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RESEARCH ARTICLE

CAUSES FOR EXTRACTION OF PERMANENT TEETH IN GENERAL DENTAL PRACTICES IN YEMEN

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Abstract

Objective: The aim of this survey was to investigate the primary causes for extraction of permanent teeth, its correlations with age and gender, as well as identify the important predictors for dental caries in Sana'a University dental clinics in Sana'a city, Yemen.

Methods: The study was conducted over a period of one year; its population consisted of 1,420 patients, aged 9–72 years, who underwent tooth extraction. There were 761 (53.6%) male and 659 (46.4%) female patients. The frequency distribution was calculated using the t-test, ANOVA and t test for differences in mean number of extracted teeth and the logistic regression model to evaluate the variables associated with causes for tooth extraction.

Results: A total of 2,585 teeth were extracted from the 1,420 patients. The highest rate (23.1%) of extraction occurred for those 41–50 years old. Males comprised 53.6% of patients but had more teeth (1598, 61.8%) extracted than females (987, 38.2%). The rate of teeth extracted on the day of the survey per patient was 1.82 ± 0.07 (2.1 ± 0.1 in males and 1.5 ± 0.05 in females). Tooth loss due to caries was 69%; periodontal disease was 28%; pre-prosthetic reasons were 1.9% and other reasons were 1.14%. There was a significant association between patient characteristics (age and gender) and number of teeth extracted in which the Mean \pm SD of extracted numbers were increase with increasing age and higher in male patients than in females ($p < 0.001$). The most frequently extracted teeth were mandibular first and second molars (446, 17.3%), followed by maxillary premolars (415, 16.1%), while mandibular canines were least frequently extracted (87, 3.4%).

Conclusion: In conclusion; dental caries and periodontal problems were the main causes for tooth extraction in Sana'a city, Yemen.

Keywords: Dental caries, periodontal disease, tooth extraction, Yemen.

INTRODUCTION

Tooth extraction is one of the dental treatments which should be considered the last decision. A reduce in the number of teeth may result in poor dietary habit and decline of quality of life¹. The number of extracted teeth can act as an indicator of socio-economic and oral hygiene level². Extraction of permanent teeth is carried out for several causes including dental caries, periodontal disease, orthodontic causes, impacted teeth, failed dental treatment, prosthetic indications and other causes. An understanding of the causes why teeth are extracted is vital to enhance oral health outcomes. A large number of cross-sectional studies have investigated for tooth loss in different countries but no previous study to the current study was carried out to

study the reasons for extraction teeth in Yemen except prevalence and pattern of Third Molar impaction in Sample of Yemeni Adults study which carried out last year³. Dental caries was the main cause for tooth loss worldwide⁴⁻¹¹, but a few studies revealed that a greater proportion of tooth extractions were due to periodontal diseases¹¹⁻¹³. Not enough data are available in Yemen and information on this topic is strongly required.

By detecting the main causes and predictors for tooth loss, it may be feasible to limit future extractions and emphasize the crucial role of prevention. Consequently, the purpose of this study was to inspect the causes for extraction of permanent teeth, its associations to several characteristics such as age and gender; and the best analysts for dental caries in Sana'a city, Yemen.

Table 1: The Mean number of teeth extracted according to patient's gender and age in Sana'a University dental clinics, Sana'a city-Yemen 2017.

Factor	Previous extraction Mean±SD	Extraction on the day of survey, Mean±SD	Total Mean±SD
Gender			
Male n=761(53.6%) ^a	5.9±0.41	2.1±0.1	8±0.51
Female n=659 (46.4%)	4.2±0.35	1.5±0.05	5.7±0.4
Age groups in years^b			
≤ 20 yrs n=85	0.4±0.1	1.5±0.1	1.9±0.2
21–30 yrs n= 274	1.5±0.1	1.9±0.05	3.4±0.15
31–40 yrs n=268	4.3±0.2	1.6±0.05	5.9±0.25
41–50 yrs n=327	6.4±0.5	2.5±0.05	8.9±0.55
51–60 yrs n=267	7.2±0.4	2.6±0.1	9.8±0.5
>= 61 yrs n=199	8.44±0.91	2.2±0.1	10.78±1.1
Total n=1420	5.1±.38	1.82±0.07	6.92±0.45

a= t test: $p<0.001$; b= ANOVA: $p<0.001$.

SUBJECTS AND METHODS

This cross-sectional study of following sampling was prepared on dental clinics in the Faculty of Dentistry, Sana'a University during the period from January to December 2017. A predesigned questionnaire for the study was divided into two parts: first asked for the patient's gender, age, marital status, education level, history of smoking, Qat chewing and the time of last dental visit. This part was completed by the dental assistants. The second half was finished by dentists and documented the information on previous dental extractions, tooth type and the cause for each extraction that was to be performed on the day of survey. Dentists were asked to record the code of tooth type and the main cause for each extraction. All permanent teeth extracted, including third molars, during the 12-month study period (January to December 2017) were recorded.

The causes for extraction were investigated for each tooth type in the upper and lower arch. Data were not separated into right and left quadrants as the prior surveys have revealed no differences in the rates of extraction for right and left sides of the oral cavity^{1,14}. The data were entered and analyzed using the SPSS software (version 16.0). The extracted teeth data with normal distribution was expressed as mean and standard deviation (SD) for previous extraction and for extraction on the day of the survey. The relationships of the categorical background variables, such as age range and gender, with reasons for tooth extraction were analyzed by the 2 test, while differences in the mean number of extracted teeth per patient were analyzed with ANOVA and t test methods. A logistic regression model was used to evaluate the variables associated with reasons for tooth loss, considering tooth extraction due to caries and other causes such as caries and periodontal disease. A p value of less than 0.05 was considered to be statistically significant.

Ethical Consideration

Ethical clearance for the study was taken from the Faculty of Medicine and Health Sciences Research Review Committee. Informed Consent was taken from the volunteers before the dental NJJKI examinations.

RESULTS

Males comprised 53.6% of patients and they had more teeth extracted (61.8%) than females ($p<0.001$). According to Table 1, the rate of teeth extracted on the day of the survey (Mean±SD) per patient was 1.82±0.07 (2.1±0.1 for males and 1.5±0.05 for females). In total, patients older than 61 years of age lost 8.44±0.91teeth followed by age group 51-60 years lost 7.2±0.4 teeth, more than all other age groups, as measured by the mean number of teeth lost per patient ($p<0.001$). The highest rates of extraction on the day of survey were in patients from 51 to 60 years old (2.6±0.1 teeth). Dental caries was responsible for 69% of all extractions, while periodontal causes accounted for 28%. Preprosthetic reasons (1.9%) and other reasons (1.14%) were less common reasons for tooth loss (Table 2). Although dental caries was responsible for most extractions in both genders, caries and periodontal disease were more common in males than females (Table 2). While caries was the leading cause for tooth extraction among young patients in ≤ 20 years of age (85.9%) and patients in 21-30 years of age (85.4%). Periodontal causes were the common causes for tooth loss in patients older than 51years (45.7% in age group 51-60 years and 49% in age group ≥61 years) ($p<0.001$) (Table 2). The most frequently extracted teeth were mandibular first and second molars (446, 17.3%), followed by maxillary premolars (415, 16.1%), while mandibular canines were least frequently extracted (87, 3.4%) (Table 3). Premolars, first and second molars of both jaws were the most frequently extracted teeth due to dental caries (Table 3). Additionally, periodontal problems were the main cause for the loss of all incisors in upper and lower jaws ($p<0.001$) (Table 3).

DISCUSSION

The current study indicated that in Sana'a city- Yemen, dental caries and its complications were the leading cause for extraction (69%). Periodontal disease was the next most common reason of teeth extraction in Sana'a city in which it counted 28% of the causes (Table 2). The current finding that caries was the most common reason is in agreement with studies carried out in Iran by Jufarian and Etebarian¹⁵, in England/Wales by

Agerholm and Sidi⁴, in Kuwait by Al-Shammari *et al.*,⁵ in Taiwan by Chen *et al.*,⁶ in Hong Kong by Corbet and Davis⁸, in Afghanistan by Da'ameh⁹; and in Brazil by Jovino-Silverira *et al.*,¹⁰ in which the caries was the most common reason for teeth extraction. On other hand the current study results are different from findings of surveys in Italy¹⁶, Japan¹, and Singapore¹⁷ which they showed that both caries and periodontal disease were almost equally important causes for tooth

loss. In addition, current study results are different from studies in Jordan¹¹ and Canada^{12,13} which demonstrated that the main cause of tooth loss was periodontal disease. Besides, Singapore¹⁷ and Germany¹⁸ had a lower percentage of dental caries compared to current study and many former studies^{3,5,19,20}. These differences may be attributed to socio-economic factors, diet, level of dental awareness on top of water fluoridation in these countries^{17,18}.

Table 2: Reasons for extraction teeth in Sana'a University dental clinics, Sana'a city-Yemen 2017.

Factor	Dental caries	Periodontal problem	Pre-prosthetic reasons	Other reasons ^b	Total
	No (%)	No (%)	No (%)	No (%)	No (%)
Gender					
Male n=761	1020(63.8%)	516(32.3%)	38(2.4%)	24 (1.5%)	1598(61.8%)
Female n=659	762(77.2%)	209(21.2%)	11(1.1%)	5 (0.5%)	987(38.2%)
Age groups in years^a					
≤ 20 yrs n =85	133(85.9%)	11(7.1%)	0(0.0%)	11 (7.1%)	155(6%)
21 - 30 yrs n=274	425(85.4%)	64(12.8%)	3(0.36%)	7 (1.5%)	499(19.3%)
31 - 40 yrs n=268	403(82.8%)	84(17.2%)	0(0.0%)	0(0.0%)	487(18.8%)
41 - 50 yrs n=327	400(67.2%)	164(27.5%)	20(3.4%)	11 (1.8%)	596(23.1%)
51 - 60 yrs n=267	260(53.6%)	222(45.7%)	4(0.62%)	0(0.0%)	486(18.8%)
≥ 61 yrs n=199	160(44.2%)	180(49.7%)	22(6.1%)	0(0.0%)	362(14%)
Total n=1420	1782(69%)	725(28%)	49(1.9%)	29 (1.14%)	2585(100%)

a=2 test: $p < 0.001$, b =Other reasons include: failure of previous dental treatment, financial problems, trauma esthetic reasons, Qat chewing and others.

Table 3: Reasons for extraction by tooth type in Sana'a University dental clinics, Sana'a city-Yemen 2017.

	Dental caries	Periodontal problem	Pre-prosthetic reasons	Other reasons	Total
Maxillary arch	89(40.5%)	106(47.9%)	13(5.8%)	12(5.8%)	220(8.5%)
Incisors n=220					
Canines n=145	82(56.3%)	50(34.5%)	4(2.5%)	9(6.3%)	145(5.6%)
Premolars n=415	322(77.6%)	82(15.6%)	9(2.2%)	2(0.44%)	415(16.1%)
First And Second molars n=350	271(77.6%)	73(20.8%)	6(1.7%)	0(0.0%)	350(13.5%)
Third molar n=184	147(80.2%)	35(18.8%)	2(1%)	0(0.0%)	184(7.1%)
Mandibular arch					
Incisors n =166	66(39.7%)	98(59.3%)	2(1.1%)	0(0.0%)	166(6.4%)
Canines n =87	43(49.4%)	38(43.8%)	4(4.5%)	2 (2.1%)	87(3.4%)
Premolars n=346	238(68.9%)	104(30%)	4(1.1%)	0(0.0%)	346(13.4%)
First And Second molars n=446	344(77.1%)	95(21.2%)	5(1.2%)	2(0.4%)	446(17.3%)
Third molar n=226	180(79.8%)	44(19.4%)	0	2(0.8%)	226(8.7%)
Total n=1420	1782(69%)	725(28%)	49(1.9%)	29(1.14%)	2585(100%)

In the current study, most patients whose teeth were extracted were 21–61 years old age groups, while extraction in younger patients (≤ 20 years) accounted for only 6% of all teeth loss. Even if, 45.7% and 49.7% of teeth extracted for periodontal disease were in patients over 50 years of age (Table 2); caries was still the major cause for extraction even in elderly patients, but to a less degree than in younger ones. This result was also reported by Thomas and Al-Maqdassy²¹. Nevertheless, current study, as previously mentioned, is not in agreement with studies where periodontal disease was the major cause of extraction in patients over 40 years old^{2,5,13,16,17}. It may be that extractions caused by caries are occurring later in the disease process, possibly following initial efforts to treat the tooth. In other words, if more teeth are restored rather than extracted, then extractions would be postponed to an older age group. Consequently, the continuing high frequency of extraction for caries may

indicate an increase in restorations prior to extraction rather than high incidence of caries in older people. In this survey, the mean number of teeth extracted per patient was 1.82, higher than the 1.26 reported by Angelillo *et al.*,¹⁶ in Italy and the 1.3 found by Corbet and Davies⁸ in Hong Kong, but lower than the 2.42 reported by Chrysanthakopoulos² in a study in Greece and the 2.3 found by Murray *et al.*,¹³ in Canada. These dissimilarities are at least in part attributed to different response rates, methodological differences plus the age of the population sample. Therefore, comparison of tooth extraction data between different countries is loaded with difficulty. When considering all the teeth patients had extracted until the day of examination, the mean number of tooth loss in patients over 60 was 8.4, the highest among all age groups. This finding substantiated the evidence for increasing prevalence of tooth loss with increasing age^{16,22}. In the current study, the most repeatedly extracted teeth were mandibular first and second molars (446, 17.3%), followed by

maxillary premolars (415, 16.1%) (Table 3), while in studies by Thomas and Al-Maqdassy²¹ and Marcus *et al.*,²² in USA, third molars were the most frequently extracted teeth, and this is mainly for impaction reasons^{4,6,16}, while first and second molars in these studies were mainly extracted due to dental caries similar to current results^{4,16,18,20}. In the current study periodontal disease was the principal cause of the tooth loss in incisors (maxillary =47.9%, mandibular=59.3%, (Table 3) similar to that reported by Corbet and Davies in Hong Kong⁸; and Morita *et al.*, in Japan which periodontal disease was the principal cause of the tooth loss in incisors. In the current study teeth extracted for pre-prosthetic reasons were mainly maxillary incisors (5.5%) (Table 3), different from that reported by Murray *et al.*,¹³ in Canada and McCaul *et al.*,¹⁴ in Scotland in which first and second premolars and teeth extracted for the same reasons were mainly first and second premolars. A likely reason for the high periodontal extraction in anterior teeth is that they are less susceptible to caries, preserved longer in the mouth, and then may be subjected to the risk of periodontal diseases^{2,5,17,19}.

In the current study, males comprised 53.6% of patients and they had more teeth extracted (61.8%) than females ($p<0.001$). According to Table 1, the rate of teeth extracted on the day of the survey was 2.1 ± 0.1 in males higher than that of 1.5 ± 0.05 in females. Multiple tooth loss was higher in men might be due to their lack of interest in spending more time on complicated restorative treatments rather than extractions as it has been confirmed by the finding of Da'ameh in Afghanistan⁹. There was proportionally more extraction for caries in women than in men in the current study (77.2% Versus 63.9% respectively) (Table 2), this finding which is in disagreement with other studies^{10,14,19,23}. While caries in the current study were the main causes of tooth loss in females, males lost more teeth due to caries and periodontal disease. The second finding was similar to previous investigations^{2,5,24,25}. What is more, male gender has been reported as a risk indicator for periodontal disease severity^{2,5,26}. Finally; studies on tooth loss have generally discussed very few factors associated with missing teeth^{10,27,28}. In this study, several predictors for tooth loss due to caries were considered. Patients' age had a significant association with dental caries, while a study by Jovino-Silveria *et al.*, in Brazil¹⁰ showed age as the best predictor for tooth loss due to periodontal disease.

CONCLUSIONS

The outcomes of this survey revealed that dental caries and periodontal diseases were the most important causes for tooth extraction in Sana'a city, Yemen. The best predictors for tooth loss due to caries were age and gender, tooth type and having had a previous extraction. What's more, strategies for efficient ways of screening for periodontal disease, in particular for middle aged people, might be requisite. Future studies could be alert on changes in causes for dental extraction in a time trend to determine whether or not

their relative importance has changed. Intervention studies could also be conducted with the available data and more surveys could be carried out to compare extraction patterns between public and private dental practices.

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AUTHOR'S CONTRIBUTION

Alhadi Y: writing original draft, methodology, investigation. **Rassem AH:** formal analysis, data curation, conceptualization. **Al-Shamahy HA:** writing, review and editing, methodology. **Al-Ghaffari KM:** formal analysis, data curation, conceptualization. All the authors approved the finished version of the manuscript.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

None to declare.

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