0)	9 (30.0)	

\*\* $p < .01$ .

**Table 7.** Logistic Multivariate Analysis Showing Associations Between Selected Variables and the Presence of Mucosal Lesions ( $n = 524$ ).

Associated variables	Adjusted OR	SE	95% CI	<i>p</i> value	Adjusted OR	SE	95% CI	<i>p</i> value
	Mucosal lesions (localized vs. none)				Mucosal lesions (generalized vs. none)			
Constant	-2.39	1.27	[-4.88, 0.10]	.060	-2.51	1.22	[-4.92, -0.11]	.041*
Age (65–74)								
$\geq 75$	0.36	0.56	[-0.74, 1.45]	.524	-0.53	0.72	[-1.94, 0.88]	.461
Sex (Male)								
Female	-0.36	0.45	[-1.24, 0.52]	.418	0.33	0.59	[-0.82, 1.49]	.573
Frequency of visits (<1/week)								
1/week	-0.97	0.52	[-1.98, 0.04]	.060	1.37	0.69	[0.02, 2.72]	.047**
>1/week	-0.14	0.53	[-1.18, 0.90]	.786	1.08	0.78	[-0.44, 2.60]	.163
Mandibular prosthesis hygiene level (no deposits)								
Recent deposits	2.74	1.13	[0.53, 4.94]	.015*	-1.64	1.19	[-3.97, 0.69]	.168
Old deposits	2.34	1.11	[0.17, 4.51]	.034*	-0.51	0.85	[-2.19, 1.16]	.548
Calculus	2.76	1.09	[0.62, 4.90]	.012**	0.98	0.70	[-0.39, 2.35]	.161
LR $\chi^2(10)$				32.26				
Prob > $\chi^2$				0.004				
Pseudo $R^2$				.1233				

Note. OR = odds ratio; CI = confidence interval; LR  $\chi^2(x)$  refers to the likelihood ratio  $\chi^2$  statistic.

\* $p \leq .05$ . \*\* $p < .01$ .

sex and oral mucosa alteration (Al-Maweri et al., 2015; Bozdemir et al., 2019; Wongviriyaya et al., 2018). In these studies, authors attributed the difference between genders to the social values of the country that expose men to more risk habits than women, including smoking and drinking, which is not applicable in Lebanon where men and woman are equally exposed to such habits. Nevertheless, the prevalence of oral mucosal lesion was affected by the individual's geographic background. Indeed, this factor may be controlled by the socioeconomic status of the population in each district, as low socio-economic status and socio-economic deprivation could lead to a poor oral health (Vieira-Andrade et al., 2011).

Systemic diseases and medication use may lead to the dry mouth sensation, which was reported by 49% of our population. This could eventually lead to oral mucosal alteration. However, similar to previous studies (Al-Maweri et al., 2015; Wongviriyaya et al., 2018), our results did not associate the medical condition of the patient to the development of oral mucosal lesion.

Previous studies have reported a higher prevalence of oral mucosal lesions in elderly wearing removable dentures compared with nonwearers (Bozdemir et al., 2019; Ferreira et al., 2010). In this study, full denture wearers showed a higher prevalence compared with partial denture wearers (Table 5). Our results are in agreement with

Bozdemir et al. (2019) and contradict the results reported by Kovacevic (2017). In fact, complete dentures are mainly made of acrylic resin in which micropores may develop over time, allowing microorganisms to inhabit the prosthesis whereas partial prostheses are primarily made of metal, which does not allow the colonization of microorganisms. Previous studies have also noted a higher prevalence of oral mucosal lesions due to maxillary dentures compared with the mandibular ones (Canger et al., 2009). This was attributed to the smaller surface of mucosa under the latter, which would increase the possibility of mucosal lesion occurrence. However, no significant difference was noted between the two types of prosthesis in our study.

The prevalence of oral mucosal lesion has also been linked to the hygiene level of dental prosthesis. In accordance with previous studies (Ferreira et al., 2010; Freitas et al., 2008), a poor hygiene level of mandibular and maxillary prosthesis resulted in a higher prevalence of oral mucosal lesions (Table 4). Also, an altered integrity of the prosthesis plays a role in the occurrence of oral mucosal lesion.

In this study, participants with unmet need for prosthesis exhibited more oral mucosal lesions than those where the need was met (Table 5). In fact, different studies reported a higher oral mucosal lesion rate in patients individuals with old prosthesis compared with those with newer prosthesis one (Bozdemir et al., 2019; Ferreira et al., 2010; Kovacevic, 2017). The stability and integrity of the prosthesis are altered with time, resulting in traumatic lesions to the oral mucosa. Although prosthesis use pattern may also influence the prevalence of oral mucosal lesions, this variable was not investigated in our study. Indeed, constant use of the prosthesis leads to the development of mucosal lesion due to mechanical irritation and infection (Bozdemir et al., 2019; Ferreira et al., 2010; Kovacevic, 2017).

The multivariate regression analysis showed that the occurrence of oral mucosal lesion is associated to the frequency of visits and mandibular denture hygiene level when other factors are controlled (Table 7). A statistically significant relation was found between owning a removable mandibular denture and the sensation of a dry mouth. In fact, the combination of dry mouth with mechanical and/or chemical irritations could lead to the development of oral mucosal lesions (Gorsky et al., 2004).

In this study, the relationship between frequency of visits and oral health was also investigated, since it could be related to the fact that an isolated individual might not be interested to maintain a good hygiene and personal appearance because of psychological problems. Unfortunately, in Lebanon, there is a lack of scheduled dental visits for elderly in residential homes. Even the health care staff and nurses are not trained nor informed about oral hygiene importance and techniques.

Our study target was the institutionalized elderly population in Lebanon. Further studies are required to investigate the same variables in the noninstitutional-

ized Lebanese elderly population to have a more representative sample of the Lebanese geriatric population.

## Conclusion

The association between oral mucosal lesion occurrence in the geriatric population living in nursing homes across Lebanon and different risk factors was investigated in this study. Variables such as age, sex, systemic disease, and medication did not favor the development of oral mucosal lesions whereas the use of dentures along with their condition and hygiene level were associated with their prevalence. In addition, the prosthodontic neglect was noted among the studied population. Therefore, the implementation of a solid oral health program in Lebanese nursing homes is crucial to ensure the well-being of the institutionalized elderly population.

## Clinical Significance

The global geriatric population is expanding, especially in developing countries. Consequently, the oral health of this population has become a point of focus in dentistry. In Lebanon, a major prosthodontic neglect has been noticed in nursing homes. The prevalence of oral mucosal lesions is an indicator of the oral health condition of elderly individuals. Therefore, this study aimed to shed the light on the importance of implementing an appropriate oral health program in Lebanese nursing homes. For this purpose, factors affecting the prevalence of oral mucosal lesion among an institutionalized elderly Lebanese population have been determined.

## Authors' Note

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## Ethical Approval and Consent to Participate

The protocol of the study was approved by the Committee of Ethics at Lebanese University, (Code: 146/242018). Written and verbal informed consent was obtained from the participants.

## Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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