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RESEARCH ARTICLE

RESOLUTION OF FACTORS AND PATTERN OF PERMANENT DENTAL EXTRACTION IN SELECTED DENTAL CLINICS IN SANA'A CITY, YEMEN

Abdul Qader Mohammed Qasem Zabara[1], Abdulwahab Ismail Mohamed Al-Kholani[2], Yaser Ahmed Salem Alrubaidi[3], Taghreed Ahmed M Al-Kibsi[3], Ameen Abdullah Yahya Al-Akwa[1], Khaled A AL-Haddad[1], Mohammed Mohammed Ali Al-Najhi[1,4], Hassan Abdulwahab Al-Shamahy[5,6]

[1]*Orthodontics, Pedodontics and Prevention Department Faculty of Dentistry, Sana'a University, Yemen.*
[2]*Department of conservative dentistry, Faculty of Dentistry, Sana'a University, Republic of Yemen.*
[3]*Department of Oral and Maxillo-Facial Surgery, Faculty of Dentistry, Sana'a University, Republic of Yemen.*
[4]*Orthodontics, Pedodontics and Prevention Department Faculty of Dentistry, Genius University for Sciences & Technology, Dhamar city, Republic of Yemen.*
[5]*Departement of Basic Sciences, Faculty of Dentistry, Sana'a University, Republic of Yemen.*
[6]*Medical Microbiology department, Faculty of Medicine, Genius University for Sciences & Technology, Dhamar city.*

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***Address for Correspondence:**
Dr. Hassan A. Al-Shamahy, Faculty of Medicine and Health Sciences, Sana'a University. Faculty of Medicine, Genius University for Sciences and Technology, Dhamar/Sana'a, Yemen. Tel- +967-1-239551; E-mail: *shmahe@yemen.net.ye*

Abstract

Back ground and objective: Tooth loss remains one of the mainly global problem. The current study aimed to investigate the causes of tooth extraction as well as to inspect possible interrelationships between tooth loss and numerous variables consisting of gender, age, education status and further risk factors, such as hypertension, diabetes, khat chewing and smoking habits.
Methods: The study retrospectively investigated 801 dental records from patients who had had as a minimum one tooth extraction. Patient variables consisting of gender, age, education status, hypertension, diabetes, khat chewing and smoking habits. The causes for tooth extraction were recorded as: periodontal disease, dental caries complications of endodontic treatment, impaction, trauma, orthodontic treatment, pre-prosthesis, and others (aesthetic causes, poor dental position, or indeterminate causes). The differences in the mean number of carved teeth per patient with patient variables included: gender, age, education status, hypertension, diabetes, khat chewing and smoking habits were investigated using analysis of variance (ANOVA).
Results: Of the 801 patient records reviewed, 1234 extracted teeth were identified. Males had a higher number of extracted teeth 665 (53.9%) than females 569 (46.1%). Males had more extractions (mean±SD=1.6±0.44, p=0.01). The highest rate of extracted teeth was identified between the age group 40-49 years (1.9±0.6 teeth). Lack of education, diabetes, high blood pressure, khat chewing and smoking habits showed a significantly more mean for tooth extraction (p<0.0001). The results showed that dental caries was the main cause of tooth extraction (53.1%), followed by periodontal disease (31.1%), and a complication of endodontic treatment (6.1%). Other reasons were considered minor.
Conclusion: Caries, and periodontal disease were the mainly frequent causes of tooth extraction. Additionally, this study demonstrated that age, hypertension, diabetes, khat chewing, and smoking were appropriate predictors of permanent tooth loss because these variables showed a statistically significant association.
Keywords: dental caries, diabetes, hypertension, khat chewing, periodontal disease, smoking habit, tooth extraction.

INTRODUCTION

Tooth loss continues to be the most common dental problem globally [1]. The causes of tooth extraction have been presented in preceding studies on various regions and completed that caries, periodontal disease, orthodontics, prosthodontic treatments trauma, unstable teeth, endodontic complications, and root fractures, are the main reasons of tooth loss[1-4]. With the intention of implement respectable oral disease prevention measures and oral health awareness policies, it is imperative to know the causes of teeth loss. In

ordinary, most studies have shown that teeth caries is the main cause of tooth loss among adult patients. What's more, periodontal diseases were the most important cause of teeth loss among patients in the late forties with significant association of this age group and periodontal disease. Alternatively, it was noted that the complications of endodontic treatment and orthodontics are the most important cause of teeth extraction among patients from 15 to 20 years of age[2,5]. Some studies have concluded that there is a relationship between teeth loss and gender, with females having more tooth loss owing to dental caries while males losing their teeth frequently due to periodontal diseases[2,5]. Other causes for instance, pre-prosthetic, root fracture, aesthetic, and poorly positioned causes were obtained to have less impact on tooth loss[4,6]. Understanding the causes of tooth extraction is fundamental to promoting oral health outcomes. A substantial amount of cross-sectional studies have been conducted to investigate tooth loss in different countries, but no previous studies have been conducted for the current study in this aspect, except for one study previously by Alhadi and others[3], despite the presence of a number of studies in Yemen dealing with different dental problems[7-28]. Dental caries was the main cause of tooth loss all over the world including Yemen[1-3,14,24,25,29], but some studies discovered that a larger ratio of tooth extraction was attributable to periodontal disease[9,11,19,22]. There is not enough data available in Yemen and the required information on this subject is very much needed. By discovering the main causes and predictors of tooth loss, it may be possible to reduce tooth extraction in the future and emphasize the critical role of prevention. Therefore, the objectives of this study were to investigate the causes of teeth extraction and to inspect possible associations between teeth loss and several variables including gender, age, educational level and other risk factors, such as, hypertension, diabetes, khat and smoking habits.

MATERIALS AND METHODS

This cross-sectional study was prepared by taking and collecting data from dental clinics in the Faculty of Dentistry, Sana'a University and Al-Murtada private clinics during the period from January to December 2021. The data were collected in a pre-designed questionnaire for the study that contained two parts: the first part is about the patient's gender, age and educational level Smoking and chewing khat etc. The second part was to be filled in by dentists and documented information about tooth extraction, tooth type and reason for each extraction.

Data analysis: Epi-info software (version 7) was used as data were entered and analyzed. The data for extracted teeth with a normal distribution were definite as the mean and standard deviation (SD) for extractions. This process computes the variation between the means experimental in two independent samples. A significance value (*p*-value) was calculated for the difference between the mean of the reference extraction±SD and the variables for the characteristics of patients (Table 1) and for extraction reasons (Table 2). The *p* value is the possibility of achieving the observed differentiation between the variable associated with the patient's characteristics and the type of cause of tooth extraction and between the general average of tooth extraction in current study.

Ethical Consideration: The ethical approval for this study was No. 661 dated January 1, 2021 and was taken from the Medical Ethics and Research Committee of Sana'a University, Faculty of Medicine and Health Sciences, and all procedures were in accordance with the ethical guidelines of the review committee.

RESULTS

The total number of patients participating in this study was 801 patients with a total of 1234 extracted teeth. The mean number of extracted teeth per patient was 1.54±0.4. Distribution of extracted teeth by gender, age groups, education level, diabetes, hypertension, khat chewing and smoking habits are shown in Table 1. The number of male patients was higher, 416 (51.9%), than female patients, 385 (48.1%). Male patients had a higher number of extracted teeth 665 (53.9%) than female patients 569 (46.1%). The age group of 30-39 years included 302 patients (37.7%), the age group 20-29 years included 253 patients (31.6%), the age group 40-49 years included 161 patients (20.1%) and the age group of <20 years and the age group of ≥50 counted only for 65 patients (8.1%) and 20 (2.5%) respectively. Consider the age groups with the average number of teeth extracted per patient. The highest mean number of extracted teeth was identified per patient between 40-49 years (1.9±0.6 teeth), with a *p*-value < 0.0001, followed by the age group over 50 years (1.8±0.6 teeth), with a *p*-value < 0.0001. On the other hand, the lowest mean number of extracted teeth per patient was identified among <20 years old (1.36±0.2 teeth). With regard to gender, the highest mean number of extracted teeth per patient was identified among males (1.6±0.44 teeth), with a probability value of 0.01. Regarding educational level, patients who held a middle school and elementary school were the highest in counting, 289 (36.1%), and 265 (33.1%) respectively, followed by the uneducated , 101 (12.6%).

Subsequently, the total number of extracted teeth, as shown in Table 1, followed the same arrangement, with 445 extracted teeth (36.1%) for middle school with the mean for the number of extracted teeth per patient was 1.6±0.53, with a *p*-value of 0.05. The highest mean number of extracted teeth per patient was identified among uneducated (1.83±0.40 teeth), with a *p*-value of <0.0001. While the lowest mean number of extracted teeth per patient was identified among college level and higher (1.1±0.03 teeth), with a *p*-value of <0.0001. A total of 76 patients (9.5%) had diabetes, 55 patients (6.9%) had hypertension, 99 patients (12.3%) had smoking habits, 112 patients (14%) had khat chewing habits and 5 patients (0.62%) have a habit of putting the sniff in the mouth.

Table 1: Characteristics of patients, numbers and extraction of teeth and significancy.

Characteristics	Patients n (%)	Teeth n (%)	Extraction	Significance
Age groups in Years				
<20	65 (8.1)	89 (7.2)	1.36±0.2	Refrerance
20 -29	253 (31.6)	357 (28.9)	1.4±0.4	0.43
30 -39	302 (37.7)	439 (35.6)	1.45±0.5	0.15
40 - 49	161 (20.1)	312 (25.3)	1.9±0.6	<0.0001
≥50	20 (2.5)	37 (3)	1.8±0.6	<0.0001
Total	801 (100)	1234 (100)	1.54±0.4	0.008
Gender				
Male	416 (53.9)	665 (53.9)	1.6±0.44	0.01
Female	385 (46.1)	569 (46.1)	1.48±0.54	0.03
Level of education				
Non-educated	101 (12.6)	185 (15)	1.83±0.4	<0.0001
Elementary school	265 (33.1)	419 (34)	1.6±0.53	0.052
Middle school	289 (36.1)	445 (36.1)	1.54±0.34	1.0
High school	55 (6.87)	85 (6.9)	1.54±0.30	1.0
College level and higher	91 (11.3)	100 (8.1)	1.1±0.03	<0.0001
Medical condition				
Diabetes	76 (9.5)	148 (12)	1.95±0.32	<0.0001
Hypertension	55 (6.9)	101 (8.2)	1.83±0.44	<0.0001
Habits				
Smoking	99 (12.3)	201 (16.3)	2.03±0.32	<0.0001
Khat chewing	112 (14)	246 (19.9)	2.19±0.24	<0.0001
Shamah consuming	5 (0.62)	15 (1.2)	3±0.54	<0.0001

The highest mean number of extracted teeth per patient was determined among the habit of putting the sniff in the mouth (3±0.54 teeth), with a p<0.0001, followed by khat chewing (2.19±0.24) with a p<0.0001, and smoking habit means extracted teeth per patient was above the overall mean (2.03±0.32; p<0.0001). Diabetics and hypertensive patients also had a high mean number of extracted teeth per patient with the averages being 1.95±0.32 teeth and 1.83±0.44 teeth, respectively, with a p-value <0.0001. Table 2 shows the results from stratification of the entire patient population with multiple causes of tooth extraction. The results indicated that dental caries was the main cause of tooth extraction with 655 (53.1%) teeth extracted due to caries, followed by periodontal disease 384 (31.1%) and endodontic complications of 75 (6.1%).

Table 2: Reasons for tooth extraction numbers and extraction of teeth and their significant.

Characteristics	Patients n (%)	Teeth n (%)	Extraction	Significance
Caries	421(52.6)	655 (53.1)	1.56±0.22	0.23
Periodontal Disease	211(26.3)	384 (31.1)	1.82±0.12	<0.0001
Endo Tx Complications	71(8.9)	75 (6.1)	1.06±0.01	<0.0001
Orthodontic Tx	6 (0.75)	14 (1.1)	2.3±0.74	<0.0001
Trauma	46 (5.7)	52 (4.2)	1.13±0.10	<0.0001
PreProsthetic Tx	8 (0.99)	16 (1.3)	2.0±0.7	<0.0001
Impaction	26 (3.2)	26 (2.1)	1.0±0.0	<0.0001
Other Reasons	12 (1.5)	12 (1)	1.0±0.0	<0.0001
Total	801 (100)	1234 (100)	Ref: 1.54±0.4	0.008

Other causes of tooth extraction such as previous orthodontics treatment (Tx), dental trauma, pre-prosthetic treatment, and impaction causes were considered minor (Table 2). The highest mean number of extracted teeth per patient was identified between periodontal disease (1.82±0.12 teeth), with a p-value <0.0001, and orthodontic treatment (2.3±0.74) with a p-value <0.0001, followed by pre-prosthetic treatment (2.0±0.7) with a p value <0.0001 (Table 2). The teeth most extracted were the second and third maxillary molars (343, 27.8%), followed by the maxillary second and third molars (313, 25.4%), while the mandibular canines were the least extracted (13, 1.05%) (Table 3).

DISCUSSION

The current study results concluded that tooth decay (53.1%) and periodontal illness (31.1%) are the most important reasons for teeth extraction in dental clinics at Sana'a University and Al-Murtadha Dental Clinic. This result is consistent with the preponderance of preceding studies conducted in the same region, such as Yemen (previously), Saudi Arabia, and Kuwait, as well as globally, in Iran and Japan, where tooth decay (dental caries) was the main cause of teeth extraction followed by periodontal illness[1-3, 29-31]. Nevertheless, in further studies, periodontal disease positioned higher than dental caries for a cause of tooth extraction[5, 32, 33]. These studies were performed in settings of private

practice wherever the majority of the patients who participated in periodontal disease were 40 years and older. The third widespread cause of teeth extraction is a complication of endodontic treatment, 75 (6.1%). Preceding researches by Pretzl *et al.*,[34] and Suzuki *et al.*,[35] clarified that root canal treatment had a considerable impact on teeth loss. They give reasons for that root canal treatment may cause weakening of fraction lesions in molars, root fracture and recurrent carious lesions. In the present survey, there was a significant diversity among the sexes. Males had more teeth extractions than female patients. This result has also been reported in previous studies in Yemen and internationally[1-3, 36-38].

Table 3: Distribution of tooth type extracted in our patients.

Reasons	n (%)
Upper Jaw	
Incisors	43 (3.5)
Canines	25 (2.02)
Premolars	167 (13.5)
1st molars	86 (7)
2nd and 3rd molars	343 (27.8)
Total Upper Jaw	664 (53.8)
Lower Jaw	
Incisors	31 (2.5)
Canines	13 (1.05)
Premolars	93 (7.5)
1st molars	120 (9.7)
2nd and 3rd molars	313 (25.4)
Total Lower Jaw	570 (46.2)
Total	1234 (100)

These studies reorganized the high number of teeth extractions among males owing to the lack of concern in adherence to teeth maintenance and restoration programs in addition to the smoking habits common among males. Also in Yemen a large number of tooth extractions among males were due to the habit of chewing khat, which is a more common practice among males than females in Yemen[1]. The mean number of tooth loss in this study was higher among the older age groups of 40-49 years and ≥ 50 years (1.9±0.6 and 1.8±0.6, respectively with $p<0.0001$), compared to the other groups, and is similar to other studies[1-4,39]. Significantly, in these two groups, teeth loss as a result of periodontal disease was more frequent than in the younger patients. Additionally, the test of the association designated a strong association between age, tooth decay and periodontal illness. This finding is attributed to multiple factors containing the presence of systemic conditions in the elderly, wide used of medications, manual dexterity and maintaining oral hygiene, and genetic susceptibility to periodontal disease. Tooth decay was also the most important cause of tooth extraction in patients aged 50 years and under, and a similar result has been described by several surveys and attributed this to bumpy dental visits, non-compliance with oral hygiene instructions, and high intake of sugar[1-3,30,38,39]. With regard to educational level, the highest rate of teeth extraction was among patients with middle school (36.1%) and elementary school (34%) but the highest rate of tooth extraction per patient was in uneducated patients (1.83±0.4 tooth), $p<0.0001$). This finding is consistent with further surveys where teeth loss was associated with primary education level and more tooth loss in the uneducated patients[1,31,40,41].

Patients with diabetes and hypertension showed a significant association with teeth extraction (high mean for tooth extraction) owing to periodontal illness while smokers reported a significant association with teeth extraction, both of which had significant association ($p<0.0001$). Passarelli *et al.*,[30] described that smoking habit and diabetes are directly related to tooth loss[30]. Alternatively, Kawahara *et al.*,[36] described that there is no clear relationship between tooth loss and systemic diseases, as diabetes. With regard to tooth types, the most common tooth type extracted were molars due to dental caries, followed mainly by periodontal disease. This result is in agreement with Passarelli *et al.*,[30] and Jafarian *et al.*,[31]. They explained this to the anatomical development of the type of molar, which results in the formation of grooves and fissures that make them more susceptible to tooth decay. In addition, the first and second molars in the oral cavity erupt at a relatively young age making them more susceptible to dental caries and periodontal attacks[30, 31]. The lower incisors were mostly extracted for periodontal reasons. This inspection has been reported subsequently, and a probable clarification is attributed to the truth that the lower incisors are less susceptible to caries because they are protected by the tongue, but are more likely to be retained in the elderly where they are more susceptible to periodontal disease[3,30,31]. Premolars were extracted mainly for orthodontic reasons and complications of endodontic treatment, and to a lesser extent. This can be attributed to the fact that premolars are extracted either to relieve congestion or to change the shape of the face. The least extracted teeth were canines (2%, 1.05%); the probable explanation is that the canines have prominent smooth clinical crowns and large swollen roots with extensive attachment making them resistant to caries and periodontal disease.

Limitations of the study

This study had some restrictions that may be useful to investigate in future projects. For example, the state of oral hygiene should be explored in conjunction with the number of teeth being extracted. In addition, caries risk assessment and periodontal screening tests including *Streptococcus mutans*, *Lactobacilli* and *Porphyromonas gingivalis*, as well as saliva buffering capacity and production tests can be investigated in order to test the degree of association with the causes of tooth extraction.

CONCLUSIONS

Consistent with the outcomes of the current study, dental caries and periodontal illness are remain the main causes of permanent teeth extraction followed by complications of endodontic treatment. This study also showed that age, diabetes, high blood pressure, khat chewing, and smoking were found to be appropriate predictors of permanent tooth loss as they showed a strong statistical association. Additional studies are

desirable to present an overview of the oral health provider's role in improve awareness of oral health and providing effective screening strategies for dental caries and periodontal disease in order to transform the dental health paradigm from treating oral disease to prevention of disease.

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AUTHOR'S CONTRIBUTIONS

Zabara AQMQ: critical review, supervision. **Al-Kholani AIM:** methodology, formal analysis, conceptualization. **Alrubaidi YAS:** data curation, investigation. **Al-Kibsi TAM:** editing, data interpretation. **Al-Akwa AAY:** investigation, conceptualization. **AL-Haddad KA:** data curation, investigation. **Al-Najhi MMA:** critical review, supervision. **Al-Shamahy HA:** methodology, formal analysis, conceptualization. The final manuscript was read and approved by all authors.

DATA AVAILABILITY

The datasets generated during this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

No conflict of interest associated with this work.

REFERENCES

1. Alhadi Y, Rassem AH, Al-Shamahy HA, Al-Ghaffari KM. Causes for extraction of permanent teeth in general dental practices in Yemen. Universal J Pharm Res 2019; 4(2): 1-5. *https://doi.org/10.22270/ujpr.v4i2.249*
2. Al-awadi, TAM, Al-haddad KA, Al-labani M, Al-Shamahy HA, Shaga-aldeen HM. Prevalence of malocclusion among Yemeni children of primary schools. Universal J Pharm Res 2020; 5(1):1-6. *https://doi.org/10.22270/ujpr.v5i1.355*
3. Ali D. Reasons for Extraction of Permanent Teeth in a University Dental Clinic Setting. Clinical, Cosm Invest Dent 2021:13:51-57. *https://doi.org/10.2147/CCIDE.S294796*
4. Passarelli PC, Lajolo C, Pasquantonio G, *et al*. Influence of mandibular third molar surgical extraction on the periodontal status of adjacent second molars. J Periodontol 2019; 90(8):847–855. *https://doi.org/10.1002/JPER.18-0415*
5. Stadler AF, Mendez M, Oppermann RV, Gomes SC. Tooth loss in patients under periodontal maintenance in a private practice: a retrospective study. Braz Dent J 2017; 28(4):440–446. *https://doi.org/10.15 90/0103-6440201701476*
6. Jovino-Silveira RC, Caldas Ade F, de Souza EH, Gusmão ES. Primary reason for tooth extraction in a Brazilian adult population. Oral Health Prev Dent 2005;3(3):151–157. PMID: 16355648
7. Mutaher NJA, AL-Haddad KA, Al-Shamahy HA, *et al*. Prevalence and causes of traumatic dental injuries to anterior teeth among primary school children in Sana'a city, Yemen. Universal J Pharm Res 2020; 5(3):38-43. *https://doi.org/10.22270/ujpr.v5i3.414*
8. Abbas AM, Al-Kibsi TAM, Al-Akwa AAY, AL-Haddad KA, Al-Shamahy HA, Al-labani MA. Characterization and antibiotic sensitivity of bacteria in orofacial abscesses of odontogenic origin. Universal J Pharm Res 2020; 5(6):36-42. *https://doi.org/10.22270/ujpr.v5i6.510*
9. Al-Akwa AA, Zabara A, Al-Shamahy HA, Al-labani MA, Al-Ghaffari KM, Al-Mortada AM, Al-Haddad AM, and Al-Sharani AA. Prevalence of *Staphylococcus aureus* in dental infections and the occurrence of MRSA in isolates. Universal J Pharm Res 2020; 5(2):1-6. *https://doi.org/10.22270/ujpr.v5i2.384*
10. Al-Haddad KA, Al-dossary OE, Al-Shamahy HA. Prevalence and associated factors of oral non-candida albicans candida carriage in denture wearers in Sana'a city-Yemen. Universal J Pharm Res 2018; 3(4):7-11. *https://doi.org/10.22270/ujpr.v3i4.176*
11. Al-Haddad KA, Al-Najhi MMA, Abbas AKM, Al-Akwa AAY, Al-Shamahy HA, Al-labani MA. Clinical features, age and sex distributions, risk factors and the type of bacteria isolated in periodontitis patients in Sana'a, Yemen. Universal J Pharm Res 2021; 6(1):1-8. *https://doi.org/10.22270/ujpr.v6i1.532*
12. Alhadi Y, Al-Shamahy HA, Aldilami A, Al-Hamzy M, Al-Haddad KA, *et al*. Prevalence and pattern of third molar impaction in sample of Yemeni adults. On J Dent Oral Health 2019; 1(5):1-6.
13. Alhadi YAA, Al-Shamahi NYA, AL-Haddad KA, Al-Kholani AIM, Al-Najhi MMA, Al-Shamahy HA, Al-labani MA. Maxillary sinus septa: prevalence and association with gender and location in the maxilla among adults in Sana'a city, Yemen. Universal J Pharm Res 2022; 7(3):20-26. *https://doi.org/10.22270/ujpr.v7i3.775*
14. Alhasani AH, Ishag RA, Yahya Al-Akwa AAY, *et al*. Association between the *Streptococcus mutans* biofilm formation and dental caries experience and antibiotics resistance in adult females. Universal J Pharm Res 2020; 5(6):1-3. *https://doi.org/10.22270/ujpr.v5i5.478*
15. Al-Kasem MA, Al-Shamahi NYA, Al-Shamahy HA, Al-Akwa AAY, Al-labani MA. Panorama-Radiographic Assessment of Impacted Teeth and Associated Pathosis Among Selected Males in Sana'a City, Yemen. J Dent Ora Heal Ad Re: JDOHAR 2020;101
16. Al-Kebsi A, Othman A, Abbas AK, Madar E, Al-Shamahy HA, Al-Gaffari K, Daname SM, Motareb F. Oral C. albicans colonization and non-Candida albicans Candida colonization among university students, Yemen. Universal J Pharm Res 2017; 2(5):1-6. *https://doi.org/10.22270/ujpr.v2i5.R2*
17. Alsamhari MMA, AlKhawlani MML, Al-Shamahy HA, *et al*. Antimicrobial activity of Sodium hypochlorite, nano Silver and Chlorhexidine against mono-species biofilms of selected microorganisms of oral sources. Universal J Pharm Res 2022; 7(1):11-16. *https://doi.org/10.22270/ujpr.v7i1.716*
18. Alsamhari MMA, Al-Najhi MMA, Al-Shamahy HA, Al-dossary OAI. Analysis of biofilms for *Streptococcus mutans* from dental root surfaces of adult patients with root caries. Universal J Pharm Res 2021; 6(5):19-23. *https://doi.org/10.22270/ujpr.v6i5.668*
19. Al-Sanabani N, A. Al-Kebsi A, Al-Shamahy H, Abbas A. Etiology and risk factors of stomatitis among Yemeni denture wearers. Universal J Pharm Res 2018; 3(1):1-6. *https://10.22270/ujpr.v3i1.R9*
20. Al-Shamahi NY, Abbas AM, Al-Shamahy HA, *et al*. Panoramic Radiographic Analysis of Signs of Proximity to the Third Molar Roots of the Mandibular Canal in Yemen. J Med Clin Case Rep 2020; 2(3): 1-7. *https://doi.org/10.39127/JDOHAR:1000101*
21. Al-Shamahi NYA, Abbas Al-Kasem M, Al-Shamahy HA, Al-Akwa AAY, Al-Ghaffari KM, Al-Mortada AM, Al-labani MA. Radiographic assessment of the course and visibility of the mandibular canal by panoramic radiography. Universal J Pharm Res 2020; 5(5):17-20. *https://doi.org/10.22270/ujpr.v5i5.481*
22. Al-Shamahy HA, Abbas AMA, Mahdie Mohammed AM, Alsameai AM. Bacterial and fungal oral infections among patients attending dental clinics in Sana'a City-Yemen. On J Dent Oral Health 2018; 1(1): 1-6.

https://doi.org/10.33552/OJDOH.2018.01.000504

23. Al-Shamahy HA, Mohammed Abdullah Al-labani MA, Ameen al-akwa. Biofilm formation and antifungal susceptibility of candida isolates from oral cavity of denture wearer and free denture individuals. EC Dental Sci 2020; 19(10):58-66.
24. Al-Shami IZ, Al-Shamahy HA, Abdul Majeed ALA, Al-Ghaffari KM and Obeyah AA. Association between the salivary *Streptococcus mutans* levels and dental caries experience in adult females. On J Dent Oral Health 2018; 1(1):1-5. *https://doi.org/10.33552/OJDOH.2018.01.000505*
25. Bamashmoos, KAO, Alhasani AH, Al-Akwa AAY, Al-Shamahy HA *et al*. Prevalence of premature loss of primary teeth at the age of 6-10 years in Sana'a city, Yemen. Universal J Pharm Res 2020; 5(4):1-6. *https://doi.org/10.22270/ujpr.v5i4.439*
26. Dahaq WAM, Al-Kholani AIM, Al-Kibsi TAM, Al-Deen HS, Al-Shamahy HA, AL-Haddad KA, Al-Akwa AAY, Al-labani MA. Tanaka and Johnston's mixed dentition validity: an analysis among Yemeni adults in Sana'a city. Universal J Pharm Res 2021; 6(6):1-5. *https://doi.org/10.22270/ujpr.v6i6.691*
27. Gylan EMA, Muharram BA, Al-Shamahy HA, *et al*. In vitro evaluation of the antimicrobial activity of five herbal extracts against *Streptococcus mutans*. Universal J Pharm Res 2022; 7(1):1-6. *https://doi.org/10.22270/ujpr.v7i1.721*
28. Yehia LAB, AL-Haddad KA, Al-labani MA, Al-Shamahy HA, Shaga-aldeen HM. Occlusal characteristics of the primary dentition among a sample of Yemeni pre-school children. Universal J Pharm Res 2020; 5(1):1-6. *https://doi.org/10.22270/ujpr.v5i1.359*
29. Aida J, Morita M, Akhter R, Aoyama H, Masui M, Ando Y. Relationships between patient characteristics and reasons for tooth extraction in Japan. Community Dent Health. 2009;26(2):104–109. PMID: 19626742
30. Passarelli PC, Pagnoni S, Piccirillo GB, *et al*. Reasons for tooth extractions and related risk factors in adult patients: a cohort study. Int J Environ Res Public Health 2020; 17(7):2575. *https://doi.org/10.3390/ ijerph17072575*
31. Jafarian M, Etebarian A. Reasons for extraction of permanent teeth in general dental practices in Tehran, Iran. Med Princ Pract 2013; 22 (3):239–244. *https://doi.org/10.1159/00034597910*
32. Ong G. Periodontal reasons for tooth loss in an Asian population. J Clin Periodontol. 1996; 23(4):307–309. *https://doi.org/10.1111/j.1600-051X.1996.tb00550.x*
33. Matthews DC, Smith CG, Hanscom SL. Tooth loss in periodontal patients. J Can Dent Assoc 2001; 67(4):207–210. PMID: 11370278
34. Pretzl B, Eickholz P, Saure D, Pfefferle T, Zeidler A, Dannewitz B. Endodontic status and retention of molars in periodontally treated patients: results after 10 or more years of supportive periodontal therapy. J Clin Periodontol 2016;43(12):1116–1123. *https://doi.org/10.1111/ jcpe.12621*
35. Suzuki S, Yoshino K, Takayanagi A, *et al*. Number of non-vital teeth as indicator of tooth loss during 10-year maintenance: A retrospective study. Bull Tokyo Dent Coll 2017; 58(4):223–230. *https://doi.org/10.2209/tdcpublication.2016-004422*
36. Kawahara H, Inoue M, Okura K, Oshima M, Matsuka Y. Risk factors for tooth loss in patients undergoing mid-long-term maintenance: a retrospective study. Int J Environ Res Public Health. 2020; 17(17):6258. *https://doi.org/10.3390/ijerph17176258*
37. Costa FO, Lages EJ, Cota LO, Lorentz TC, Soares RV, Cortelli JR. Tooth loss in individuals under periodontal maintenance therapy: 5-year prospective study. J Periodontal Res 2014;49(1):121–128. *https://doi.org/10.1111/jre.12087*
38. Yoshino K, Ito K, Kuroda M, Sugihara N. Tooth loss in problem-oriented, irregular, and regular attenders at dental offices. Bull Tokyo Dent Coll 2016; 57(1):11–19. *https://doi.org/10.2209/tdcpublication.57.11*
39. Chrysanthakopoulos NA. Reasons for extraction of permanent teeth in Greece: a five-year follow-up study. Int Dent J. 2011; 61(1):19–24. *https://doi.org/10.1111/j.1875-595X.2011.00004.x11*
40. Silva-Junior MF, Sousa ACC, Batista MJ, Sousa M. Oral health condition and reasons for tooth extraction among an adult population (20–64 years old). Cien Saude Colet 2017; 22(8):2693–2702. *https://doi.org/10.1590/1413-81232017228.22212015*
41. Hamasha AA, Al Qudah MA, Bataineh AB, Safadi RA. Reasons for third molar teeth extraction in Jordanian adults. J Contemp Dent Pract. 2006; 7(5):88–95. *https://doi.org/10.5005/jcdp-7-5-88*