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RESEARCH ARTICLE

PREVALENCE OF ORAL REACTIVE HYPERPLASTIC LESIONS AND ASSOCIATED RISK FACTORS IN A SAMPLE OF YEMENI DENTAL PATIENTS IN SEVERAL UNIVERSITIES AND PUBLIC HOSPITALS

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Abstract

Background and aims: Reactive lesions may result from the oral mucosa's continuous exposure to endogenous and external stimuli. The nature of these lesions is not cancerous. They display a variety of pathologies, from neoplasms to reactive, inflammatory, and developmental abnormalities. Dental plaque and tartar, sharp edges of severely carious teeth, defective dental fillings, chronic biting habits, ill-fitting dental/oral appliances, and food impaction are just a few examples of the various forms of chronic, low-grade irritation of the oral mucosa that can cause reactive lesions. Benign neoplastic proliferations and oral reactive lesions look a lot alike. Investigating the frequency of reactive periodontal lesions and the characteristics that are linked to them in a sample of adult Yemeni dentistry patients in Sana'a City was the goal of this study.
Method: An observational cross-sectional study of 1197 Yemeni dental patients attending the Faculty of Dentistry, Sana'a University, Alrazi University, Alyemenia University, Aljomhori and Althawra hospitals were examined for the presence of reactive hyperplastic lesions.
Results: A total of 48 (4%) patients were found to have reactive hyperplastic lesions. Focal fibrous hyperplasia is the most common type representing (91.7%). Peripheral giant cell granuloma was the second most common type representing (6.3%). The most risk factors were qat chewing, teeth grinding, cheek biting and poor oral hygiene.
Conclusion: In the current study, irritant fibroma and pyogenic granuloma were the most and least common oral reactive hypertrophic lesions, respectively. Compared with males, the prevalence of lesions in female patients was equal, and older age groups were more probable to grow oral reactive hypertrophic lesions. The most frequent location for lesions was the gingiva.
Keywords: Focal fibrous hyperplasia, peripheral giant cell granuloma, peripheral ossifying fibroma, pyogenic granuloma, reactive hyperplastic lesions.

INTRODUCTION

The oral cavity is constantly exposed to a wide range of exogenous and endogenous stimuli, including physical, chemical, and microbial agents. Chronic, low-grade inflammatory stimuli, in particular, have been found to induce a heightened repair response, resulting in what are collectively known as reactive hypertrophic lesions (RHLs). These lesions generally resemble tumors and may be symptomatic or discovered incidentally during routine dental visits[1]. Various factors influence the clinical presentation of these lesions, such as age, trauma, gender, or degree of irritation, and the extent and features of the lesion. It is well documented that rheumatoid gingivitis is caused by chronic, mild inflammation caused by plaque and tartar, sharp edges of rigorously carious teeth, defective fillings, chronic biting habits, ill-fitting dental or oral appliances, and food impaction. It has also been reported that some of these lesions may be directly influenced by female hormone levels in females[2]. Clinically, these proliferations are generally painless, have a pedicled or firm base, and range in color from pale pink to red. Some of these lesions may bleed easily when touched, depending on their vascularity. The upper surfaces of RHLs may be ulcerated or non-

ulcerated, and a few millimeters to several centimeters is their size range. Furthermore, the onset of RHLs often rapid, with potential size fluctuations, and they may regress over time[3].

RHLs have been classified by Eversole into peripheral (extraosseous) lesions that occur on the soft tissues of the oral cavity such as gingiva, tongue etc., or central (intraosseous) occur inside the jaws. RHLs are more frequently seen on the gingiva and alveolar ridge followed by tongue, and buccal mucosa. Less common sites of involvements are hard palate and floor of the mouth. Though these lesions can occur across wide age groups and both genders, they are predominantly found in the females with a ratio of 2.5:1 to males, and with a high incidence in 5th, 6th and 7th decades of life[4,5].

The most common localized reactive lesions of oral cavity include focal fibrous hyperplasia (FFH), pyogenic granuloma (PG), peripheral giant cell granuloma (PGCG), and peripheral ossifying fibroma (POF) [6]. Histologically, RHLs consist of one or more of the connective tissue components, including collagen fibers, bone, endothelial cells, and multinucleated giant cells. This distinctive feature aids in their histopathological differentiation from each other[7]. It is interesting that the prevalence of RHLs has been estimated to vary from 5.6%[8] to 48%[9]. Several factors have been proposed in the literature to explain this variation, including geographical and lifestyles differences; diverse nomenclatures used to these lesions; racial factors; and the study population involved[10].

Indeed, the close resemblance in the clinical manifestation of the RHLs to the neoplastic lesions is a challenging matter for diagnosis and optimal treatment. Additionally, these lesions are painless, which often leads to them being overlooked for an extended period of time[11]. The aim of this study was to find out how common RHLs are and what factors were associated with them in a sample of adult Yemeni dental patients in Sana'a city.

METHODS

Study design: An observational cross-sectional clinical study.

Study population: A sample of Yemeni dental patients attending the Faculty of Dentistry, Sana'a University, Alrazi University, Alyemenia University, Aljomhori and Althawra hospital dental clinics.

Inclusion criteria: Adults and children over 5 years Yemeni dental patients.

Exclusion criteria: Children below 5 years, edentulous patients and non-Yemeni patients.

Sample size calculation: All patients visiting the oral medicine department of the three universities between February 2024 and June 2024 were included, according to the predetermined inclusion criteria.

Method of data collection: A total of 1,197 Yemeni patients, 724 males and 473 females, who attended the selected dental clinics were examined. All participants gave their informed consent, and each patient's relevant data was recorded using a data collecting routine. Risk factors and demographic information were gathered before the clinical assessment. Dental history was also verified, including data on previous dental treatments, any previous poor restorations, and their location. Habits such as cheek biting, teeth grinding, smoking, snuff use, qat chewing, and poor oral hygiene were also recorded. Participants underwent an additional clinical examination and an intraoral examination in a dental chair. An intraoral examination of soft tissues was performed, and if any oral lesions were found, the patient was referred to hospitals for histological examination to determine the tumor type. After collecting the information and laboratory results, the data were analyzed and tabulated.

Ethical considerations: Formally, ethical approval was achieved from the Medical Ethics Committee in the Faculty of Dentistry at Sana'a University No. (263). Permission was sought to examine the patients and agreement was obtained from all subjects that participated in the study.

RESULTS

The number of females was 473 (39.6%) and males 724 (60.4%), with 679 (56.7%) of patients aged ≤ 25 years, and 518 (43.3%) of patients aged ≤ 25 years (Table 1). Married patients comprised 431 (36%), while single patients comprised 766 (64%). Regarding occupations, most patients were students (724) (60.5%), followed by laborers (245) (20.5%), and housewives (144) (12%), while other occupations were less common.

Table 1: Sex and age distribution of patients presenting to oral medicine departments for investigation of reactive hypertrophic lesions (RHLs).

Characters	N (%)
Sex	
Female	473 (39.6)
Male	724 (60.4)
Age	
≤ 25 year	679 (56.7)
> 25 Year	518 (43.3)
Total	1197 (100)

Based on medical history, 201 patients (16.8%) had systemic diseases, such as diabetes, hypertension, rheumatoid arthritis, and others (Table 2). Most RHLs occurred in the age group >25 years, with 34 cases (70.8%) of the total, while only 14 cases (29.2%) were in the age group ≤25 years. Regarding gender, most RHLs occurred in males, with 29 cases (60.4%) of the total, while only 19 cases (39.6%) were in females (Table 3). The correlation between age, sex, and the prevalence of reactive hypertrophic lesions (RHLs) is displayed in Table 3. In both sexes, the frequency of RHLs was almost equal. For females, it was 4.7%, with an associated odds ratio (OR) of 1, a confidence interval (CI) of 0.53–1.9, and X^2=0.0, with a *p*-value of 0.99. Males also had the same results.

Table 2: Distribution of social and occupational status of patients presenting to oral medicine departments for investigation of reactive hypertrophic lesions (RHLs).

Characters	N (%)
Marital status	
Married	431 (36)
Single	766 (64)
Occupation	
Students	724 (60.5)
Workers	245 (20.5)
Housewife's	144 (12.0)
Teachers	23 (1.9)
Others	61 (5.1)
Medical history	
Systemic diseases	201 (16.8)
Total	1197 (100)

This indicates that the correlations and ORs were similar for both sexes, concluding that there is no association between RHLs and sex.

Regarding age, the prevalence of RHLs was higher in the older age group (>25 years), reaching 6.6%, with an associated OR of 3.3 times, a CI of 1.7–6.6, with a significant X^2 of 15.5, and a *p*-value of <0.0001. Younger ages showed a significant protective OR of 0.3.

The association between occupation, marital status, and the prevalence of reactive hypertrophic lesions (RHLs) in patients who visit oral medicine departments for RHL examination is displayed in Table 4. Regarding marital status, the prevalence of RHLs was higher in the married group, reaching 6.7%, with an associated odds ratio (OR) of 2.8 times, a confidence interval (CI) of 1.5–5.3, a significant X2 coefficient of 12.9, and a *p* value of 0.0003. Meanwhile, single individuals showed a lower prevalence of RHLs, with an OR of 0.5. Regarding occupations, the prevalence of RHLs was higher among housewives, reaching 9.03%, with an associated OR of 2.9 times, a CI of 1.4–5.8, a significant X2 coefficient of 10.7, and a *p* value of 0.001. While other occupations had no association with the occurrence of reactive hypertrophic lesions. Table 5 illustrates the correlation between the occurrence of oral and dental disorders and reactive hypertrophic lesions as well as personal activities like smoking, qat usage, oral cleanliness, and Shammah.

Table 3: Association between sex, age, and incidence of reactive hypertrophic lesions (RHLs).

Characters	N (%)	OR	CI	X^2	*p* value
Sex					
Female n=473	19 (4.7)	1.0	0.53-1.9	0.0	0.99
Male n=724	29 (4)	1.0	0.53-1.9	0.0	0.99
Age					
≤ 25 Year n=679	14 (2.1)	0.3	0.15-0.6	15.5	<0.0001
> 25 Year n=518	34(6.6)	3.3	1.7-6.6	15.5	<0.0001
Total, n=1197					

Table 4: The association of marital status and occupation with RHLs occurrence among patients who presented to the oral medicine departments for investigation of reactive hypertrophic lesions (RHLs).

Characters	N (%)	OR	CI	X^2	*p* value
Marital status					
Married, n=431	29 (6.7)	2.8	1.5-5.3	12.9	0.0003
Single, n=766	19 (2.5)	0.5	0.28-0.91	5.2	0.002
Occupation					
Students, n=724	15 (2.1)	0.28	0.14-0.53	17.9	<0.0001
Workers, n=245	14 (5.7)	1.6	0.82-3.2	2.3	0.12
Housewife's, n=144	13 (9.03)	2.9	1.4-5.8	10.7	0.001
Teachers, n=23	2 (8.7)	2.2	0.6-8.6	1.3	0.24
Others, n=61	4 (6.6)	1.6	0.5-4.8	0.73	0.35
Medical history					
Systemic diseases, n=201	18 (9)	3.0	1.6-5.6	13.5	0.0002
Total, n=1197	48 (4.01)				

An associated odds ratio (OR) of 3.8 times, a confidence interval (CI) of 2.02–7.14, a significant X2 coefficient of 22, and a *p* value of less than 0.0001 were found when qat chewing was examined as a risk factor for RHLs. Also, smoking was an associated risk factor for developing RHLs, in which the OR was 2.4 times, with a confidence interval (CI) of 1.2–4.6, with a significant X^2 coefficient of 7.5 and a *p* value of 0.006.

Tooth grinding was a risk factor associated with the development of RHLs with an OR of 9.4 times, confidence interval (CI) of 2.8 to 29.7, with a significant X^2 coefficient of 24.9 and *p* value < 0.0001. Cheek biting was a risk factor associated with the development of RHLs with an OR of 13 times, confidence interval (CI) of 5.11 to 32.6, with a significant X^2 coefficient of 56, *p* value < 0.0001. Poor hygiene status of the mouth was a risk factor associated with the development of RHLs with an OR of 1.9 times, confidence interval (CI) of 1.01 to 3.5, with a significant X^2 coefficient of 4.6 and *p* value of 0.03. Clicking of the mouth was a risk factor associated with the development of RHLs with an OR of 9.4 times, confidence interval (CI) of 2.8 to 29.7, with a significant X^2 coefficient of 24.9, *p* value < 0.0001. The presence of pigmented and white lesions in the mouth of patients was a risk factor associated with the development of RHLs with an OR of 11.5 times, confidence interval (CI) of 5.3 to 24.8.

Table 5: The relationship between reactive hypertrophic lesions and personal behaviours such as oral hygiene, qat consumption, Shammah, and smoking; and the incidence of oral and dental diseases.

Factors		N (%)	OR	CI	X^2	*p* value
Qat chewing n=559	yes	29 (5.2)	3.8	2.02-7.14	22	<0.0001
Shammah intake n=30		0.0 (0.0)	0.0	0.0-3.9	1.3	0.25
Smoking, n=201	yes	15 (7.5)	2.4	1.2-4.6	7.5	0.006
Teeth grinding n=19	yes	5 (26.3)	9.4	2.8-29.7	24.9	<0.0001
Check biting n=29	yes	9 (47.4)	13	5.11-32.6	56	<0.0001
Hygiene status	fair n=390	17 (4.3)	1.14	0.6-2.2	0.18	0.67
	good n=452	11 (2.4)	0.4	0.23-0.98	4.7	0.03
	poor n=355	20 (5.6)	1.9	1.01-3.5	4.6	0.03
Extra oral examination	Clicking n=19	5 (26.3)	9.4	2.8-29.7	24.9	<0.0001
	NAD n=1178	43(3.6)	-	-	-	-
Intra oral examination	Depopulated tongue n=10	1 (10)	2.7	0.4-16.5	0.94	0.33
	NAD n=1187	15 (1.3)	-	-	-	-
	Pigmented and white lesions n=49	13(26.5)	11.5	5.3-24.8	67.3	<0.0001
	ulcer and pigmented n=12	1 (8.3)	2.1	0.3-1.4	0.59	0.44
	White lesions and pigmented n=14	1 (7.1)	1.8	0.3-12	0.36	0.54
	White lesions n=77	17(22.1)	9.9	5.2-18.9	69.7	<0.0001
Periodontal diseases	Gingivities n=55	16(29.1)	14.2	6.8-29.5	94.2	<0.0001
	Periodontitis n=67	32 (47.8)	63.7	30.4-134	352	<0.0001
Examination of teeth	Caries n= 1186	47 (3.96)	0.41	0.05-8.8	0.74	0.38
	NAD n=17	1(5.9)	-	-	-	-

Also, the presence of white lesions alone in the mouths of patients was a risk factor associated with the development of RHLs with an OR of 9.9 times, confidence interval (CI) of 5.2 to 18.9, with a significant X^2 coefficient of 69.7, *p* value < 0.0001. A history of gingivitis was a risk factor associated with the development of RHLs with an OR of 14.2 times, confidence interval (CI) of 6.8 to 29.5, with a significant X^2 coefficient of 94.2, *p* value < 0.0001. A strong association of periodontitis with the development of RHLs was found in which OR was 63.7 times, confidence interval (CI) of 30.4 to 134, with a significant X^2 coefficient of 325, *p* value < 0.0001.

Table 6: Different types of reactive hypertrophic lesions and their locations among patients presenting to oral medicine departments for clinical examinations.

Characters	N (%)
Lesion types	
Irritational fibroma	44 (91.7)
Peripheral gaint cell granuloma	3 (6.3)
Pyogenic granuloma	1 (2.1)
Lesion sites	
Buccal mucosa	17 (35.3)
Lower labial mucosa	13 (27)
Lateral border of the tongue	9 (18.8)
Alveolar mucosa	6 (12.6)
Tip of the tongue	1 (2.1)
Dorsum of the tongue	1 (2.1)
Upper labial mucosa	1 (2.1)
Total	48 (100)

The various reactive hypertrophic lesion types and their sites in patients who come to oral medicine departments for clinical examinations are displayed in Table 6.

Table 7: Physical characteristics of reactive hypertrophic lesions among patients presenting to oral medicine departments for clinical examinations.

Description		N (%)
Size	1 cm or less	39 (81.3)
	More than 1 cm	9 (18.7)
Shape	Multi- nodular	1 (2.1)
	Single nodule	47 (97.9)
Surface	Smooth	48 (100)
Margin	Irregular well defined	1 (2.1)
	Regular well defined	47 (97.9)
Color	Pink	42 (87.5)
	Reddish pink	4 (8.3)
	Pinkish white	1 (2.1)
	White	1 (2.1)
Neck	Sessile	48 (100)
Texture	Firm	48 (100)

Only one (2.1%) of the reactive hypertrophic lesions were pyogenic granulomas, whereas the majority (44, 91.7%) were irritating fibromas, followed by peripheral giant cell granulomas (3, 6.3%). Regarding the locations of the lesions in the oral cavity, the oral mucosa was the most common site, with 17 (35.3%), followed by the lower labial mucosa, with 13 (27%), the lateral border of the tongue, with 9 (18.8%), and the alveolar mucosa, with 6 (12.6%). The tip of the tongue, dorsum of the tongue, and the upper labial mucosa each accounted for only one case (2.1%).

Table 8: Duration, onset, pain, bleeding, and distribution of reactive hypertrophic lesions among patients presenting to oral medicine departments for clinical examinations.

Characters		N (%)
Duration	5 years and less	38 (79.2)
	more than 5 years	10 (20.8)
Course	Constant	46 (95.8)
	Progressive	2 (4.2)
Character of onset	Gradual	48 (100)
Pain full	No	48 (100)
Bleeding	No	47 (97.9)
	Yes	1 (2.1)
Distribution	localized and solitary	48 (100)

The physical features of reactive hypertrophic lesions in patients who come to the oral medicine department for a clinical evaluation are displayed in Table 7. Nine (18.7%) of the lesions were bigger than 1 cm, while 39 (81.3%) were less than 1 cm. Only one (2.1%) multi-nodular lesion was discovered based on its morphology, whereas the other lesions (97.9%) were solitary nodules. All lesions had smooth surfaces. Most lesions had well-defined and regular margins (47 (97.9%)), and only 1 had ill-defined and irregular margins. Considering color, most lesions were pink (42 (87.5%), followed by reddish-pink (4 (8.3%), while pink-white and whitish-white were present in one case each. The necks of all lesions were sessile, and the texture of the lesions was firm (consistent) in all (48/48). Table 8 shows the duration, onset, pain, and bleeding of reactive hypertrophic lesions, and their distribution among our patients. Examining the duration of the lesions, 38 (79.2%) lesions had been present for 5 years or less, while 10 (20.8%) had been present for more than 5 years. The progressive course of the lesions was steady in 46 (95.8%) cases, while two (4.2%) cases were progressive. The onset of the lesions was gradual in all (48/48, 100%), all lesions were painless, bleeding occurred in only one case, and all lesions were localized and isolated.

DISCUSSION

Oral neoplastic lesions, including reactive benign prosthetic hyperplasia (BPH), are frequently observed in the oral mucosa in routine dental clinics and hospitals in Yemen[4,11-14]. These lesions may be symptomatic or encountered incidentally when a patient visits an outpatient dental clinic for routine treatment. The clinical presentation of these lesions depends on various factors such as age, degree of irritation or trauma, gender, distribution, and nature of the lesion[5]. The most common predisposing factors are persistent low-grade chronic inflammation, recurrent chronic irritation due to plaque and tartar accumulation, cheek biting, hormonal disorders, and trauma from exogenous factors such as sharp edges of broken teeth, loose fillings, and ill-fitting dentures[4, 15]. Numerous studies have been conducted to collect epidemiological data on neoplastic lesions in general or on oral cavity lesions in Yemen[4, 11-13, 16-22]. However, little attention has been paid to collecting statistics on benign hypertrophic lesions of the oral mucosa, which may cause recurrent problems such as aesthetic dissatisfaction or impaired masticatory function.

In the current study the prevalence of RHLs was approximately equal in both sexes. For females, it was 4.7%, with an OR of 1, and *p*-value of 0.99. This indicates that the correlations and ORs were similar for both sexes, concluding that there is no association between RHLs and sex. This current finding differs from that reported in Brazil, where these hyperplastic reactive oral lesions are found mainly in females contrasted to males, with a ratio of 2.5:1 as described by Kamile LD *et al*.,[23]. Our sex distribution also differs from that described by Da Saliva *et al*., in Nigeria[24] and Soyele OO *et al*.,[25] in Brazil, where most hyperplastic reactive oral lesions were described in females contrasted to males, with a ratio of 2:1, 1.8:1, and 1.4:1, respectively[24, 25]. Also, in studies conducted by Sangle *et al*.,[26] , Kadeh H *et al*.[27], and Ala Aghbali[9], the lesions were obtained to be more prevalent in women than in men (2.2 times higher), which is coherent with the findings of all the previous studies mentioned[9, 26-27]. The higher incidence of these lesions among female patients worldwide may be attributed to the role of hormones as a predisposing factor in their development. What is more, this latter difference may be attributed to women's greater concern for oral hygiene in places other than Yemen, as they visit dental clinics for examinations and treatment more often than men in Iran, Nigeria, and Pakistan. However, in Yemen, men's concern for oral health may be equal or even better than that of women.

In our age-related study, the prevalence of RHLs was higher in the older age group (>25 years), reaching 6.6%, with an associated odds ratio of 3.3 times, a confidence interval of 1.7–6.6, a significant X2 of 15.5, and a *p*-value <0.0001. This result is similar to that reported by Ayaz M *et al*., in Pakistan[28], Kadeh *et al*., in Iran[29], Kumar *et al*.,[30] in India, Halikiri *et al*.[31], and Awange *et al*., in India[32] in where a high incidence of oral reactive hypertrophic lesions in the second and third decades and with a mean age of 30 years. However, obtained result is different from that reported by Soyele O *et al*.[25], in their studies, they found that RHLs appear in a wide age range from 10 to 70 years, with a higher incidence in the fifth, sixth, and seventh decades of life.

In the current study, prevalence of RHLs was higher in the married group, reaching 6.7%, with an associated odds ratio (*OR*) of 2.8 times, a confidence interval (*CI)* of 1.5–5.3, a significant X^2 coefficient of 12.9, and a *p* value of 0.0003. Regarding occupations, the prevalence of RHLs was higher among housewives, reaching 9.03%, with an associated *OR* of 2.9 times, a CI of 1.4–5.8, a significant X^2 coefficient of 10.7, and a *p* value of 0.001. While other occupations had no association with the occurrence of reactive hypertrophic lesions. The higher frequency of these lesions in married and housewives persons did not mentioned or tested in previous studies and no clear reasons for these results.

When khat chewing was tested as a risk factor of RHLs, there was an associated odds ratio (OR) of 3.8

times, a confidence interval (CI) of 2.02–7.14, a significant X^2 coefficient of 22, and a *p* value of <0.0001. Also, smoking was an associated risk factor for developing RHLs, in which the OR was 2.4 times, with a confidence interval (CI) of 1.2–4.6, with a significant X^2 coefficient of 7.5 and a *p* value of 0.006. This association can be confirmed that Qat chewing and smoking are important stimulating factors, to developed RHLs. DaSilva *et al.*[24], reported that the smoking rate is higher in patients with RHLs, compared to other reactive lesions. To prevent recurrence, a careful histopathological evaluation and confirmation of the absence of an infected lesion base are essential. Furthermore, dentists and patients should try to reduce controllable triggers, such as khat chewing and smoking.

In this study, tooth grinding was a risk factor associated with the development of RHLs with an OR of 9.4 times, confidence interval (*CI*) of 2.8 to 29.7, with a significant X^2 coefficient of 24.9 and *p* value < 0.0001. Cheek biting was a risk factor associated with the development of RHLs with an OR of 13 times, confidence interval (*CI*) of 5.11 to 32.6, with a significant X^2 coefficient of 56, *p* value < 0.0001. Poor hygiene status of the mouth was a risk factor associated with the development of RHLs with an *OR* of 1.9 times, confidence interval (*CI*) of 1.01 to 3.5, with a significant X^2 coefficient of 4.6 and *p* value of 0.03. Clicking of the mouth was a risk factor associated with the development of RHLs with an OR of 9.4 times, confidence interval (CI) of 2.8 to 29.7, with a significant X^2 coefficient of 24.9, *p* value < 0.0001. The presence of pigmented and white lesions in the mouth of patients was a risk factor associated with the development of RHLs with an OR of 11.5 times, confidence interval (CI) of 5.3 to 24.8, with a significant X^2 coefficient of 67.3, *p* value < 0.0001. Also, the presence of white lesions alone in the mouths of patients was a risk factor associated with the development of RHLs with an OR of 9.9 times, confidence interval (CI) of 5.2 to 18.9, with a significant X^2 coefficient of 69.7, *p* value < 0.0001. A history of gingivitis was a risk factor associated with the development of RHLs with an OR of 14.2 times, confidence interval (CI) of 6.8 to 29.5, with a significant X^2 coefficient of 94.2, *p* value < 0.0001. A strong association of periodontitis with the development of RHLs was found in which OR was 63.7 times, confidence interval (CI) of 30.4 to 134, with a significant X^2 coefficient of 325, *p* value < 0.0001. Benign oral lesions primarily represent hypertrophic tumor-like proliferations, but they do not have any neoplastic features on histology[33]. These lesions are small reactive growths that can develop as a result of persistent irritation or trauma to the oral soft tissues[34]. The most common sources of persistent irritation of the oral mucosa are teeth grinding, cheek biting, poor oral hygiene, mouth picking, the presence of pigmented and white oral lesions, and periodontitis. These factors are the most significant risk factors for RHLs in previous studies[33,34]. This may be explained by the fact that poor oral hygiene leads to heavy plaque and tartar deposition, and local traumatic injuries such as cheek biting and foreign bodies lead to mucosal irritation[35,36].

In the current study most of the reactive hypertrophic lesions were irritant fibromas, with 44 (91.7%), followed by peripheral giant cell granulomas, with 3 (6.3%), and only one (2.1%) was a pyogenic granuloma. Hallikeri K *et al*.[31], Hunasgi S *et al.*[35], and Koneru A *et al.*[36], they reported roughly similar to obtained results with predominant of irritant fibromas. According to research by Santosh Hunasgi *et al*., and Binita Gandhi *et al*., oral reactive hyperplastic lesions frequently appear in the mandible, especially in the posterior region[31,35-36]. They state that the alveolar ridge and gingival tissue are the most often affected areas by these lesions[36]. Compared to the maxillary, the mandibular arch typically had the lesions (80%). Santosh Hunasgi *et al.* and Binita Gandhi *et al.*, research, which found that oral reactive hyperplastic lesions are frequently seen in the mandible, especially in the posterior area, is also consistent with this[31,35-36].

Rather of being cancerous, the benign reactive hyperplastic oral lesions are mostly reactive and inflammatory in nature. The fibrous lesion, also known as a fibrous epulis or fibroma, is the most common and frequently occurring of all the reactive hyperplastic lesions of the oral cavity[37,38]. Mandeep Kaur and colleagues discovered that up to 33% of people in Jammu and Kashmir State had traumatic fibroma, while 27% and 25% of people had inflammatory papillary hyperplasia and pyogenic granuloma of the oral mucosa, respectively[39]. According to Maturana-Ramirez *et al*., the largest incidence of localized fibrous lesion (71.1%) in the Chilean population is followed by pyogenic granuloma (21.1%), which is consistent with the findings of the aforementioned research[40].

Gingiva was the most often impacted area (44.2%), as in all of the earlier research[27]. Chronic stimulations from bacterial plaque buildup and poor dental restorations may be the reason of the increased frequency of these lesions in the gingiva. Furthermore, the periodontal ligament, gingival connective tissue, or periosteum may be the source of several of these diseases, such as POF and PGCG[9]. The idea that RHLs are identical in nature but at various stages of evolution is supported by the fact that gingiva is the most common site of RHLs. According to Daley *et al.*[41], fibrous hyperplasia, or IF, is caused by the progressive replacement of PG's vascular texture by fibrotic tissue. The aforementioned notion is supported by the current analysis, which found that the mean age of patients afflicted by IF was greater than that of PG cases. Other studies, nevertheless, did not note this variation[42]. In the present study, the majority of lesions were 1 cm or less in size (39 (81.3%)), while 9 (18.7%) were larger than 1 cm. considering the morphology of the multi-nodular the lesions, only 1 (2.1%) was found, while the remaining lesions were solitary nodules (97.9%). All lesions had smooth surfaces. Just one lesion had irregular and poorly defined margins, whereas the majority (47, or 97.9%) had regular and well-defined margins. In terms of color, the majority of lesions were pink (42, or 87.5%), followed by reddish-pink (4, or

8.3%), and there was one instance of each of pink-white and whitish-white. The lesions had a hard (consistent) texture and all of them had sessile necks (48/48). The oral reactive hyperplastic lesions in the current study are essentially the same as those previously described by Neville B.W. *et al.*[1], and Regezi J *et al.*[43], where they appeared sessile, had a pedunculated appearance due to the small number of lesions attached to the stalk, and ranged in size and color from pink to reddish, bleeding at the slightest touch. Table 3 shows the duration, onset, pain, and bleeding of reactive hypertrophic lesions, and their distribution among patients presenting to the oral medicine department for clinical examination. Examining the duration of the lesions, 38 (79.2%) lesions had been present for 5 years or less, while 10 (20.8%) had been present for more than 5 years. The progressive course of the lesions was steady in 46 (95.8%) cases, while two (4.2%) cases were progressive. The onset of the lesions was gradual in all (48/48, 100%), all lesions were painless, bleeding occurred in only one case, and all lesions were localized and isolated. Obtained results are roughly similar that reported in literatures[4,23-25,44].

Limitation of the study

Cross-sectional methodology makes it difficult to infer causal links because exposure and outcome are measured only once. Given the short time frame for data collection and the fact that the study is limited to one region of Yemen, this type of study is susceptible to some bias.

CONCLUSIONS

Given the increasing prevalence of oral reactive hypertrophic lesions in the Yemeni population as well as globally, decisive action is now required to halt their occurrence and progression. This can be achieved simply by providing awareness sessions on proper oral hygiene to patients who come to the dental clinic for routine checkups or any type of dental treatment. People who lack access to dental treatment are generally unaware of the importance of maintaining proper oral hygiene and superior aesthetics for a better and healthier life. In conclusion, in the current study, irritational fibroma and pyogenic granuloma were the most and least common oral reactive hypertrophic lesions (RHLs), respectively. Furthermore, compared to male individuals, female patients had an equal prevalence of the lesions, and older age groups were more susceptible with higher incidence rate of oral reactive hypertrophic lesions. The gingiva was the most common site of the lesions.

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AUTHOR'S CONTRIBUTIONS

Rajeh SAY: formal analysis, conceptualization, data organization to obtain a clinical MSc degree in Dental Sciences. **Al-Shamahy HA:** supervision. **Al-kibsi TA:** supervision. Final manuscript was checked and approved by all authors.

DATA AVAILABILITY

The accompanying author can provide the empirical data that were utilized to support the study's conclusions upon request.

CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

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