The Reasons for Dental Extraction of Permanent Teeth in a Jordanian Population, Including Considerations for the Influence of Social Factors

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ABSTRACT

Objective: *This study aimed to identify the causes of dental extraction and to clarify if there is any influence of the sociodemographic factors in a Jordanian population.*

Methods: *Prospective Descriptive study, all sectors of dental practice in northern Jordan were included in the sample, from the four northern governorates of Jordan. A questionnaire was distributed to randomly selected dentists and collected during first two weeks of June 2004.*

Results: *Data were collected from 49 dentists, at the end of the study period 853 teeth were extracted from 512 patients. Caries was the most frequent cause for extraction (34.8%), followed by periodontal diseases (30.6%) and orthodontics (9.8%). In the age group under 50, dental caries was the main reason for extraction. However, in the age group over 50; periodontal diseases became the principal reason for extractions. Statistical analysis indicated that there was significant relationship between extractions due to periodontal diseases with tooth brushing also with occupation. Extractions due to orthodontic reasons were significantly related to females. Extractions for patients in various occupations showed important variations.*

Conclusions: *Although no statistical relation was found between all causes of extraction and social factors but still there is a link between social and economical factors and different causes of extractions.*

KEYWORDS

Extraction, Periodontal disease, Orthodontics, Socio-Demographic.

INTRODUCTION

There are different reasons for dental extractions which vary geographically and many studies to determine these reasons **(table 1)** were conducted in different countries, including France, England and Wales, Scotland, Norway, Antigua, and Jordan.[1-10] In Jordan, Haddad found that periodontal diseases were the major cause accounting for (33.4%) of extractions, followed by caries (27.6%),[6] while Ta'ani found that caries was the major cause accounting for 56.4% of all extractions.[7]

The studies which are shown in **table 1** confirmed that extraction due to dental caries is significantly related to age, but did not measure the effect of social and economical factors.[1-10] However, in other studies tooth loss was found to be affected by social, economical, or other factors. For example, Periodontal diseases which is one of the most common causes of tooth loss has been shown to be affected by social, psychological, and biological conditions experienced in early life and through out life.[11]

In Jordan, two studies were conducted by Haddad and Ta'ani;[6,7] Ta'ani found the peak of extraction was between 31-40 years 72.3%, while Haddad found the peak was 41.8% between 21-30 years.

Periodontal diseases appeared to be a leading cause of dental extraction in elderly people.[1-10] This is due to periodontitis, which is a chronic disease affected by many causative and aggravating factors, which act throughout life.[11,12]

Extraction for orthodontic reasons has been performed for decades in daily dental practice, these extractions are performed either to gain space or to prevent malocclusion.[13]

Extraction due to orthodontic reasons is strongly related to age.[1-7] A study was conducted in Norway showed that 95.5% of extractions in patients younger than 16 years were due to orthodontic reasons; in this study the total extractions due to orthodontic reasons were 20%.[4]

(Table 1) *Percentages of permanent teeth extractions due to caries and periodontal diseases in different studies*

Author (s)	Country	Year	% Caries	% Perio
Ta'ani[7]	Jordan	2003	56.4	23.4
Haddad[6]	Jordan	1999	27.4	33.4
Cahen[1]	France	1984	49.0	32.4
Klock[4]	Norway	1988	35.0	19
Vignarajah[5]	Antigua	1990	61.6	29.9
Agerholm & Sidi[2]	England & Wales	1988	47.5	26.5
Murray[8]	Canada	1997	28.9	35.9
Ong[9]	Singapore	1995	35.4	35.8
Reich[10]	Germany	1993	20.7	27.3
kay[3]	Scotland	1984	50	21

Two studies were carried out in Jordan investigating the causes of tooth loss in a Jordanian sample and the percentage of dental extraction due to orthodontic referral ranged between 3-5.3%.[6,7]

There is a growing interest in the impact of behavior and social factors on health issues. Mc Garth and Bedi found that there were gender variations in the social and psychological impact on oral health.[14] Also Hamasha carried a study in Jordan to evaluate risk indicators of tooth loss in Jordanian adults, they found that those who brushed irregularly, smokers, and those who had no professional teeth cleaning in the last year had significantly fewer remaining teeth.[15]

The aim of this study is to identify the causes of dental extraction of permanent teeth and to clarify if there is any influence of the sociodemographic factors in a Jordanian population.

MATERIALS & METHODS

During June 2004 a systematic random sample of 49 dentists was drawn from the records of Jordan Dental Association, Irbid branch. Every fourth dentist from a list of 198 general practitioners was selected. The list includes names and addresses of 218 dentists in the four northern governorates of Jordan, (Irbid, Mafraq, Jerash, and Ajlun). Specialists and dentists working outside the northern area were excluded, those were 20 dentists. As it has been shown by the data collected by department of general statistics, the northern region of Jordan occupies 32% of its total area (28,870 km^2), with an estimated population of 1.4308 million, which represents 27.5% of the Jordanian people.

After preliminary construction of the questionnaire, it was distributed to 5 dentists to test its validity; the suggestions regarding some modifications in the design of some questions were taken into account. Subsequent to final construction of the questionnaire, 5 dentists filled it up during a pilot study, these filled questionnaires were used to measure the reliability of the test using Krombach-alpha test, and the coefficient of reliability was 0.84 which meets the purpose of the study.

During the first two weeks of June 2004, each selected dentist was contacted and interviewed personally, for whom the aim of the study was explained. Each participating dentist was supplied with 20 questionnaires, and they were asked to fill a questionnaire for each patient who was scheduled for extraction of one or more of his or her permanent teeth. An Arabic version of the questionnaire was available and dentists who prefer to fill the questionnaire in Arabic were provided with the Arabic copy. The IRB committee of the Jordan University of Science and Technology approved for the research and each patient included in the study was signed an informed consent for participating the information taken from his dentist in the study.

The following demographic and social variables were recorded and assessed for the study population: age, gender, place of residence and occupation.

For the purpose of accuracy, every cause of extraction was defined precisely after modifications made on definitions available in the literature[1,3] and explained to the participating dentists. These causes are:

- **Caries:** Caries or its sequels, remained roots, and fractures of teeth weakened by caries
- **Periodontal Diseases:** Mobility, periodontal abscess, and loss of function
- **Orthodontic Reasons:** Prevention or correction of malocclusion
- **Prosthetic Request:** Before fitting a denture (fixed or removable) even if functioning
- **Other Reasons:** Failed restorative procedure, cheek bite, impaction (impacted tooth with communication with the oral cavity and causing pain or discomfort), pericorinitis, trauma, inability to pay for conservative treatment, and prophylaxis.

After two weeks all participants were visited, the completed questionnaires were collected. There were 586 questionnaires, of which 74 questionnaires (12.6%) were excluded due to incomplete information. The total questionnaires which were included in the study were 512; these were given numbers from (1 to 512) and entered into Excel for Windows Professionals XP™. At the end, the questionnaire data were processed on the Jordan University of Science and Technology, Department of Public Health, by means of computerized SPSS package for Windows (*SPSS Inc. version 11, Chicago, IL, USA*). Frequency distributions were used together with Pearson Chi-Square test and Wald's Chi-square test. The significance was set at $P<0.05$.

RESULTS

A random sample of 49 dentists was selected from the list of Jordan Dental Association, Irbid branch, all of them agreed to participate in the study. At the end of the study period 853 teeth were extracted from 512 patients,

of them 258 were males and 254 were females. More than one-half of the samples were patients between 20-39 years old. The mean age of the patients was 36 years with a range between 7 and 74 years. **Table 2** shows the description of socio-demographic variables and tooth brushing habits of the sample.

The number of family members ranged between 2 and 15. The monthly income of the families with a range between 85 JD and 1300 JD. The marital status of our sample is shown in **table 2**; with the majority of patients (65%) were married. Smokers represented 32.8% of the sample. The majority (98%) of the sample did not visit dental clinics except in case of pain or discomfort.

It was found that 61.4% were inhabitants of urban areas, 14.7% in suburban areas, and 23.9% in rural areas. Only twenty percent of the sample was brushing their teeth twice or more daily. Similar proportions of patients were brushing their teeth once daily and less than once.

The majority of our samples were house wives (28.7%), only 4.1% were not employed during the research period. **Table 4** shows frequency distribution for patients in different occupations.

Numbers and percentages of extraction due to different reasons are shown in **table 3**, Caries and periodontal diseases were the main causes of extraction, responsible for 34.8% and 30.6% (of total extractions) respectively, while extractions due to orthodontic reasons and prosthetic reasons (9.8% and 8%) came next. Trauma and impaction with other reasons of extractions contributed to minor percentages of extractions in this study, on the other hand failed restorative procedure seems to occupy high percentage (4.8%) of extractions in our sample.

Table 3 revealed that Percentages of extraction due to caries in different age groups. caries was shown to be the main cause of extraction, responsible for 34.8% of total tooth extractions, the peak of extraction due to caries occurred in the age group from 30-39 years, and responsible for 52.7% of extractions in this age group, these changes was proved to be statistically significant (P=0.00).

The results showed that periodontal diseases were the second most common cause of extraction in our sample, responsible for 30.6 % of total extractions. Periodontal diseases showed to be the major cause of tooth loss in the elderly, responsible for more than 70% of extractions in patients older than 50 years, this relation between extractions due to periodontal diseases and age groups was proved to be highly significant (P=0.000). As shown in **table 7**, removing teeth due to orthodontic reasons represented 9.8 % of total extractions carried during the study period. 36 patients had their teeth extracted for orthodontic reasons, of them 30 patients were younger than 20 years. In this age group 66.7% of extractions were due to orthodontic reasons.

Only 19 patients out of 512 patients underwent extractions of 68 teeth for prosthetic reasons; this represents 8.0% of total extractions in our sample. As **table 3** shows the peak of extraction due to prosthetic reasons was in the age group 40-49 years, in this age group 18.2% of extractions were due to prosthetic reasons, also a high percentage of extraction due to prosthetic reasons 11.8% was found in older patients.

Relating caries to gender, as shown in **table 4**, 9.7 **Table 7** showed the percentages of extractions due to caries among patients in different occupations. The results shows clearly that extractions due to caries in house wives were the highest (35.4%) among all different occupation,

(Table 2) *Frequency distribution of socio-demographic variables and tooth-brushing habits of the sample*

Socio-Demographic Variable	N (%)
Gender	
Male	258 (50.4)
Female	254 (49.6)
Age Groups (year)	
< 20	64 (12.5)
20-29	144 (28.1)
30-39	129 (25.2)
40-49	82 (16)
50-59	48 (9.4)
> 59	45 (8.8)
Marital Status	
Single	166 (32.4)
Married	332 (64.8)
Divorced	0 (0)
Widows	14 (2.8)
Occupations	
Professionals	63 (12.3)
Employees	74 (14.5)
Workers	79 (15.4)
House wives	147 (28.7)
Retired	41 (8)
Students	87 (17)
Not employed	21 (4.1)
Smoking	
Smokers	168 (32.8)
Non-smokers	344 (67.2)
Residency areas	
Urban	314 (61.4)
Sub-urban	75 (14.7)
Rural	123 (24)
Tooth brushing habits	
2 times or more daily	106 (20.7)
Once Daily	194 (37.9)
Less than once daily	212 (41.4)
Total	**512 (100)**

(Table 3) *Frequency distribution of extracted permanent teeth according to the age and causes of extraction*

Cause	Age Group (years)							P*
	<20 N (%)	20-29 N (%)	30-39 N (%)	40-49 N (%)	50-59 N (%)	60≤ N (%)	Total N (%)	
Caries	23 (22.5)	77 (42.3)	97 (52.7)	71 (39.2)	12 (13.3)	17 (14.9)	297 (34.8)	0.000
Perio diseases	1 (1)	20 (11)	38 (20.6)	61 (33.7)	66 (73.2)	75 (65.8)	261 (30.6)	0.000
Ortho reasons	68 (66.7)	16 (8.8)	0 (0)	0 (0)	0 (0)	0 (0)	84 (9.8)	0.000
Prosthetic request	1 (1)	3 (1.6)	11 (6)	33 (18.2)	6 (6.7)	14 (12.3)	68 (8.0)	0.02
Other Causes								
Failed Restorative procedures	1 (1)	14 (7.7)	14 (7.6)	5 (2.8)	4 (4.4)	3 (2.6)	41 (4.8)	0.35
Impaction	0 (0)	17 (9.3)	4 (2.2)	3 (1.7)	0 (0)	0 (0)	24 (2.9)	0.003
Cheek bite	0 (0)	4 (2.2)	2 (1.1)	1 (0.5)	0 (0)	0 (0)	7 (0.8)	0.70
Pericorinitis	4 (3.8)	16 (8.9)	7 (3.8)	3 (1.7)	1 (1.2)	2 (1.8)	33 (3.9)	0.09
Trauma	1 (1)	4 (2.2)	1 (0.5)	0 (0)	1 (1.2)	0 (0)	7 (0.8)	0.95
Patient in able to pay	1 (1)	7 (3.8)	6 (3.3)	3 (1.7)	0 (0)	0 (0)	17 (2.0)	0.62
Prophylaxis	0 (0)	0 (0)	2 (1.1)	0 (0)	0 (0)	0 (0)	2 (0.2)	0.70
Unspecified	2 (2)	4 (2.2)	2 (1.1)	1 (0.5)	0 (0)	3 (2.6)	12 (1.4)	-
Total	102 (100)	182 (100)	184 (100)	181 (100)	90 (100)	114 (100)	853 (100)	

**Pearson Chi-square test, Statistical significant at P<0.05*

(Table 4) *Frequency distribution of extractions due to caries in regard to gender, occupation, smoking, and tooth brushing habits*

Socio-Demographic Variable	Teeth extracted N (%)	P
Gender		
Male	150 (50.5)	
Female	147 (49.5)	
		0.54*
Occupations		
Professionals	31 (10.4)	
Employees	42 (14.2)	
Workers	54 (18.2)	
House wives	105 (35.4)	
Retired	21 (7.1)	
Students	34 (11.4)	
Not employed	10 (3.4)	
		0.0001**
Smoking		
Smokers	103 (61.3)	
Non-smokers	186 (54.1)	
		0.12*
Tooth brushing habits		
2 times or more daily	63 (21.2)	
Once Daily	116 (39.1)	
Less than once daily	118 (39.7)	
		0.18*
Total	297 (34.8)	

** Pearson Chi-square test, Statistical significant at P<0.05*
*** Wald's Chi-square Statistical significant at P<0.05*

(Table 5) *Frequency distribution of extractions due to periodontal diseases in regard to gender, occupation, smoking, and tooth brushing habits*

Socio-Demographic Variable	Teeth extracted N (%)	P
Gender		
Male	129 (49.4)	
Female	147 (50.6)	
		0.54*
Occupations		
Professionals	26 (10)	
Employees	29 (11.1)	
Workers	33 (12.6)	
House wives	96 (36.8)	
Retired	59 (22.6)	
Students	1 (0.4)	
Not employed	17 (6.5)	
		0.812**
Smoking		
Smokers	82 (31.4)	
Non-smokers	179 (68.6)	
		0.5*
Tooth brushing habits		
2 times or more daily	25 (9.6)	
Once Daily	64 (24.5)	
Less than once daily	172 (65.9)	
		0.000*
Total	261 (30.6)	

** Pearson Chi-square test, Statistical significant at P < 0.05*
*** Wald's Chi-square Statistical significant at P < 0.05*

(Table 6) *Extractions due to periodontal diseases in diabetic and non diabetic patients in different age groups*

Age-Group	Perio / DM +ve		Perio / DM -ve	
	Patients	Teeth	Patients	Teeth
<20	1	1	0	0
20-29	0	0	9	20
30-39	2	3	15	35
40-49	2	14	20	46
50-59	15	45	13	21
>60	15	44	12	31
Total	**35**	**108**	**69**	**153**

(Table 7) *Frequency distribution of extractions due to prosthetic reasons among patients in different occupations*

	Teeth extracted N (%)	P*
Professionals	4 (5.9)	
Employees	14 (20.6)	
Workers	10 (14.7)	
House Wives	16 (23.5)	0.056
Retired	20 (29.4)	
Students	3 (4.4)	
Not Employed	1 (1.5)	
Total	**68 (100)**	

** Wald's Chi-square Statistical significant at P<0.05*

(Table 8) *Frequencies and percentages of extractions in males and females*

Cause	Male (%)	Female (%)
Failed Restorative Procedure	12 %	15.7%
Impactions	4.3%	3.5%
Cheek Bite	0.8%	5.1%
Pericorinitis	5.4%	6.7%
Trauma	2.3%	0.4%
Prophylaxis	0.8%	0.4%

on the other hand professionals show to extract fewer teeth due to caries compared to employees and workers; such variations was found to be statistically significant. Percentage of tooth extraction due to caries in smokers (61.3%) was slightly higher than that of non smokers (54%), with no significant difference (P=0.12). The relation between tooth extraction due to caries and tooth brushing habits is shown in **table 4** which showed that only 21.2% of extracted teeth were from patients who brushed their teeth twice or more daily. Similar proportions can be noticed in patients brushing their teeth once and less than once daily. This relation did not prove to be significant.

When relating extractions due to periodontal diseases to gender, it can be noticed that similar non-significant proportions (P=0.68) of both males (24.8%) and females (26.4%) extracted teeth due to periodontal diseases as it appeared in **table 5**, in which the effect of occupation on extractions due to periodontal diseases was also studied, and it was found that housewives were the most commonly affected group. This relation was not statistically significant (Wald's Chi-square Statistical significant at P<0.05). Percentage of tooth extraction due to periodontal diseases in non-smokers (68.3%) was slightly higher than that of smokers (31.4%), of the 104 patients underwent extractions due to periodontal diseases 33 were smokers (31.7%) and 71 were non-smokers (68.3%), these variations had no statistically significant difference (P=0.12).

As shown in **table 5**, extractions due to periodontal diseases were studied in relation to tooth brushing, results showed that of the 261 teeth extracted due to periodontal diseases 25 teeth were from patients brushing their teeth two or more times daily, 64 teeth from patients brushing their teeth once daily, and 172 teeth from patients brushing their teeth less than once daily. These figures proved to be statistically significant (P=0.000).

Even with the small numbers of patients underwent extractions due to orthodontic reasons, these extractions shows to be highly related to females (P=0.05) in our sample, where 13 male patients underwent extractions due to orthodontic reasons compared to 23 females. Also facing the small number of patients who extracted their teeth due to prosthetic reasons, 14 male patients underwent extractions compared to 5 females.

Extractions due to prosthetic reasons in relation to gender did not show to be statistically significant relation (P=0.09). Occupation was studied as a factor which may influence the decision of extraction. In spite the small number, the results showed in **table 7** revealed that extractions due to prosthetic reasons in employees were the highest (20.3%) among all different occupations; however professionals showed to extract fewer teeth due to prosthetic reasons compared to employees and workers. This relation was not proved to be statistically significant (Wald's Chi-square Statistical significant at P<0.05).

Trauma and impaction with other reasons of extractions contributed to minor percentages of extractions in this study, on the other hand failed restorative procedure seems to occupy high percentage (4.8%) of extractions in our sample. **Table 3** showed these causes contribute for variable percentages in different age groups. Although these causes contributed to minor percentages but they seem to affect both genders in different percentages, **table 8** shows percentages of extractions in males and females.

DISCUSSION

The selection of dentists participated in this study was based upon a common trend by researchers who carried studies related to our topic. Kay[3] contacted every fourth dentist recorded in the Scottish Health Board, also Klock[21] selected a sample of 500 dentists (1 in 7) drawn from the Norwegian Dental Association. Other researchers in France, England & Wales, and Jordan did the same.[1,2,6,7]

The sample seems to be representative, because dentists from all sectors providing dental care participated; (Ministry of Health, Royal Medical Services, Private sector, and Dental teaching center of Jordan University of Science and Technology). This sample also covers all districts of the four northern governorates of Jordan.

The duration of collecting data was two weeks, Haddad[6] and Klock[21] did the same. Other researchers who carried relevant studies spent periods ranging from one week[3] to three months.[7]

The personal contact and interview in addition to good social relations between dentists in northern Jordan made all the 49 selected dentists participating. The mentioned factors and the clarity of the questionnaire (English and Arabic virgins; all reasons were explained and defined) made the calibration of participants easier.
Results of this study showed that caries was the main cause of extraction; this result agreed with results of many authors.[1-5,7,9] On the other hand the results were in disagreement with Haddad6 and Murray[8], who found that caries was the second reason after periodontal diseases. Haddad found that periodontal diseases are the main cause of extraction in a Jordanian population; this may be explained by that the majority of his sample was older than 40 years.[6] Also 55.5% of Murray's[8] sample was over 40 year old.

It was found in this study that caries was responsible for 34.8% of total extractions, this percentage may vary between different authors, and this is primarily explained by the number of reasons listed in the questionnaire. The results of many authors agreed with results of this work,[1-5,7,9] with percentages ranging between 35%[4] and 61.6%[5]. The relatively low percentage of caries shown in this work is due to the design of the questionnaire, where failed restorative procedures (4.8%) and patient's inability to pay for conservative treatment (2.0%) were analyzed as separate reasons; also the choice between the twelve reasons listed in our questionnaire will decrease the percentage of any.

Caries remain the main cause of extraction in different age groups until the age of 50 years, this agreed with Cahen[1] who analyzed 14621 extractions from 910 dentists, and also agreed with other authors.[2-5] This could be explained by caries being the disease of the young groups. The result agreed with that of Ta'ani[7] who stated that caries was the main reason for extraction until the age of 40 years; this may be due to his sample, where 220 patients (24.4%) out of 898 patients were between 50 and 60 year old, also the difference in percentages between extractions due to caries and extractions due to periodontal diseases in the age group 40-49 years was less than 2.0%; this makes Ta'ani's results comparable to the findings of this study.

Regarding the peak of extractions due to caries, it was found that the peak (52.7%) was in the age group from 30-39 years, this agreed with that of Ta'ani[7] and Klock[4], the presence of the peak in this age group reflect the duration in which destruction of tooth structure needs to occur and also the duration of the failure of restorative procedure to become apparent and tooth status indicate extraction. Other researchers[1,6] found that the peak of extractions due to caries was in the age group 20-29 years. Haddad6 found that this percentage was 41.8% in patients between 21-30 year, and 39.9% in patients between 31-40 years, this may be explained by the fact that only 15 patients (2.5% of his sample) were in this age group, and this percentage does not represent the actual percentage of this group in the society.

The effect of gender variation on causes of dental extractions was discussed by several authors, such as Mc Garth and Bedi who found that there were gender variations in the social and psychological impact on oral health.[14] Our results showed that more extractions because of caries were carried out for males (57.8%), this finding was in agreement with that of Agerholm[2] and Reich[10], but this did not prove to be statistically significant; this might be due to little difference in percentage between males and females (Females 55.1%), also it is important to remember that in the oriental society man still control the life issues of whole family including health issues, but we have to keep in mind that females have a better attitude toward preserving good health.

The percentage of extractions from patients brushing their teeth at least two times daily was lower, unfortunately this did not reflect a statistically significant relation; this result is incomparable because none of authors who carried researches related tooth brushing to specific reasons of tooth extraction, although Hamasha[15] stated that regular tooth brushing could reduce tooth loss and improve oral health.

None of the studies which investigated different reason of extractions and reviewed by the researcher[1-10] compared extractions due to caries between smokers and non-smokers. This work revealed that percentage of extraction due to caries among smokers was 61.3% compared to 54.1% in non-smokers. This agreed with the conclusion of Hamasha[15] who stated that the mean number of remaining teeth decreased significantly in smokers, although Hamasha[15] did not link smoking to specific reason of extraction. Also Hart *et al.*[23] found statistically significant data correlating tobacco use with a higher Decayed, Missing and Filled Index (a measurement of caries and tooth loss experience of patients). Back to the fact that this relation had not been discussed clearly in the literature, but we all can notice the negative attitude among smokers toward health, also authors had found a relation between smoking and increased incidence of cervical caries[24] which is difficult to treat and the availability of specialist service to treat it is limited in this community, which will make extraction a better and easier choice.

Extractions due to caries in patients with different occupations showed that house wives were more commonly to have their teeth extracted due to caries compared to patients in other occupations, this relation has shown to

(Table 9)

Author (s)	Country	Year	%Impaction	%Trauma
Current study	Jordan	2004	2.9	0.8
Ta'ani[7]	Jordan	2003	13.0	0.6
Haddad[6]	Jordan	1999	12.7	3.9
Cahen[1]	France	1984	3.4	1.6
Klock[4]	Norway	1988	-	1.6
Vignarajah[5]	Antigua	1990	1.3	0.6

be statistically significant, where percentages of extraction in different occupation were compared in the same age group, and this excludes the effect of age on extractions carried to patients in different occupations, (Wald's Chi-square test). The percentage of extractions due to caries was found to be 73.3% among patients who did not have university education, and 54.3% in patients with university education. These results of our work are incomparable because of lack in information in the literature concerning the relation between various socio-economic factors and causes of extraction. Most of the workers in our community do not have any mean of social security and health insurance also the low income of workers worsens the problem and this was reflected in our results.

With reference to periodontal diseases, the results of the current study showed that periodontal diseases were responsible for 30.6% of all extractions, this agreed with the results of many authors[2,3,5,7,10] who found percentages ranging from 21%[3] to 32.4%[1]. Also our work was in agreement with most of the literature[1-10] in that periodontal diseases are the main cause for extraction in elderly. In Jordan Haddad[6] showed that periodontal diseases were the main cause of extraction, and this is due to the shift in his sample toward older patients. The highest percentage of extractions due to periodontal diseases was 35.9%, in Canada in 1997,[8] where it is important to mention that 54.9% of the Canadian sample was patients over 40 years old.

The peak of extractions due to periodontal diseases was in the age group 50-59 years; this was in agreement with different studies[1,2,5-7,9] which confirmed that the peak of extractions due to periodontal diseases was in patients between 46-70 years. These finding from different authors can be explained by the fact that periodontitis is a chronic disease process which acts throughout life.[11]

Mc Garth and Bedi had found that there were gender variations in the social and psychological impact on oral health.[14] This work showed that more extractions because of periodontal diseases were carried out for females (26.4%) compared to (24.8%) in males, this finding agreed with that of Agerholm[2] and Vignarajah[5], but this finding did not prove to be statistically significant. This slight higher percentage in females being affected more than males can be explained by the fact that inflammatory periodontal diseases are altered by hormonal changes throughout different phases of female life (Puberty, Menses, Pregnancy, Oral contraceptive pills, and Menopause) which will influence their physiological and psychological attitudes as shown by different studies.[25,26]

Patients brushing their teeth at least two times daily was noticeably lower (9.6%), compared to (24.5%) in those who brush once daily, this percentage arises dramatically in patients who brush their teeth irregularly (65.9%); this reflect a statistically significant relation. This result agreed with the conclusion of Hamasha[15] who stated that regular tooth brushing could reduce tooth loss and improve oral health. Also Teng *et al.* found that chronic periodontitis cases were presumably attributable to irregular tooth brushing.[26]

None of the published articles studied the causes of extraction and compared extractions due to periodontal diseases between smokers and non-smokers, although it is well documented in the literature that smoking is a major risk factor for the prognosis of periodontal diseases. Many of these studies[16-18,22] significantly related smoking with the continuity and severity of attachment loss in periodontal diseases. Al Wahadini stated that cigarette smoking was a major environmental factor associated with accelerated periodontal destruction in Jordanian young adults.[18] This study revealed that percentage of extraction due to periodontal diseases among smokers was higher when compared to non-smokers. This agreed with the conclusion of Hamasha[15] who stated that the mean number of remaining teeth decreased significantly in smokers, although Hamasha[15] did not link smoking to specific reason of extraction, Rieder *et al.* also found that smoking habits significantly influenced the treatment outcomes of supportive periodontal therapy.[27] The relation between dental extractions due to periodontal diseases in different age groups and diabetes is shown in **table 6**, from these results it is apparent that number of teeth extracted per patient were higher among diabetic patients (3.1 teeth/patient) compared to (2.2 teeth/patient) in non-diabetic patients.

Interestingly appeared that housewives were more commonly to have their teeth extracted due periodontal diseases, then followed by retired personals, this may be due to that the mean age of the sample of both housewives and retired personals is higher than other categories in our sample. Comparing professionals, employees, and workers, workers showed to extract more teeth than others, and this may be due to economical status of workers in our society. It was difficult to compare these results to others as there was lack of studies in the literature to explore this relation. However, the results can be explained by the presence of barriers to the utilization of dental services in low income, uninsured populations, and therefore tooth extraction was the solution or only available treatment option.

Removing teeth due to orthodontic reasons represented 9.8% of total extractions carried out during this study, this agreed with Cahen[1], Agerholm[2], Elizabeth[3], Haddad[6], and Murrary[8], who all found percentages between 5.3%[6] to 13,3%[2]. Higher percentage (20%) was found

by Klock[4], this can be explained by the declining caries prevalence and more attention to esthetics. Also this percentage is inflated by the higher participation rate among Norwegian public than private practicing dentists who see few patients less than 19 years of age.[4] Ta'ani found the percentage to be 3%[7], this low percentage is due to the fact that his sample population consisted of adult population (≥20 years).

The peak of extraction due to orthodontic reasons was in patients younger than 20 years, and this agreed with most authors.[1-10] The explanation for this is that younger patients seek more orthodontic treatment.

Since females are more concerned about their esthetics and teeth appearance it was confirmed in our study that more females had teeth extractions for orthodontic reasons (63.8%) when compared to (36.2%) in males. This was in agreement with other studies.[2,3,10]

Extractions for orthodontic reasons cannot be truly related to tooth brushing, because these extractions are carried upon orthodontist decision, also patients having orthodontic treatment have to maintain better oral hygiene, so most authors did not relate these extractions to brushing habits.

Extractions due to prosthetic reasons represented 8% of total extractions carried during the research period. The definition of teeth extracted for prosthetic reasons was "any tooth extracted before fitting a denture (fixed or removable) even if functioning". In England and Wales this percentage was 3.8% based on a definition "teeth to be removed before fitting a denture which are not periodontally involved or could be restored",[2] Elizabeth *et al.* defined these teeth as "teeth which were extracted because their removal facilitated better prosthetic restoration"[3] and found the percentage to be 12%.

In Jordan Haddad[6] found the percentage of teeth extracted due to prosthetic reasons to be 8.1% which is very close to percentage in the current study (8%), however Ta'ani stated that only 1.4% of extractions were due to prosthetic reasons.

Concerning the peak of extractions due to prosthetic reasons, results of the current study showed that this peak was in patients over 60 years old, this agreed with many authors.[1-4] In Jordan both studies[6,7] found the peak in the age group 41-50 years, this can be explained that most of extractions carried for prosthetic reasons were for periodontally diseased teeth and dentists who had performed these extractions registered them as for periodontal reasons, this fact is reflected in the high percentages of extractions due to periodontal reasons in elderly.

Males had extracted their teeth due to prosthetic reasons when compared to females; this was in agreement with Cahen[1] and Reich[10]. This can be explained by the fact that males can easily make a decision to extract teeth.

However in another study by Elizabeth[3], more females required teeth extractions for prosthetic reasons, her work revealed that males had more teeth extracted due to caries and periodontal diseases, and therefore, had fewer teeth remained in their mouths at the stage of prosthetic treatment.

On the subject of other causes of extraction **table 9** was designed for comparison between results obtained from this study and other studies.

The difference in findings regarding percentage of extractions due to impaction between the current study and both studies carried in Jordan[6,7] is due to strict definition of impaction designed by the author (no communication with the oral cavity); and this will reflect the low percentage of extractions due to impaction in our sample and this was in agreement with Cahen[1], who studied extractions of more than 14000 teeth.

Other causes which can be related to socioeconomic status were included in this work, such as failed restorative procedures which were responsible for 4.8% of extractions in this study. This can be explained by inability of patients to utilize high standard dental care because of cost, therefore patient may seek mummification instead of root canal treatment, or ignoring the necessity of a crown for a heavily restored tooth which would consequently result in extraction of these particular teeth. Patient's inability to pay for conservative treatment and other causes are also other factor which represents 2.0% and 1.4% respectively. These factors together represented 8% of all extractions carried out during the study period; we have to remember that this percentage is the same of that due to prosthetic reasons. Here we can imagine the influence of socioeconomic factors on the decision of teeth extraction for both the patient and the dentist.

CONCLUSIONS

From the results of this study, it was found that caries was shown to be the main cause of dental extraction in young patient, while periodontal disease was the main cause of extractions in elderly. Orthodontic and prosthetic reasons were strongly linked to the age of patients, and extractions due to orthodontic demands were statistically linked to females. It was also significantly proved that regular tooth brushing reduce extractions due to periodontal diseases.

We recommend further studies to be carried to measure the socio economical factors as a cause of dental extraction in conjugation with social scientists.

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