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ORAL MANIFESTATIONS IN HOSPITALIZED COVID-19 PATIENTS: A LONGITUDINAL STUDY

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Abstract

Objectives: *This study was conducted to determine the occurrence of oral manifestations in patients with COVID-19 hospitalized with 4 months of follow-up.*

Material and methods: *This research surveyed the patients admitted to Shahid Beheshti Hospital in Kashan. Patients admitted to the hospital were asked to fill a questionnaire containing questions about the amount of xerostomia, changes in their sense of smell and taste compared to the past, the appearance of a new white or red area in their mouth, the occurrence of ulcers or burning in the mouth. Then, photographs of the palate, tongue region, buccal region on both sides, floor of the mouth and teeth from the patient's front view were taken. The patient was followed weekly in the hospital. The first outside of the hospital follow-up was done two weeks after their discharge and then monthly up to 4 months. Finally, all the photos were reviewed and compared by an oral disease specialist.*

Results: *Out of 304 patients, only 5 patients (1.6%) had no symptoms in their oral on the day of admission. The most common oral manifestation was coated tongue (77%) followed by xerostomia (70.1%). Also, 45.1% gustatory disorders and 43.1% olfactory disorders were reported. With increasing age, the occurrence of oral manifestations increased ($p<0.05$), but the occurrence of oral manifestations was not related to gender ($p>0.05$). The results of generalized estimating equation analysis showed a decrease in oral manifestations during the study ($p<0.001$).*

Conclusion: *Coated tongue, xerostomia and gustatory disorders were among the most prevalent oral manifestations reported in this study. Older patients had more oral manifestations. The occurrence of manifestations was not related to gender. By recovering from the disease, the occurrence of oral manifestations also decreased.*

Clinical Significance: *Diagnosing and treating oral manifestations can cause to diagnose and treat COVID-19 disease.*

Keywords: *COVID-19, hospitalized patients, oral manifestation.*

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Introduction

The COVID-19 pandemic started in December 2019 and according to the statistics of the World Health Organization, it infected more than 600 million people around the globe by September 2022, and took the lives of nearly 6.5 million people. Corona virus disease or COVID-19 is a disease caused by a new coronavirus and its pathogen is a beta virus, which is similar to SARS and MERS. Fever, sore throat, shortness of breath and dry cough are among the signs and symptoms of the novel coronavirus 2019. Also, some published papers reported about skin and oral signs and symptoms [*Fini M, 2020; Ghotbi B et al., 2020; Soori H, Akbari H, 2022; Kosari M et al., 2024*].

Oral manifestations related to this virus include various types of manifestations such as ulcers, blisters and macules, which differ in the number, color, and location of manifestations [*Amorim Dos Santos J et al., 2021a; Binmadi N et al., 2022; Farid H et al., 2022*]. Oral manifestations due to swallowing disorders, creating multiple ulcers, reducing the speech capability and chewing ability, can affect the patient's quality of life. Also, it can slow down the recovery rate of patients and increase their mortality rate because of the reduction in the eating ability [*Nguyen P et al., 2005*].

Considering the transmission of the virus through the nasal or oral breathing, as well as the presence of ACE2 receptors in the tongue mucosa and salivary glands - which are the receptors of this virus - it can be assumed that the oral mucosa can be the first area infected with the COVID-19 virus [*Petrescu N et al., 2020; Amorim Dos Santos J et al., 2021a*]. It is still not completely clear whether the occurrence of oral manifestations is due to infection with the virus or due to the background effects of concurrent infections, disruption of the individual's immune system, or complications of drug treatment [*Yazdanpanah F et al., 2020*].

It is important to recognize oral manifestations in patients with COVID-19 for two reasons; First, knowing the origin of the manifestation is very important in choosing the treatment. For example, prescribing supportive treatments such as corticosteroids and dexamethasone mouthwashes, regardless of the viral origin of the lesion, exacerbate it [*Kim A, Gandhi R, 2021; Binmadi N et al., 2022*]. Second, since those who contracted COVID-19 have a weak immune system [*Binmadi N et al., 2022*], they may be prone to autoimmune manifestations in their mouths, which are sometimes premalignant [*Jagtap S et al., 2017; Goodson M, 2019*]; which can be partially prevented from becoming malignant by correctly diagnosing the symptoms and informing patients of the importance follow-ups [*Goodson M, 2019*].

This study was conducted with the aim of investigating the occurrence of oral manifestations of COVID-19 patients admitted to Shahid Beheshti Hospital in Kashan in 2021-2022 and following them up for 4 months after getting discharged.

Materials and methods

Design of the research and the population: This is a descriptive study and was conducted with a longitudinal method. Patients with COVID-19 admitted to Shahid Beheshti Hospital in Kashan were examined in 2021-2022. This hospital was the only one in Kashan where patients with COVID-19 were admitted. The inclusion criteria of the patients included a certain diagnosis of COVID-19 through a positive lung CT scan, PCR or serum antibody and the ability to cooperate, speaking and opening the mouth.

In this study, to facilitate the survey, the oral manifestations of the patients have been categorized into four levels. A patient with no oral manifestation considered to be at "zero level", with manifestations from the mild group including xerostomia, coated tongue, fissured tongue, depapillated tongue, scalloped tongue, geographic tongue, frictional hyperkeratosis considered to be at the "mild level", having manifestations of one of the important groups including external and intraoral herpes group, fungal infections, olfactory and gustatory disorders group, pigmentation group and lichen planus group, Aphthous, pemphigus, single ulcers with or without manifestation of mild group in "moderate level" and having more than two important groups were placed in "severe level" (Table 2).

Size of the sample: To determine the sample size, the study of Behzad Iranmanesh and co-authors was considered. In this study, the prevalence of oral manifestations was in the mucosa of the lip (26%) and palate (22%) [*Iranmanesh B et al., 2020*]. With 5% accuracy and 95% confidence, the sample size was calculated as 296 people. The

samples were selected through a convenience sampling method.

Data gathering method: By visiting the hospital on a daily basis, the list of newly admitted patients was taken. Then, a written consent was taken from the patients and questionnaires were distributed among them. The questionnaire contained questions about the history of oral manifestations, the degree of xerostomia, changes in the sense of smell and taste compared to before, the appearance of new white and red areas in the mouth, the presence of ulcers or burning in the mouth were asked. The Visual Analogue scale was used to measure xerostomia. No test was used to measure the changes in smell and taste, and only the patient's report regarding the change in these senses was considered.

Seven subsides of the mouth including left and right buccal, floor of the mouth, teeth from the front view, palate, ventral and dorsum of the tongue were photographed with a cellphone camera under natural light. Also, the information of the patient's file, including name and surname, age, contact number, their underlying diseases, medicines taken by the patient, history of addiction and tests taken from them during their hospitalization were also recorded. Because the recovery time for oral manifestations is about 2 weeks. The follow-up of the patient was done weekly in the same way until hospitalization.

The first follow-up was done via phone call two weeks after the patient's discharge. The patient was asked to fill-up the questionnaire again via the press line portal. Then a sample of the hospital photos were sent to them via WhatsApp so that they could take and send pictures of the buccal areas on both sides, floor of the mouth, tongue, teeth and palate.

All the photos were examined by a maxillofacial specialist and their manifestations were recorded. In the same way, the next follow-up was done 2 weeks after the first follow-up (the first month after discharge). Future follow-ups were done monthly up to 4 months to reduce the complications of the virus and the patient's relative recovery. In the meantime, the patient was referred to the office of an oral disease specialist for an in-person examination, if needed.

In this study, to facilitate the review, the condition of patients' oral manifestations was classified

Table 1

Demographic distribution of COVID-19 patients

Variables	Status	Count (%)
Gender	Male	163 (44.7)
	Female	168 (55.3)
Age group	Under 39 years old	74 (24.3)
	40-59 years	138 (45.4)
	Above 60 years old	92 (30.3)
Education	Illiterate	74 (24.3)
	K12 education	158 (52.0)
	Academic degree	72 (23.7)
Vital status	Alive	300 (98.7)
	Deceased	4 (1.3)
Age (*years*) SD ±X		95 ± 15.50
Total patients		304

Table 2

Abundance distribution of oral manifestation of COVID-19 patients

Time	Oral manifestation status Number (%)			
	N.A	Mild	Moderate	Severe
Admission day (n=304)	5(1.6)	16 (5.3)	64 (21.1)	219 (72.0)
One week follow-up in the hospital * (n=42)	1(2.4)	3 (7.1)	7 (16.7)	31 (73.8)
Observation time after discharge				
Two weeks (n=227)	10(4.4)	30 (13.2)	57 (25.1)	130 (57.3)
One month (n=201)	16(8.0)	53 (26.3)	70 (34.8)	62 (30.9)
Two months (n=163)	18(11.0)	54 (33.2)	62 (38.0)	29 (17.8)
Three months (n=122)	18(14.8)	48 (39.3)	46 (37.7)	10 (8.2)
Four months (n=103)	15(14.5)	45 (43.7)	36 (35.0)	7 (6.8)

Note: ** Hospital follow-up of patients who were hospitalized more than a week.*

into four levels. A patient without oral manifestation at "N.A level", having only manifestations of the mild group including xerostomia, coated tongue, fissured tongue, depapillated tongue, scalloped tongue, geographic tongue, frictional hyperkeratosis at "mild level", having manifestation of one of the important groups includes the group of external and intraoral herpes, fungal infections, the group of olfactory and gustatory disorders, the group of pigmentations and the group of lichen planus, aphthous, pemphigus, single ulcer with or without manifestation of the mild group in "moderate level" and with manifestation of more than two important groups were categorized as "severe level".

Data analysis: After collecting the data, first the data was imported into SPSS-22 software and the occurrences of oral manifestations were calculated. T-tests and ANOVA were used to compare quantitative variables (age, number of oral manifestations) and Chi-Square and Fisher's exact tests were used for qualitative variables (gender, level of oral manifestations). Finally, generalized estimating equation analysis using logit link was used to analyze the data over time.

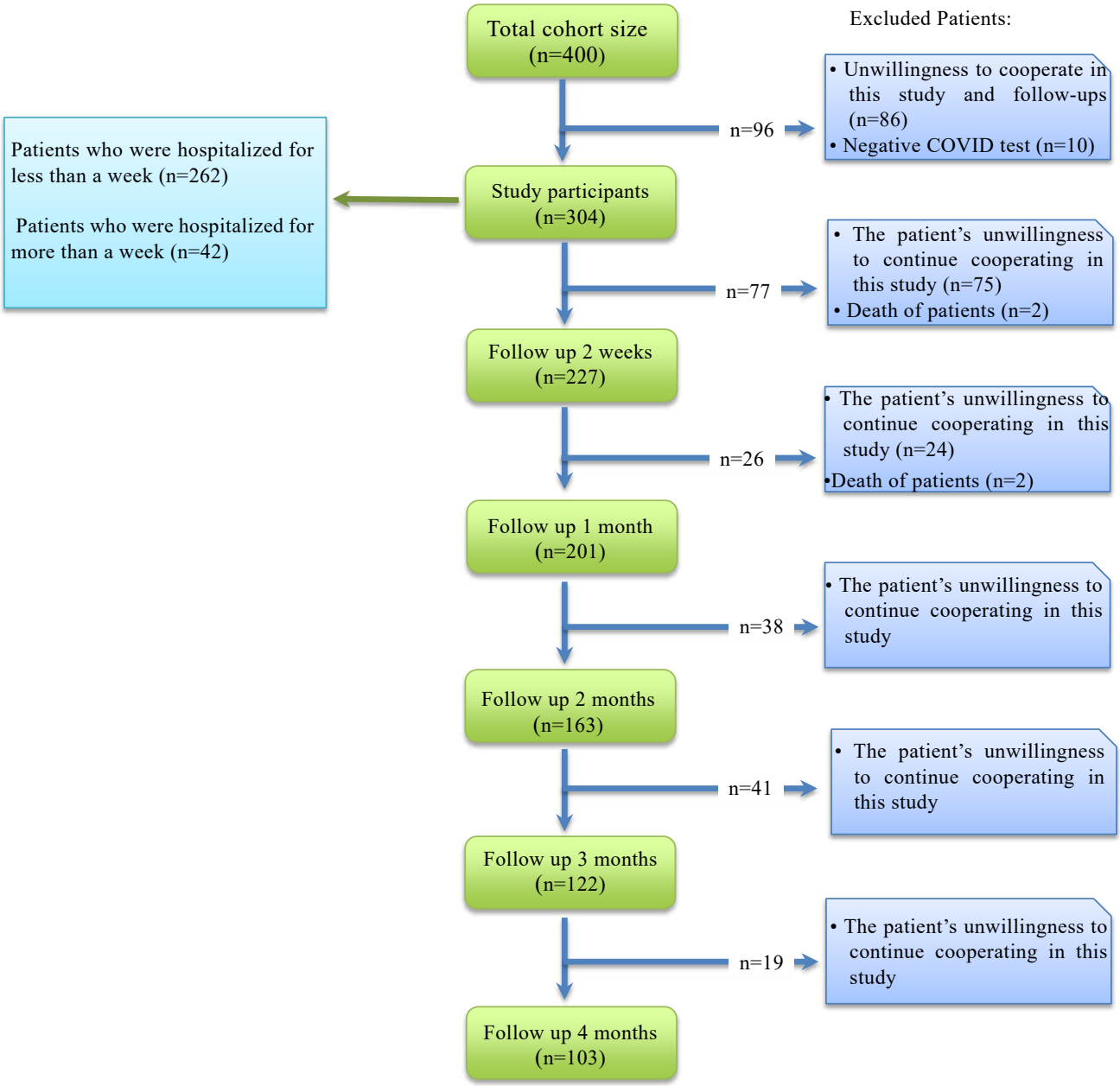

Figure. Consort of study

Table 3

The abundance of oral manifestations status in COVID-19 patients in terms of gender and age

Mouth manifestation status	Gender Number (%)			Age count Number (%)				
	Female	Male	p value	Under 39	40 – 59	Above 60	Total (%)	p value
Admission day								
N.A	4(2.4)	1(0.7)		3(4.1)	2(1.4)	0(0.0)	5(1.6)	
Mild	3(1.8)	13(9.6)		6(8.1)	6(4.3)	4(4.3)	16(5.2)	
Moderate	36(21.4)	28(20.6)	0.136	16(21.6)	33(23.9)	15(16.3)	64(21.1)	0.029
Severe	125(74.4)	94(69.1)		49(66.2)	97(70.3)	73(79.4)	219(72.1)	
Total (%)	168	136		74	138	92	304	
One week follow-up in the hospita								
N.A	1(4.0)	0(0.0)		0(0.0)	1(4.8)	0(0.0)	1(2.4)	
Mild	3(12.0)	0(0.0)		1(10.0)	2(9.5)	0(0.0)	3(7.1)	
Moderate	3(12.0)	4(23.5)	0.763	4(40.0)	2(9.5)	1(9.1)	7(16.7)	531.0
Severe	18(72.0)	13(76.5)		5(50.0)	16(76.2)	10(90.9)	31(73.8)	
Total (%)	25	17		10	21	11	42	
Two weeks after discharge								
N.A	6(4.7)	4(4.1)		4(6.9)	4(3.9)	2(3.0)	10(4.4)	
Mild	13(10.1)	17(17.3)		6(10.3)	20(19.6)	4(6.0)	30(13.2)	
Moderate	27(20.9)	30(30.6)	0.075	20(34.5)	22(21.6)	15(22.9)	57(25.1)	0.029
Severe	83(64.3)	47(47.9)		18(48.3)	56(63.9)	46(68.6)	130(57.3)	
Total (%)	129	98		48	102	67	227	
One month after discharge								
N.A	11(9.9)	5(5.6)		4(8.0)	7(7.6)	5(8.5)	16(8.0)	
Mild	27(24.3)	26(28.9)		16(32.0)	27(29.3)	10(16.9)	53(26.4)	
Moderate	39(35.1)	31(34.4)	0.788	16(32.0)	33(35.9)	21(35.6)	70(34.8)	0.171
Severe	65(30.7)	28(31.1)		14(28.0)	25(27.1)	23(39.0)	62(30.8)	
Total (%)	111	90		50	92	59	201	
Two months after discharge								
N.A	14(14.1)	4(6.3)		3(8.3)	8(10.8)	7(13.2)	18(11.0)	
Mild	34(34.3)	20(31.3)		15(41.7)	25(33.8)	14(26.4)	54(33.1)	
Moderate	36(36.4)	26(40.6)	0.059	17(47.2)	25(33.8)	20(37.7)	62(38.0)	0.171
Severe	15(15.1)	14(21.9)		1(2.8)	16(21.7)	12(22.7)	29(17.8)	
Total (%)	99	64		36	74	53	163	
Three months after discharge								
N.A	15(21.1)	3(5.9)		3(10.3)	10(17.5)	5(13.9)	18(14.8)	
Mild	23(32.4)	25(49.0)		14(48.3)	23(40.4)	11(30.6)	48(39.3)	
Moderate	28(39.5)	18(35.3)	0.243	12(41.4)	20(35.1)	14(38.9)	46(37.7)	0.148
Severe	5(7.0)	5(9.8)		0(0.0)	4(7.0)	6(16.7)	10(8.2)	
Total (%)	71	51		29	57	36	122	
Four months after discharge								
N.A	12(21.1)	3(6.5)		2(8.3)	9(17.3)	4(14.8)	15(14.6)	
Mild	21(36.8)	24(52.2)		12(50.0)	23(44.2)	10(37.0)	45(43.7)	
Moderate	21(36.8)	15(32.6)	0.329	10(41.7)	17(32.7)	9(33.3)	36(35.0)	0.548
Severe	3(5.3)	4(8.7)		0(0.0)	3(5.8)	4(14.8)	7(6.8)	
Total (%)	57	46		24	52	27	103(100)	

Results

In this study, 304 patients with COVID-19 were included in the study (Fig). 44.7% (136 people) were men. The age range of patients was from 17 to 90 years with an average age of 50.95 and a standard deviation of 15 years. 30.3% (92 people) of patients were over 60 years old. During the research, 2 men and 2 women deceased. The cause of death of 2 people was reported to be mucormycosis, and 2 other people were due to severe pulmonary involvement following COVID-19 disease (Table 1).

Cardiovascular diseases (37.2% of people) were the most prevalent diseases among the participants; Therefore, cardiovascular medications were the most commonly used medicines among the patients (33.9%) (Data not shown).

The majority of patients were in the "severe level" (72.1%) in terms of oral manifestations on the day of admission. Improvement in severity and reduction in number of manifestations were seen in subsequent follow-ups. In the follow-up of the fourth month, the state of oral manifestations was often at "mild level" (43.7%) (Table 2).

In this study, women had more "severe level" oral manifestations than men on the day of admission and at the two-week follow-up. The recovery process was faster in women and this ratio reversed from the first month onwards. In none of the follow-ups, the relationship between gender and oral manifestations was statistically significant (Table 3).

In terms of age, patients were divided into three groups: under 39 years old (24.4%), between 40 and 59 years old (45.4%) and over 60 years old (30.2%) so that the number of patients in each group was almost equal. Oral manifestations in people over 60 years old were more than other groups and the course of recovery was slower in them. The relationship between age and the occurrence of oral manifestations on the day of admission and two weeks after discharge was direct and statistically significant (p=0.029) (Table 3).

The most common oral manifestation of patients on the day of admission was coated tongue (77%). This manifestation had a significant effect at the end of the follow-up. Xerostomia was the second most common symptom (70.1%); 73.7% of patients reported xerostomia feeling prodromal (before the onset of acute clinical symptoms of the disease such as fever or cough), 45.1% of patients experienced gustatory disorders and 43.1% experienced olfactory changes.

Among the gustatory disorders, Ageusia was reported to be 20.1%. At the end of the follow-up, the tasting sense of all subjects had been partially recovered. Anosmia was also reported to be 18.8% on the day of admission, and in the fourth month follow-up, only one person still suffered from loss of smell, 12.5% had dysgeusia on the day of admission.

Single ulcers were reported in 25.7% and angular cheilitis in 41.8%. The healing of herpes virus lesions, aphthous and ulcers was observed during 4 months. A patient with pemphigus was also identified who cooperated until the first month and then refused to continue participating in the study. Reduction of fungal lesions and furry tongue was observed in the fourth month. Four cases of lichen planus and 22 cases of frictional hyperkeratosis were seen on the day of admission, and the decrease in their frequency was due to the withdrawal of the patient from the study (Table 4).

Out of 304 patients, only 42 (13.8%) were hospitalized for more than 1 week, 227 people (74.6%) participated in the two-week follow-up and 201 people (66.1%) participated in the first month follow-up. Until the first month of follow-up, 4 patients also deceased. Over time and with the improvement of the patients, their cooperation also decreased. Finally, the follow-ups were completed in the fourth month with the cooperation of 103 people (33.8%). The results of generalized estimating equation analysis showed a decrease in oral manifestations during the study ($p<0.001$) (Fig).

Discussion

The prevalence of oral manifestations in patients with COVID-19 is variable and has been reported from 25.6% in Nuno Gonzalez study to 88.8% in Jerome R. Lechien's study [*Lechien J et al., 2020; Nuno-Gonzalez A et al., 2021*].

In the present study, on the day of admission, 98.4% of patients had oral manifestations, 72.1% of the population had their oral manifestations at a "severe level", which decreased to 6.8% at the end of the follow-up. In their study, Nada O. Binmadi and colleagues reported 29% of oral manifestations, which were symptomatic in only 68% of cases [*Binmadi N et al., 2022*]. The cause of this difference can be considered to be the broader

Table 4

Abundance distribution of the oral manifestations and changes in sensations in COVID-19 patients

Group admission day		time (%)						
		Admission day	Hospital follow-up*	two weeks	one month	two months	three months	four months
coated tongue [a]		234(77.0)	34(81.0)	153(67.4)	119(59.2)	80(49.1)	50(41.0)	42(40.8)
xerostomia [b]		213 (70.1)	33(78.6)	91(40.1)	32(15.9)	13(8.0)	3(2.5)	2(1.9)
Changes in sensations	gustatory disorders [c]	137(45.1)	16(38.1)	94(41.4)	44(21.9)	28(17.2)	15(12.3)	6(5.8)
	olfactory disorders [c]	131(43.1)	15(35.7)	92(40.5)	36(17.9)	20(12.3)	10(8.2)	5(4.9)
Pigmentation	melanin related pigmentation d	80(26.3)	15(35.7)	54(23.8)	48(23.9)	40(24.5)	28(23.0)	23(22.3)
	iron and hemoglobin related pigmentation [e]	46(15.1)	7(16.7)	23(10.1)	8(4.0)	4(2.5)	2(1.6)	1(1.0)
Ulcerative, vesicular and bullous lesions	herpes simplex	24 (9.7)	4(5.9)	9(0.4)	5(2.5)	1(0.6)	0	0
	recurrent aphthous stomatitis	11(3.6)	4(9.5)	17(7.5)	5(2.5)	3(1.8)	1(0.8)	0
	pemphigus	1(0.3)	1(2.4)	1(0.4)	1(0.5)	0	0	0
	single ulcers	78 (7.25)	14(3.33)	45(8.19)	13(5.6)	3(8.1)	1(0.8)	3(2.9)
White and red mucosa lesions	Pseudomembrane candidiasis	86(28.3)	16(38.1)	24(10.6)	8(4.0)	1(0.6)	1(0.8)	0
	Glossit	28(9.2)	7(16.7)	10(4.4)	3(1.5)	2(1.2)	0	0
	Denture stomatitis	65(21.4)	9(21.4)	44(19.4)	26(12.9)	11(6.7)	2(1.6)	1(1.0)
	Angular cheilitis	127(41.8)	17(40.5)	32(14.1)	4(2.0)	0	0	1(1.0)
	Lichen planus	4(1.3)	1(0.3)	4(1.8)	4(2.0)	4(2.5)	1(0.8)	1(1.0)
	frictional hyperkeratosis	22(7.2)	1(2.4)	18(7.9)	16(8.0)	12(7.4)	10(8.2)	8(7.8)
	furry tongue	108 (5.35)	9(21.4)	20(8.8)	4(2.0)	3(1.8)	1(0.8)	0
	geographic tongue	10(3.3)	2(4.8)	5(2.2)	2(1.0)	1(0.6)	0	0
	depapillated tongue	43(14.1)	8(19.0)	16(7.0)	8(4.0)	4(2.5)	4(3.3)	1(1.0)

Notes: ** Hospital follow-up of patients who were hospitalized for more than a week.*
[a] *Coated tongue is classified into four levels: severe, moderate, mild, no. In this study, it was assumed that two levels, severe and moderate, are the disease-type coated tongue.*
[b] *Xerostomia was measured according to Visual Analogue scale score. The patient was asked to rate his xerostomia from 0 to 10 (0 no dryness and 10 very dry). In this study, it was assumed that a score of 6 and above is pathological dryness.*
[c] *The changes in smell and taste were measured according to the patient's opinion regarding the change in sensations compared to before.*
[d] *Most of the melanin related pigmentation existed physiologically or were formed as a result of drug use.*
[e] *Most of the pigmentation related to iron and hemoglobin were seen as petechiae.*

types of manifestations that have been discussed in our study. Fissured, scalloped and coated tongue are among the manifestations that were not considered in the above study.

In the meantime, women showed more manifestations on the day of admission, which the study of Binmadi N.O. et al. (2022) was in line with this finding; Of course, they reported a statistically significant relationship between gender and the occurrence of oral manifestations (p=0.027) [*Binmadi N et al., 2022*]. Exacerbated vigor, the activity of innate immune mechanisms [*Oertelt-Prigione S, 2012*] and hormonal modulations may be responsible for the higher prevalence of manifestations among this gender [*Taneja V, 2018*]. However, in the present study, follow-ups showed that women had a better recovery process and regained their oral health faster than men. Contrary to our findings, Behzad Iranmanesh et al. reported a same rate of manifestation in both sexes [*Iranmanesh B*

et al., 2020]. Manifestations were also more common at older ages. Several studies have confirmed this finding and stated that immune system suppression is one of its effective factors [*Iranmanesh B et al., 2020; Binmadi N et al., 2022*].

One of the important findings of this study is the high prevalence of xerostomia among patients. In our study, the frequency of xerostomia on the day of admission was 70.1%, of which 73.7% was prodromal. The study of J. Amorim dos Santos et al., Elaha Ghasemzadeh et al. and Paolo J Fantozzi et al. showed that xerostomia can appear before the onset of other clinical symptoms of COVID-19 [*Fantozzi P et al., 2020; Amorim J et al., 2020; Fathi Y et al., 2021*]. In the study by Binmadi N.O. et al. (2022), the amount of xerostomia was reported lower than the present study (42% vs. 70.1%). This difference is probably due to the difference in the average age of the studeceased populations [*Stankeviciene I et al., 2021*] and the different clinical conditions of the patients (66% under 34 years old versus 24.3% under 39 years old - 7% history of hospitalization versus 100% history of hospitalization) [*Binmadi NO et al., 2022*]. Several other studies also reported the prevalence of xerostomia but with a lower percentage than ours [*Amorim Dos Santos J et al., 2021b; Kamel A et al., 2021; Stankeviciene I et al., 2021*]. Contrary to all these studies, Yu-Hsueh Wu et al. reported a low prevalence of xerostomia at 3.9% [*Wu Y et al., 2021*].

Studies indicate that the average duration of xerostomia is short and it has been reported to be persistent only in a few casesm [*Fantozzi P et al., 2020; Amorim dos Santos J et al., 2021b; Fathi Y et al., 2021; Sharma P et al., 2022*]. In the present study, at the end of follow-up, 1.9% of people still complained about xerostomia.

The study of Bruna Sinjari et al. (2020) stated that xerostomia increases significantly during hospitalization ($p = 0.02$), and this increase was also seen in the one-week follow-up of our hospital.

To date, gustatory disorders have been reported as the most frequent oral manifestation associated with COVID-19, and has been variable with rates ranging from 5.6% in initial reports from China [*Mao L et al., 2020*] to 88.8% in a study by otorhinologists [*Lechien J et al., 2020*]. Also, the papers show that 95% of gustatory disorders are secondary to olfactory disorders and distinguishing these two disorders is very difficult for most patients [*Fantozzi P et al., 2020; Farid H et al., 2022*].

In our study, on the day of admission, 45.1% of patients suffered from changes in the sense of taste, which was similar to the report of J. Amorim dos Santos et al. [*Amorim Dos Santos J et al., 2021a*] and less than the results of Binmadi N.O. et al. (2022). The fact that the study population is younger can be seen as the reason for this difference [*Amorim Dos Santos J et al., 2021a; Sehanobish E et al., 2021*]. Among them, 20.1% of patients had Ageusia and 12.5% had Dysgeusia. Gherlone E.F. and colleagues reported Dysgeusia as 11.4% [*Gherlone E et al., 2021*] and Amorim dos Santos J and colleagues (2021a; 2021b) reported 33% of Dysgeusia and 26% of Ageusia.

Olfactory disorder, as another symptom of COVID-19, was ranked sixth in the current study (43.1%) and its frequency was similar to some reports [*Fantozzi P et al., 2020; Binmadi N et al., 2022*]. 18.8% of this disorder was Anosmia, which was different from the report of Gherlone E.F. It can be said that this difference is caused by the different way of investigating Anosmia (asking the patient versus a special test to measure smell) in two studies [*Gherlone E et al., 2021*].

Fungal lesions are important and opportunistic lesions that are likely to occur in a variety of systemic diseases. In the current study, the most common lesion on the day of admission was angular cheilitis from the category of fungal infections with a frequency of 41.8%, but in the study by J. Amorim dos Santos et al., this lesion was in the last category in terms of frequency [*Amorim Dos Santos J et al., 2021a*]. Vitamin 12B deficiency, iron deficiency, dry lips and decrease in the face height are related to this disorder [*Glick M., 2015*]. Considering the average age of patients in our study, the high number of toothless people, and especially the higher rate of xerostomia, the more common occurrence of this lesion is justifiable.

Among other important fungal lesions, false membrane candidiasis can be mentioned. Weakened immune system is one of the important causes of this lesion [*Glick M., 2015*]. Its frequency in our study on the day of admission was 28.3% and contrasts with the study by Binmadi N et al. (2022) who reported 6%, Wu et al. (2021) reported 3.9%

and Nuno Gonzalez A. et al. (2021) reported 1%. The higher average age and more acute clinical conditions of our patients caused the occurrence of this lesion to be higher than the values in the mentioned studies. In these studies, pseudomembranous candidiasis lesions were healed within a few days, which was in line with the findings of our follow-up.

Some studies have considered ulcerative lesions as one of the most common oral lesions [*Wu Y et al., 2021; Di Spirito F et al., 2022; Farid H et al., 2022*], and there are many reports of the high prevalence of ulcers [*Amorim dos Santos J et al., 2021b, Nuno-Gonzalez A et al., 2021; Di Spirito F et al., 2022*]. Meanwhile, fungal lesions were the most common lesions in our study and a few of our patients had oral thrush (3.6%). The higher severity of the COVID-19 disease in hospitalized people has caused more corticosteroids to be prescribed in these patients (98.4%), which can justify this decrease in the occurrence of aphthous [*Altenburg A et al., 2014*].

The rate of petechia observed in the present study on the day of admission was 15.1% and in the report of Binmadi N. et al. (2022), it was 6%. There are two reasons for this discrepancy. One is that 37.2% of our patients routinely took cardiovascular medications, but in the above study, these people constituted 3.5% of the population. Another reason can be considered to be the higher accuracy of diagnosis in our study. Because the oral examination and diagnosis in our study was carried out by a specialist in oral, maxillofacial, and facial diseases, while in the mentioned study, only the patient was asked about the presence of petechiae [*Glick M, 2015; Binmadi N et al., 2022*].

Geographical tongue is another lesion that several studies have reported about its appearance in the mouths of patients with COVID-19 [*Amorim Dos Santos J et al., 2021a, 2021b; Binmadi N et al., 2022; Farid H et al., 2022*]. The prevalence of this lesion in our study on the day of admission was 3.3% and close to other reports [*Wu Y et al., 2021; Binmadi N et al., 2022*]. The hereditary and congenital nature of this lesion [*Glick M, 2015*] can be the cause of this similarity and its slight decrease during the follow-ups.

In general, in the present study, with the passage of time, improvement was observed in most of the oral lesions; This reduction was more evident in the first two weeks after discharge. In this regard, Huma Farid and colleagues also stated that mucosal lesions disappeared or decreased in size within 6 days to 2 weeks [*Farid H et al., 2022*]. Iranmanesh B. and colleagues (2020) also mentioned this recovery of lesions between 3 and 28 days.

Conclusion

Coated tongue and xerostomia were the most common oral manifestations and fungal lesions were the most frequently observed lesions. Oral manifestations increased with age. The occurrence of oral manifestations was not related to gender. The follow-ups showed that as the disease improves, oral manifestations also decrease. However, a certain relationship between the occurrence of oral manifestations and the virus has not been obtained, and their occurrence can be considered as a result of the weakened immune system and the use of medicines, but in general, their recognition and identification by dentists can lead to early diagnosis of COVID-19 disease and help to treat it better.

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