

A survey of reasons for extraction of permanent teeth in Jordan

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تم استعراض حالات قلع الأسنان الدائمة في الأردن لتقييم أسباب القلع و لبيان نمط أمراض الفم في هذا البلد. تم الحصول على البيانات من ٥٠ طبيب أسنان يعملون في مراكز طب الأسنان العامة حيث طلب منهم تسجيل حالات قلع الأسنان الدائمة خلال أربعة أسابيع مع تحديد العمر والجنس وعدد الزيارات لطبيب الأسنان والأسنان التي تم قلعها في السابق. تم جمع ١٨٤٨ سناً مقلوعاً من ١٢٣٣ مريضاً. بينت الدراسة أن أسباب القلع كانت كما يلي: النخر السني (٥٠,١٪)، وأمراض الأنسجة الداعمة السننية (٢٩,١٪)، والرُض (١,٧٪)، ومشاكل الزوج (٨,٨٪)، والمعالجة التقويمية (٦,٩٪)، وأسباب أخرى (٣,٤٪). حتى سن الخمسين كان السبب الرئيسي هو النخر السني، يتبعه أمراض الأنسجة الداعمة السننية، إلا أن الوضع انعكس بعد ذلك العمر، وقد تعرضت الإناث لحالات قلع أكثر من الذكور، و كثيراً ما تم قلع الأسنان الخلفية بسبب النخر السني بالمقارنة مع الأسنان الأمامية التي كانت تفلح بسبب أمراض الأنسجة الداعمة السننية. كانت حالات القلع عند المراجعين غير المنتظمين أكثر منها عند المراجعين المنتظمين في معظم المجموعات العمرية. تبين الدراسة الحالية أن نخر الأسنان هو السبب الرئيسي للقلع في الأردن، بالرغم من أن أمراض الأنسجة الداعمة السننية أصبحت السبب الرئيسي في المرضى الذين تزيد أعمارهم عن ٥٠ سنة.

The objective of this study was to survey the extractions of permanent teeth in Jordan in order to assess the reasons for extractions which may reflect the pattern of oral diseases in the country. Data were obtained from 50 dentists working in public dental centers, who were requested to record permanent teeth extracted during 4 weeks, specifying age, gender, dental attendance and previously extracted teeth. One thousand eight hundred forty-eight extracted teeth were collected from 1233 patients. The results showed that the causes of extraction were caries (50.01%), periodontal disease (29.1%), trauma (1.7%), eruption problem (8.8%), orthodontic treatment (6.9%) and other reasons (3.4%). Up to the age of 50 years, the main reason was caries followed by periodontal disease, but the situation was reversed after that age. Females experienced more extractions than males. Posterior teeth were frequently extracted due to caries compared to anterior teeth, which were extracted due to periodontal disease. The extractions were more from irregular dental clinic attenders than regular ones in most age groups. The current study showed that caries was the leading cause of extraction in Jordan, although periodontal disease became the major cause in patients over 50 years old.

Introduction

Understanding the reasons for tooth loss in different populations is important in the formulation of strategies and the planning of dental health services, as well in providing information about the prevalence of dental diseases and the availability of dental care.

Studies investigating the reasons for tooth extraction have been carried out in many countries, mostly in developed industrial Europe.¹⁻¹³ The results of these studies showed that dental caries and periodontal disease were the most common causes of tooth loss (Table 1). Dental caries was the most important cause of tooth loss in the population under the age 40 and the periodontal disease was the major cause for tooth loss in patients over 40 years old.

There seems to be an interesting variation in the order of the causes of extractions among the developed countries. While caries accounts for 60% of extractions in Finland, it is only 20.7% in Germany. Also for periodontal disease, the highest percentage (38%) is in Japan while it is the lowest percentage (10%) in New Zealand.

Similar studies had not been reputed in Jordan before. In the present study, the results are reported from a detailed survey carried out in

Jordan and covers a large group of dentists in public dental health centers, spread over most of the country.

This study investigated the reasons for extractions carried out during a four-week period of the study, taking account the patients' age, gender, pattern of attendance and previous extracted teeth. Furthermore, a dental survey at this time is of particular importance to permit the development of preventive dental program in Jordan.

Materials and Methods

This study covered the public dental centers in eight of twelve governorates in Jordan including the capital city, Amman. These cities are located in north, middle and south of the country. The public dental centers are connected to Jordan University Hospital, Ministry of Health, Military Dental Services and United Nations Relief and Works Agency for Palestine Refugees (UNRWA). Fifty participating dentists were almost equally distributed among the eight governorates. The questionnaire was sent by post or by hand and direct contact was kept to discuss any problems that might arise in completing the questionnaire.

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Table 1. Reasons for teeth extractions. Results of nationwide studies.¹⁻¹³

Author(s)	Year of publication	Country	Period of time	Age range (Yr)	No. of persons in the study	No. of teeth extracted	Caries %	Perio. %	Pre-prosth. %	Ortho %	Trauma %	Impaction %	Other Reasons %	
	1967	Sweden	2 weeks	5-86	17,595	34,456	47	11	34	-	-	-	8	
	1972	Denmark	2 weeks	6-76+	2,302	5486	58	30	(<4)	(<4)	(<4)	(<4)	(<4)	
	1974	New Zealand	1week	0-70+	3,090	7,770	51	10	14	12	1	6	6	
	1984	Finland	1 mnth	16-70+	2,542	3,883	60	18	12	1	1	5	3	
	1985	France	1 mnth	6-70	-	14,621	49	32	3	8	2	3	3	
	1986	Scotland	1week	0-70+	1,082	2,190	50	21	12	7	3	-	7	
	1988	England/Wales	1 mnth	0-80+	2,919	5274	48	27	4	13	1	5	1	
	1991	Norway	2 weeks	6-80	692	985	35	19	4	20	-	-	22	
	1993	Germany	2 weeks	7-85	882	1215	20.7 (18.7)*	27.3	11.2	4.1	0.4	14.7	2.9	
	1996	Canada	1 week	1-60+*	847**	1710		35.9	3.9	7.4	0.8	11.2	6.4	
	1996	Singapore	12 mnth	< 15-55	1276	272	28.9 (6.7)*	35.4	35-8	2.1	5.4	0.8	4.0	9.8
	1996	Italy	2 weeks	16-59+	839	1056		33.1	5.3	7.2	-	12	8	
	1994	Japan	4 weeks	6-80+	-	-	34.4	38	-	0.6	-	3.1	2.9	

(*) % For caries and periodontal diseases
 (**)Studies involved data for permanent and deciduous teeth
 (-) Empty cells refer to unavailable data

Two thousand forms were sent out. The questionnaire form was simply designed in order to take minimum time from the dentist's work hours. A dental hygienist or any other member of the dental surgeon's support staff could record most of the data. It asked for information about patient age, gender, previous extracted tooth or teeth and dental clinic attendance. In an explanatory letter attached to the questionnaire, the staff was instructed to ask the patient if he or she attended any dental clinic for routine check in the previous 6-12 months. Patients who attended such clinic only for the relief of pain were recorded as irregular attenders. The instructions also included questions about the criteria for the assignment of extraction. The adopted criteria were based on those used by Ainamo *et al*⁴, Cahen *et al*⁵, Kay and Blinkhorn⁶, Agerholm and Sidi⁷ and Murry *et al*¹⁰. These are:

- 1) Caries: Teeth requiring extraction because of caries (initial or recurrent) and its consequences. Extracted root's remnants where the crown was lost through caries and teeth fracturing due to weakening by caries. Failed root canal treatment and fracture of teeth weakened by endodontist.

- 2) Periodontal disease: Teeth requiring extraction due to periodontitis including pain, loss of function, loose and supporting teeth.
- 3) Trauma: Teeth extracted due to or as a result of trauma, including jaw fractures.
- 4) Eruption problems: Partial impacted and fully impacted teeth and those, which are characterized by pericoronitis (persistent inflammation around third molar, which necessitated removal of one or all third molars).
- 5) Orthodontic treatment: Teeth to be removed for orthodontic treatment (reasons).
- 6) Other: Any other reason, which is not encompassed by one of the above categories.

Data analysis was performed using the Chi-square test with the SAS program, in order to compare the effect of a number of factors such as age, gender and attendance on the incidence of tooth extraction.

Results

The number of extracted teeth classified according to age is described in Table 2. The groups aged 21-30, 31-40 and 51-60 make up about the same proportion of 20% each and represented the highest number of extracted teeth in the present study. Table 2 also shows differences between males and females. Up to the age of 50

Table 2. Number and percentage of teeth extractions according to age groups including the proportions of male (M) and female (F).

Age group	Male (%)	Female (%)	Total (%)
10 - 20	118 (13.5)	167 (17.1)	285 (15.4)
21 - 30	145 (16.6)	227 (23.3)	372 (20.1)
31 - 40	166 (19.0)	204 (20.9)	370 (20)
41 - 50	108 (12.4)	156 (16.0)	264 (14.3)
51 - 60	210 (24.1)	158 (16.2)	368 (19.9)
61 - 70	95 (10.9)	54 (5.5)	149 (8.1)
70 +	30 (3.4)	10 (1.0)	40 (2.2)
Total	872	976	1848

$$\chi^2 = 62.1034 \quad df = 6 \quad p < 0.0001$$

years, females experienced significantly more extractions than males who, on the other hand, had significantly more extractions after the age of 50 ($p < 0.0001$). Of the teeth extracted, about 55% were from patients up to age 40 and 45% were from those above 40 years of age.

Of the 1848 teeth extracted during the study, Table 3 shows that about 50% were extracted because of caries, 29.1% because of periodontal disease, 1.7% for trauma, 8.8% for eruption problems, 6.9% for orthodontic treatment and 3.4% for other reasons which is mainly for preprosthetic treatment. The relationship between causes and gender was highly significant ($p < 0.0001$). The significance was mainly due to percentage differences of periodontal diseases, eruption problem and orthodontic problems.

Table 3. Number and percentage of extractions for different reasons for all patients and to male (M) and female (F).

Sex	Caries	Perio	Trauma	Eruption	Ortho	Others	Total
M	427 (49.2%)	286 (32.9%)	18 (2.2%)	48 (5.5%)	49 (5.6%)	40 (4.6%)	868 (100%)
F	499 (50.9%)	252 (25.7%)	13 (1.3%)	115 (11.8%)	79 (8.1%)	22 (2.2%)	980 (100%)
Total	926	538	31	163	128	62	1848

Figure 1 shows that the reasons for tooth loss varied in importance in different age groups: 67.5%, 77.6% and 52.7% of extractions in the 21-30, 31-40 and 41-50 age groups, respectively, were due to caries. However, in the age groups over 50 years, periodontal disease was the commonest cause of extraction. Despite periodontal disease becoming an increasingly important cause of extraction in older patients, caries continue to be the next commonest cause for extraction. For other reasons, trauma accounted for only a small

REASONS FOR EXTRACTION OF PERMANENT TEETH

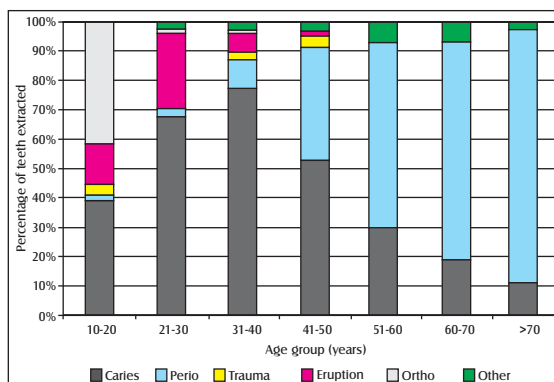


Fig. 1. Proportion of extractions attributable to each cause in each age group.

percentage in age groups 10-20, 31-40 and 41-50 (3.8%, 2.2% and 4.2% respectively). Eruption problems accounted for 13.7%, 25.3% and 6.8% of teeth extracted in age groups 10-20, 21-30 and 31-40 respectively. Orthodontic treatment accounted for 41.8% in the 10-20 age group, which is slightly higher than caries (39%).

Dental attendance patterns had an important influence on the number of extractions as can be judged from Table 4. All the groups showed significantly more irregular attenders than regular except for 10-20 age group (Fig. 2). Regular attenders had 545 (29.5%) teeth extracted while the teeth extracted from the irregular attenders were 1198 (64.8%), the balance of 105 (5.7%) being made up by unrecorded information with respect to attendance. In both regular and irregular groups, females had more extractions than males, except in the case of periodontal disease where males are more than females in the regular group (Table 4; $p < .0001$). The relationship between causes and gender was highly significant ($p < 0.0001$) because of the percentage differences of periodontal diseases, eruption and orthodontic problems. The commonest reason for extraction within regular and irregular groups was caries. The second reason for extraction in the two groups is periodontal disease. The irregular attenders had more extractions with respect to all reasons except in the orthodontic treatment category, where there were more extractions in the regular group.

The relationship between the tooth type and number of extracted teeth is shown in Fig. 3. Posterior teeth in both maxilla and mandible were extracted more often than anterior teeth. Of the posterior teeth, both maxillary and mandibular first premolars and first and third molars were the most frequently extracted. A slightly lower number of laterals were extracted compared with centrals

Table 4. Number and percentage of extractions for different reasons for males (M) and female (F) with respect to regular and irregular attenders.

Reasons for extraction	Attendance					
	Regular			Irregular		
	M	F	Total	M	F	Total
Caries (100%)	96 (40.0%)	147 (60.0%)	243 (100%)	316 (49.0%)	331 (51.0%)	647
Perio (100%)	59 (54.0%)	50 (46.0%)	109 (100%)	198 (52.4%)	180 (47.6%)	378
Trauma (100%)	5 (71.0%)	2 (29.0%)	7 (100%)	11 (55.0%)	9 (45.0%)	20
Eruption (100%)	10 (14.0%)	63 (86.0%)	73 (100%)	35 (41.0%)	50 (59.0%)	85
Ortho (100%)	40 (40.0%)	60 (60.0%)	100 (100%)	7 (27.0%)	19 (73.0%)	26
Other	11 (85.0%)	2 (15.0%)	13 (100%)	27 (64.0%)	15 (36.0%)	42

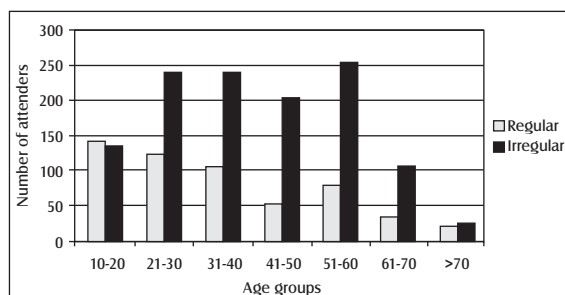


Fig. 2. Distribution of regular and irregular attenders within the age groups.

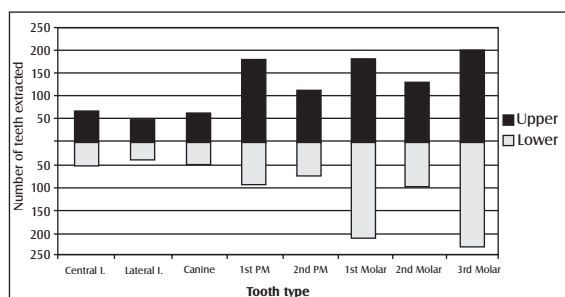


Fig. 3. Number of current extracted anterior and posterior teeth in upper and lower jaws according to tooth type.

and canines of both jaws.

The numbers for each type of the extracted teeth and the reasons for extraction are given in

Table 5. Extraction for different reasons according to tooth type.

Tooth type	Caries	Perio	Truma	Eruption	Orth	Other	Total	%
1	1	10	36	16	0	1	4	67
3.6	1	7	36	0	0	0	7	50
2.7	2	13	30	2	0	0	2	47
2.5	2	5	29	0	1	0	4	39
2.1	3	18	31	2	2	5	4	62
3	3	13	33	0	0	0	4	50
3.3	4	63	37	0	2	69	7	178
2.7	4	28	24	0	2	38	2	94
4	5	78	39	1	4	5	5	132
9.6	5	31	36	2	2	3	2	76
4	5	78	39	1	4	5	5	132
5.1	5	31	36	2	2	3	2	76
7.1	5	78	39	1	4	5	5	132
4.1	5	31	36	2	2	3	2	76

Table 5. Periodontal disease was the commonest reason for extraction in anterior teeth. A large number of posterior teeth was extracted for orthodontic treatment. On the other hand, the commonest reason for extraction of the upper and lower posterior teeth was caries.

It is interesting to note that there is a great similarity with respect to the type and number of extracted teeth between those that were extracted in this study and those that had been extracted previously (Fig. 4).

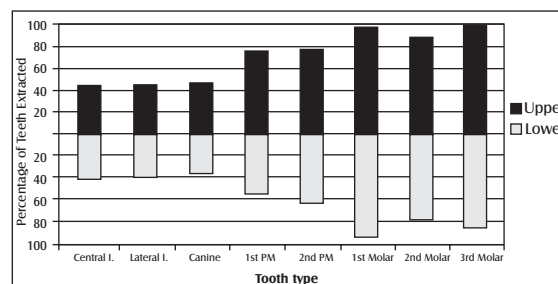


Fig. 4. Percentage distribution of previous extracted anterior and posterior teeth in upper and lower jaws according to tooth type.

Discussion

The results of the present study may be applicable to the country as a whole for two reasons. Firstly, it covers 8 out of the 12 governorates including the capital Amman. The latter contains more than a quarter of the whole population and the other selected locations are

located in the north, middle and south of Jordan. Secondly, this study involved the public dental clinics that contain comprehensive facilities for wide varieties of treatments and to which the majority of the population go for their dental care and treatment. It is believed that the present study should therefore reflect the effect of social, economic and environmental factors as well as tradition and the personal attitude of the patient bear on the treatments carried out by the practicing dentists.

The correct classification of extractions is crucial to the validity of the study. Several factors were considered when formulating the system, which conformed as far as possible to previously used internationally defined criteria. Furthermore, great care was taken to ensure that the study also remained relevant to current standards of clinical practice. To ensure that the adopted system was made quite clear to everyone related to the scheme, recourse was made to direct contacts whether in person or by phone as well as the use of detailed explanatory letters.

Many authors have described variations in the determination or diagnosis of oral diseases among dentists. The main request to participating dentists was to be sure that the carious lesion or the periodontal disease led to such advance stage that extraction had to be done. As mentioned above, in all the clinics of this study, comprehensive treatment was available and this may reduce the possibilities of extraction when there was a chance to save the tooth.

It is important to bear in mind that the extraction of teeth is only based on disease-related factors. Studies in many European and other countries have shown that the decision to extract a tooth is substantially influenced by factors related to both the patient's and dentist's specific requirement.^{14,15} These factors may include the dentist's philosophy of practice, his experience as well as esthetic, prosthetic and economic considerations. These factors may have played important role in the decision for tooth extraction but in most other studies including this study, they have not been taken into considerations.

This study has shown that caries is the leading cause of extraction in Jordan. Previous studies in European and other industrial countries have given figures of between 20.7% and 60%¹⁻¹³ for the proportion of teeth extracted for caries. So although Jordan is a developing country and its facilities are not comparable with those in the developed countries, the results of this study with

respect to caries accounting for 50.01% for the teeth lost is similar to those in industrialized countries.^{4-11,16} The second commonest reason for extraction found in this study is the periodontal disease, this also is in agreement with the results reported previously.

The pattern of tooth extraction due to caries and periodontal reasons in relation to age is again similar to the findings for industrialized countries.^{6-9,11,13,16-19} In the majority of the studies, the predominant cause was caries and its complications up to the age of 40. However, some studies found that the indicated age is 50 years which is in agreement with the findings of the present work. For those above 50 years, the pattern reveals that periodontal disease becomes the predominant cause. The recession of caries as the main cause for teeth extraction over the age of 50 years is due, as Kay and Blinkhorn⁶ suggested, to the fact that fewer teeth are then remaining and therefore could very likely be attacked by periodontal disease.

Although caries is important cause for extraction in the younger patients, the 10-20 group shows more extraction due to orthodontic treatment (41%) rather than caries (39%). This is in agreement with the findings of previous studies.^{7,10} This also reflects that this age group is more concerned about the esthetic and function of their teeth, resulting in more demand for orthodontic treatment.

In this study, females experienced more extractions while later in their lives, males above the age of 50 had more extractions. This may be due to the males tending to delay their dental visits until pain and discomfort are present.⁶ However, Stabholz et al¹⁵ explained this as due to the fact that the females tend to seek dental treatment more often than males during their adulthood because of esthetic and dental health reasons.

Similar to other findings, this study also showed that molars (56.9%) were the most frequently extracted teeth and were mainly due to caries.^{4,5,7,9,11,13,16,19,20} However, the anterior teeth were lost due mainly to periodontal disease. This is in agreement with the findings of Stabholz et al¹⁵, Ong et al¹⁷ and others with respect to lower anterior teeth. Many workers have explained that mandibular teeth, because of their position, are less susceptible to caries and are likely to be retained longer and therefore, become affected by periodontal disease.^{4,5,7,12,13,21}

However, it is found that extraction of the first molar was mainly due to caries rather than periodontitis. Similar findings were also reported

by others.⁴⁻⁷ The early eruption of this permanent tooth may cause exposure for carious attack more than other molars.

In this study, the third molar was found to be the most frequently extracted molar and mainly due to caries and eruption problems as reported by others.^{4,5,9,12,13} With respect to premolars, the first premolars in both orders were extracted mainly because of caries, orthodontic treatment and periodontal disease in that descending order. The second premolars were extracted mostly because caries followed by periodontal disease causes, with a very small number due to orthodontic treatment. This study showed that orthodontic treatment was one of, but not the most, important reason for premolar teeth extraction. However, other workers^{5,9,12} have reported that these premolars were not affected by periodontitis. It may be that in those studies, many patients were treated for their malocclusion and had these teeth extracted earlier before they were exposed to periodontal disease.

Interestingly, the number of extracted teeth due to caries and periodontal disease was lower within the regular clinic attendees group than in the irregular attending group. This is in agreement with the findings of the Scottish study.⁶ The regularity of dental attendance had an important role with regard to extraction.^{6,12} The higher prevalence of dental caries in irregular attenders suggests that regular dental check ups are required so that the administration of preventive measures may be performed. It shows also that earlier diagnosis of lesions prevents any further complication or progression and thus prevents extraction.

In respect to the type of teeth extracted, the results show great similarity between the patterns of current extractions and those of previous extractions indicating that the causes for extraction are to a great extent accumulative.

In summary, the results of the present study indicate that caries is the most frequent reason for tooth extraction in Jordan, with the number of extractions due to periodontitis only exceeding those for caries over the age of 50. This study has also emphasized the importance of regular attendance at dental clinics. It showed that the regulars by receiving frequent proper treatment and instructions for good oral health consequently have fewer teeth extracted than the irregulars. Thus, good dental health in Jordan, as in many similar countries, should bring to the foreground the need for country-wide dental clinics and an awareness campaign among the populace

focused on the importance of frequent attendance to their dental hygienist and following proper dental care practices.

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