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RESEARCH ARTICLE

PATTERNS OF AND REASONS FOR TOOTH EXTRACTIONS IN A SAUDI POPULATION

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ABSTRACT

Aim: The aim of this study was to detect the patterns of and reasons for permanent tooth extractions in a Saudi population in Saudi Arabia. **Materials and Methods:** 318 Saudi patients aged ≥10 years residing in the Kingdom of Saudi Arabia with at least one permanent tooth extracted or diagnosed for extraction were randomly selected. The Study was carried out from September 2018to December 2018. The reason for extraction was documented whether by asking the patient why his/her tooth was extracted or by clinical and radiographic examination for the tooth diagnosed for extraction. The criteria for extraction categories (reasons) were based on Murray *et al*. 1996,[3] and one reason for each tooth was recorded. The data obtained were documented in a patient examination form then statistically analyzed using Chi-Square Test and T-Test. **Results:** The highest percentage of tooth extractions was observed in the age group 10-29 years (35.3%).Tooth extractions due to caries were more in females compared with males, but they due to periodontal disease were more in males compared with females. There was a significant relationship between the reasons for tooth extractions and the extracted tooth types $p < 0.05$, so caries was (70.1%), followed by eruption problems (12.8%), periodontal disease (7.4%), orthodontics (5.7%), prosthodontics (1.8%), pericoronitis (1.6%), and trauma (0.6%); also, the most frequently extracted tooth type was the molars (74.7%), followed by premolars (18.6%), and anterior teeth (6.7%); mandibular and maxillary third molars were the most frequently extracted teeth (19.1%) and (18.4%), followed by the mandibular and maxillary first molars (13.4%) and (8.2%), respectively; however, the least frequently extracted teeth were the mandibular canines (0.7%), followed by the maxillary lateral incisors (0.9%). Of all tooth types, premolars were the most commonly extracted teeth due to orthodontics, molars due to caries, and incisors due to periodontal disease. Caries was the main reason for tooth extractions in all ages. Tooth extractions due to caries, eruption problems, orthodontics, and pericoronitis were more in patients ≤ 40 years than in patients > 40 years; however, tooth extractions due to periodontal disease were more in patients > 40 years than in patients ≤ 40 years. **Conclusion:** Caries is epidemic; it's advised to intensify efforts towards dental sealants and fluoride application with implementing dental preventive and educational programs in order to raise the public awareness of oral hygiene instructions and natural dentition.

INTRODUCTION

Tooth extraction doesn't only cause dysfunction of the masticatory system, but it also has negative social and psychological impact on the patient. Because substantial proportions of the population of Saudi Arabia continue to have teeth extracted, the patterns of and reasons for such loss should be a matter of concern to researchers. With the revolutionary changes facing human societies in the 21st century in lifestyle, dietary habits, education, and the rise of recent oral health educational and preventive programs in many countries, such as Saudi Arabia, it is important to keep searching for the patterns of and reasons for tooth extractions in order toimplement factual and effective dental public health preventive policies. Extraction of permanent teeth happens because of various reasons including dental caries, periodontal disease, orthodontic treatments, traumatic injuries, eruption problems, prosthetic indications, pericoronitis, and patient's request (Caldas *et al*., 2000; Baqain *et al*., 2007; Murray *et al*., 1996; Sayegh *et al*., 2004; Richards *et al*., 2005; Brennan *et al*., 2001; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Corraini, 2009; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Bano *et al*., 2014; Murray *et al*., 1997; Safadi *et al*., 2018). For instance, current

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orthodontic treatments require the extraction of important parts of the dentition which are commonlythe premolars.[2,4,12,16]In addition, almost all studies haven't only considered dental caries and periodontal disease major reasons for tooth loss worldwide (Caldas *et al*., 2000; Baqain *et al*., 2007; Murray *et al*., 1996; Sayegh *et al*., 2004; Richards *et al*., 2005; Brennan *et al*., 2001; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi, 2016; Alesia, 2013; Murray *et al*., 1997), but they have also indicated to dental caries as the main reason for tooth extractions (Caldas *et al*., 2000; Baqain *et al*., 2007; Murray *et al*., 1996; Sayegh *et al*., 2004; Richards *et al*., 2005; Brennan *et al*., 2001; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Bano *et al*., 2014; Murray *et al*., 1997; Safadi *et al*., 2018). Moreover, although dental caries has been referred to as the disease more prevalent in younger age groups (Caldas *et al*., 2000; Baqain *et al*., 2007; Sayegh *et al*., 2004; Brennan *et al*., 2001; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand, 2009) and periodontal disease in older age groups (Caldas *et al*., 2000; Baqain *et al*., 2007; Murray *et al*., 1996; Sayegh *et al*., 2004; Brennan *et al*., 2001; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Bano *et al*., 2014; Murray *et al*., 1997; Safadi *et al*., 2018), many studies have referred to dental caries as an important cause of tooth loss at all ages (Murray *et al*., 1996; Reich, 1993) Also, it has been noticed that mandibular molars have the tendency to be more frequently extracted than maxillary molars (Baqain *et al*., 2007; Sayegh *et al*., 2004; Chrysanthakopoulos, 2011; Khalifa *et al*., 2012; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Bano *et al*., 2014; Safadi *et al*., 2018), and molars have been mainly extracted due to caries (Caldas *et al*., 2000; Baqain *et al*., 2007; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Safadi *et al*., 2018). These findings can help official authorities to direct health policies towards the main problems avoiding random ineffective schemes. Therefore, more research is needed to be carried out in order to investigate facts related to the patterns of and the reasons for tooth extractions and to find out the common global phenomena.

MATERIALS AND METHODS

Ethical approval: The study was registered with the research center of Riyadh Elm University (FRP/2018/222) and received ethical approval from the institutional review board of the same institution (RC/IRB/2018/1139).

Selection of the content for analysis and statistical analysis: 318 Saudi patients aged ≥10 years residing in Saudi Arabiawith one or more permanent teeth extracted or diagnosed for extraction were randomly selected. The study was conducted from September 2018to December 2018. After taking the patient consent on an informed consent statement form for clinical studies, each patient was clinically examined for extracted or diagnosed for extraction maxillary and mandibular permanent teeth.

Also, radiographic examination was used including panoramic, periapical, and bitewing radiographs. Using the criteria for extraction categories based on Murray *et al*. 1996,[3]the reason for extraction was documented whether by asking the patient why his/her tooth was extracted or by clinical and radiographic examination for the tooth diagnosed for extraction, and one reason for each tooth was recorded. The criteria for extraction categories (reasons for tooth extractions) based on Murray *et al*. 1996 were as the following:

Caries: As well as initial and recurrent caries, this category includes all sequelae of caries, including extracted roots, where the crown was lost through caries and teeth fracturing due to weakening by caries. Failed root treatments, initially treated because of caries, should also be placed in this category.

Periodontal disease: Where pain, loss of function or pocketing requires that the tooth be extracted.

Orthodontic: Teeth extracted to prevent or correct malocclusion, be they impacted, incompletely erupted or supernumerary.

Prosthodontic: Teeth which are extracted because their removal facilitates a better prosthetic restoration.

Trauma: This category should include teeth lost only as a result of trauma, including jaw fractures (fractured restorations should be placed in the caries category).

Pericoronitis: Persistent inflammation around third molars which necessitates removal of one or all third molars.

Eruption problems (referred to as impacted in the original reference of Murray *et al*.[3]): Removal of unerupted or partially erupted tooth. The data obtained were documented in a patient examination form then statistically analyzed using Chi-Square Test to test the association between categorical variables (age, reason, tooth type) and Independent Samples T-Test to test the differences in the mean number of extracted teeth per patient by gender. All statistical analyses were performed using the IBM SPSS Statistics 20 data processing software. The significance level was set atp < 0.05.

RESULTS

Extracted Tooth Types: Chi-Square Test showed that there was a significant difference in the percentages (number of observations) of the extracted tooth types p=0.000 <0.05 (df =15, a=5% (one side test, right), with referring to Chi-Square statistical tables, $\square^2$ tab=24.996 < $\square^2$ cal= 1524.878) (Table 2).Therefore, the most frequently extracted tooth typewas the molars (74.7%), followed bypremolars(18.6%), and anterior teeth (6.7%). The most frequently extracted teeth werethe mandibulararthird molars (19.1%), followed by the maxillary third molars (18.4%), the mandibular first molars (13.4%), the maxillary first molars (8.2%), and the mandibular and maxillary second molars (8.0%) and (7.6%), respectively. However, the least frequently extracted teeth were the mandibular canines (0.7%), followed by the maxillary lateral incisors (0.9%) (Table 1, Chart 2). Furthermore,Mode=38 which indicated that the left mandibular third molars were the most frequently extracted tooth type.

Table 1. Distribution of Extracted Tooth Types

Tooth Type	Frequency (n)	Valid Percent
Maxillary Central Incisor	24	1.4%
Maxillary Lateral Incisor	15	.9%
Maxillary Canine	18	1.0%
Maxillary First Premolar	92	5.3%
Maxillary Second Premolar	111	6.4%
Maxillary First Molar	142	8.2%
Maxillary Second Molar	132	7.6%
Maxillary Third Molar	320	18.4%
Mandibular Central Incisor	27	1.6%
Mandibular Lateral Incisor	19	1.1%
Mandibular Canine	13	.7%
Mandibular First Premolar	49	2.8%
Mandibular Second Premolar	71	4.1%
Mandibular First Molar	233	13.4%
Mandibular Second Molar	138	8.0%
Mandibular Third Molar	331	19.1%
Total	1735	100.0%

Table 2. Chi-Square Tests

	Tooth Types
Chi-Square	1524.878
df	15
Asymp. Sig.	.000

Table 3. Distribution of Reasons for Tooth Extractions

Reasons	Count (n)	Percent (%)
Caries	1216	70.1%
Periodontal Disease	129	7.4%
Orthodontics	99	5.7%
Prosthodontics	32	1.8%
Trauma	10	.6%
Eruption Problems	222	12.8%
Pericoronitis	27	1.6%
Total	1735	100.0%

Table 4. Reasons for Tooth Extractions According to Extracted Tooth Types

Tooth	Jaw	Caries n	Periodontal Disease n	Orthodontic n	Prosthodontic n	Trauma n	Eruption Problems n	Pericoronitis n	Total n
Third Molar	Maxillary	185	3	12	8	0	109	3	320
	Mandibular	175	1	15	6	0	111	23	331
Second&	Maxillary	258	13	0	3	0	0	0	274
First Molar	Mandibular	346	15	0	7	0	2	1	371
Premolar	Maxillary	153	7	41	1	1	0	0	203
	Mandibular	75	12	31	2	0	0	0	120
Canine	Maxillary	10	6	0	1	1	0	0	18
	Mandibular	1	11	0	1	0	0	0	13
Incisor	Maxillary	12	19	0	0	8	0	0	39
	Mandibular	1	42	0	3	0	0	0	46
Total	Count (n)	1216	129	99	32	10	222	27	1735

Table 5. Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1761.869	54	.000
Likelihood Ratio	1180.675	54	.000
Linear-by-Linear Association	105.032	1	.000
N of Valid Cases	1735		

Table 6. Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.710	.000
N of Valid Cases		1735	

Table 7. Reasons for Tooth Extractionsand Age Groups

Age Group, Years		Reasons for Tooth Extractions							Total
		Caries	Periodontal disease	Orthodontic	Prosthodontic	Trauma	Eruption problems	Pericoronitis	
10-29	Count	362	10	77	12	4	130	18	613
30-40	Count	339	3	18	7	1	64	7	439
41-50	Count	285	29	0	8	2	17	2	343
≥51	Count	230	87	4	5	3	11	0	340
Total	Count	1216	129	99	32	10	222	27	1735

Table 8. Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	405.588	18	.000
Likelihood Ratio	404.734	18	.000
Linear-by-Linear Association	103.153	1	.000
N of Valid Cases	1735		

Table 9. Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.435	.000
N of Valid Cases		1735	

Table 10: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	148.344	15	.000
Likelihood Ratio	147.477	15	.000
Linear-by-Linear Association	72.871	1	.000
N of Valid Cases	1735		

Table 11. Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.281	.000
N of Valid Cases		1735	

Table12. Age Groups by Extracted Tooth Types

		Age Group, Years				Total
		10-29	30-40	41-50	≥51	
Maxillary/ mandibular incisors	Count	12	5	27	41	85
Maxillary/ mandibular canines	Count	4	0	8	19	31
Maxillary/ mandibular premolars	Count	112	71	63	77	323
Maxillary/ mandibular first molars	Count	146	93	71	65	375
Maxillary/ mandibular second molars	Count	74	79	60	57	270
Maxillary/ mandibular third molars	Count	265	191	114	81	651
	Total	613	439	343	340	1735

Table 13. Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig(2-tailed)
Number of extracted teeth per patient Equal variances assumed	1.587	.209	-.339	316	0.735
Equal variances not assumed			-.321	202.059	0.748

Table 14. Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.422	6	.000
Likelihood Ratio	45.397	6	.000
N of Valid Cases	1735		

Table 15. Symmetr ic Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.160	.000
N of Valid Cases		1735	

Reasons for Tooth Extractions and Extracted Tooth Types: Chi-Square Test showed that there was a statistically significant relationship between the reasons for tooth extractions and the extracted tooth types p=0.000<0.05 (df=54, a=5% (one side test, right), with referring to Chi-Square statistical tables, $\square^2$ tab=67.80< $\square^2$ cal=1761.869) (Table 5). The Contingency Coefficient value was (71.0%) with p=0.000 <0.05 (Table 6). Therefore, the reasons for tooth extractions were distributed as the following: caries (70.1%), followed by eruption problems (12.8%), periodontal disease (7.4%), orthodontics (5.7%), prosthodontics (1.8%), pericoronitis (1.6%), andtrauma (0.6%) (Table 3, Chart 1).

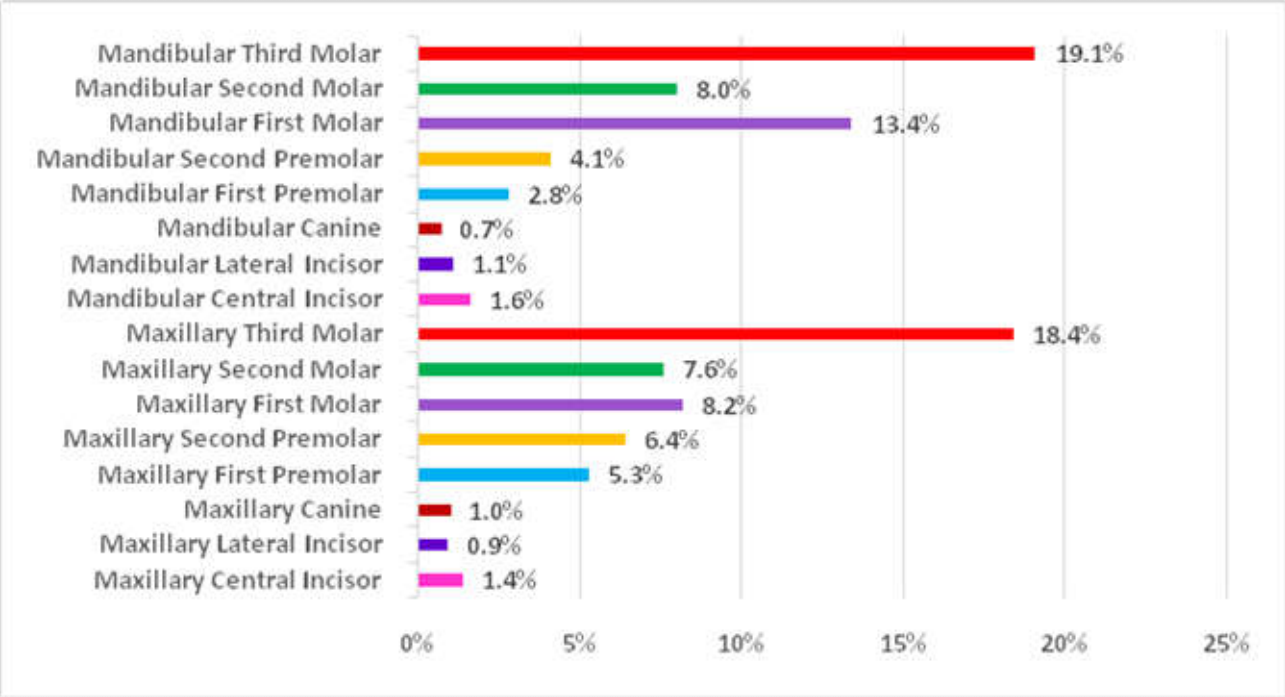

Chart 1. Distribution of Reasons for Tooth Extractions

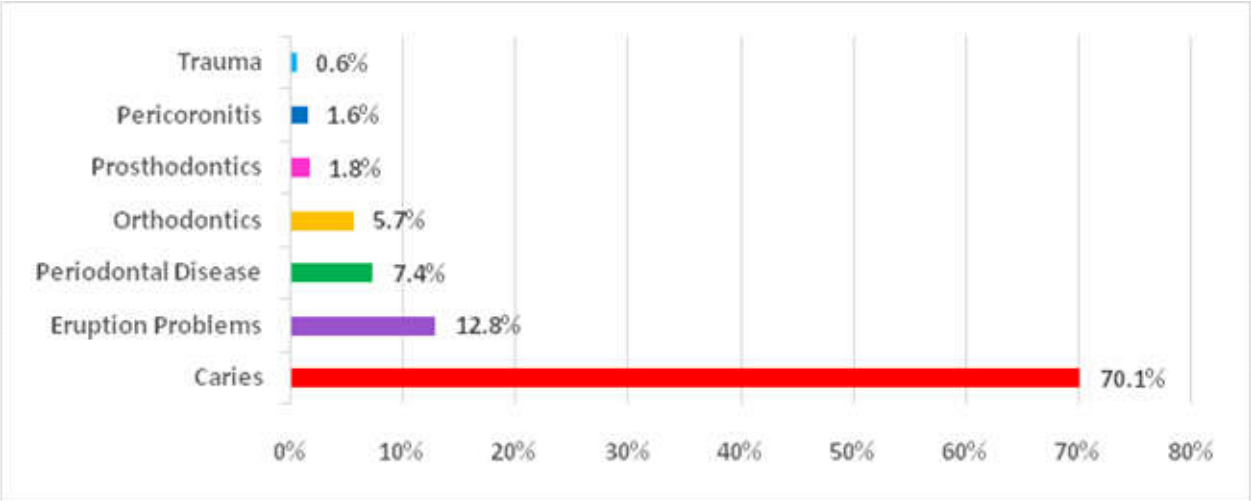

Chart 2. Distribution of Extracted Tooth Types

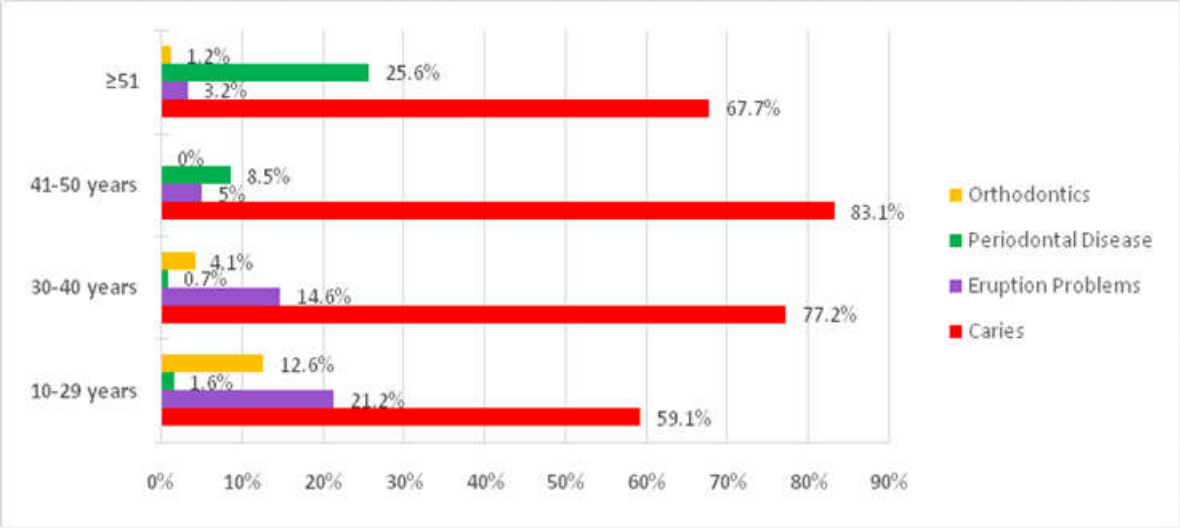

Chart 3. Age Groups by the Four Common Reasons for Tooth Extractions

In addition, Mode=1 which indicated that caries was the most common reason for tooth extractions according to this study encoding.

Molars: First molars, second molars, and third molars were the most commonly extracted teeth due to caries of all tooth types (Table 4).

Third molars: Of all reasons for tooth extractions, the main reason for mandibular third molars extractions was caries (52.9%), followed by eruption problems, such as impaction (33.5%), pericoronitis (6.9%), and orthodontics (4.5%); also, of all reasons for tooth extractions, the main reason for maxillary third molars extractions was caries (57.8%), followed by eruption problems (34.1%), and orthodontics (3.8%). However, mandibular third molars were the most commonly extracted tooth type due to eruption problems (50%) and pericoronitis (85.2%) of all tooth types, and maxillary third molars were the second most commonly extracted tooth type due eruption problems (49.1%) and pericoronitis (11.1%) of all tooth types.

First and second molars: Of all reasons for tooth extractions, caries was the predominant reason for mandibular and maxillary first and second molars extractions (93.3%) and (94.2%), followed by periodontal disease (4.0%) and (4.7%), respectively. In addition, mandibular first and second molars were the most frequently extracted tooth type due to caries (28.5%) of all tooth types, and maxillary first and second molars were the second most frequently extracted tooth type due to caries (21.2%) of all tooth types.

Incisors: Of all reasons for tooth extractions, the main reason for mandibular incisors extractions was periodontal disease (91.3%), followed by prosthodontics (6.5%), and caries (2.2%); also, of all reasons for tooth extractions, the main reason for maxillary incisors extractions was periodontal disease (48.7%), followed by caries (30.8%), and trauma (20.5%). In addition, mandibular incisors were the most commonly extracted tooth type due to periodontal disease (32.6%) of all tooth types, and maxillary incisors were the second most commonly extracted tooth type due to periodontal disease (14.7%) of all tooth types. Moreover, maxillary incisors were the most commonly extracted tooth type due to trauma (80%) of all tooth types.

Canines: Of all reasons for tooth extractions, the main reason for maxillary canines extractions was caries (55.6%), followed by periodontal disease(33.3%), prosthodontics and trauma (5.6% and 5.6%); however, of all reasons for tooth extractions, the main reason for mandibular canines extractions was periodontal disease (84.6%), followed by caries (7.7%), and prosthodontics (7.7%).Furthermore, of all tooth types, mandibular canines were more frequently extracted due to periodontal disease than maxillary canines (8.5%) and (4.7%), respectively. Nevertheless, of all tooth types, mandibular and maxillary canines were equally extracted because of prosthodontics (3.1%) and (3.1%), respectively.

Premolars: Of all reasons for tooth extractions, the main reason for maxillary premolars extractions was caries (75.4%), followed by orthodontics (20.2%), and periodontal disease (3.4%); also, of all reasons for tooth extractions, the main reason for mandibular premolars extractions was caries (62.5%), followed by orthodontics (25.8%), and periodontal disease (10%). However, of all tooth types, maxillary premolars were more frequently extracted due to caries (12.6%) than mandibular premolars (6.2%). Also, of all tooth types, maxillary premolars were the most commonly extracted tooth type due to orthodontics (41.4%), and mandibular premolars were the second most commonly extracted tooth type due to orthodontics (31.3%). Both mandibular incisors and canines were equally the least commonly extracted teeth due to caries of all tooth types (0.1%) and (0.1%), respectively. Both maxillary canines and premolars were equally the second most frequently extracted teeth due to trauma of all tooth types (10%) and (10%), respectively (Table 4).

Reasons for Tooth Extractionsand Age Groups: Chi-Square Test showed that there was a statistically significant relationship between the reasons for tooth extractions and the age of the patient p=0.000<0.05 (df=18, a=5% (one side test, right), with referring to Chi-Square statistical tables, $\square^2$ tab=28.869< $\square^2$ cal=405.588) (Table 8). The Contingency Coefficient value was (43.5%) with p=0.000 <0.05 (Table 9). Therefore, of all reasons for tooth extractions, caries was the first and main reason for tooth extractions in all age groups 10-29:59.1%; 30-40:77.2%; 41-50:83.1%; and ≥51:67.6%, and periodontal disease was the second most common reason for tooth extractions only in older age groups ≥51:25.6% and 41-50:8.5%, while eruption problems were the second most common reason for tooth extractions only in younger age groups 10-29:21.2% and 30-40:14.6% (Chart 3). In addition, of all age groups, it was observed that the percentages oftooth extractions because of periodontal disease were higher in patients > 40 years of age than in patients≤ 40 years of age 10-29:7.8%; 30-40:2.3%; 41-50:22.5%; and ≥51:67.4; however, of all age groups,the percentages oftooth extractions because of orthodontic reasons were higher in patients ≤ 40 years of age than in patients > 40 years of age and were the highest in the age group 10-29 years as the following:10-29:77.8%; 30-40:18.2%; 41-50:0%; and ≥51:4.0%; furthermore,of all age groups, the percentages of tooth extractions because of caries were higher in patients ≤ 40 years of age than in patients > 40 years of age 10-29:29.8%; 30-40:27.9%; 41-50:23.4%; and ≥51:18.9%; also,of all age groups,the percentages oftooth extractions because of eruption problems, such as impaction were higher in patients ≤ 40 years of age than in patients > 40 years of age and were the highest in the age group 10-29 years as the following:10-29:58.6%; 30-40:28.8%; 41-50:7.7%; and ≥51:5.0%; furthermore, of all age groups, the percentages of tooth extractions due to pericoronitis were higher in patients ≤ 40 years of age than in patients > 40 years of age as the following: 10-29:66.7%; 30-40:25.9%; 41-50:7.4%; and ≥51:0%. Moreover, of all age groups, the percentages oftooth extractions because of trauma were the highest in the age group 10-29 years, followed by the age group ≥51as the following:10-29:40%; 30-40:10%; 41-50:20%; and ≥51:30%. Finally, of all age groups, prosthodontic reasons were distributed as the following:10-29:37.5%; 30–40:21.9%; 41-50:25%; and ≥51:15.6% (Table 7).

Extracted Tooth Types and Age Groups: Chi-Square Test showed that there was a statistically significant relationship between the extracted tooth types and the age of the patient p=0.000<0.05 (df=15, a=5% (one side test, right), with referring to Chi-Square statistical tables, $\square^2$ tab=24.996 < $\square^2$ cal=148.344) (Table10). The Contingency Coefficient value was(28.1%) with p=0.000 <0.05 (Table11).

Therefore, the highest percentage of tooth extractions was observed in the age group 10-29 years n=613 (35.3%), followed by 30-40 years n=439 (25.3%), 41-50 years n=343 (19.8%), and≥ 51years n=340 (19.6%). From the aforementioned percentages, it was observed that tooth extractions decreased with age.

Third molars: Third molars were more frequently extracted in patients ≤ 40 years of age than in patients > 40 years of age (10-29:40.7%; 30-40:29.3%; 41-50:17.5%; and ≥51:12.4%).

First molars: First molars were more frequently extracted in patients ≤ 40 years of age than in patients > 40 years of age (10-29:38.9%; 30-40:24.8%; 41-50:18.9%; and ≥51:17.3%).

Second molars: Second molars were more frequently extracted in patients ≤ 40 years of age than in patients > 40 years of age (10-29:27.4%; 30-40:29.3%; 41-50:22.2%; and ≥51:21.1%).

Canines: Canines were more frequently extracted in patients> 40 years of age than in patients ≤ 40 years of age (≥51:61.3%; 41-50:25.8%; 30-40:0 %; 10-29:12.9%).

Incisors: Incisors were more frequently extracted in patients > 40 years of age than in patients ≤ 40 years of age (≥51:48.2%; 41-50:31.8%; 30-40:5.9%; 10-29:14.1%).

Premolars: Premolars were most frequently extracted in the age group 10-29 years 34.7%; of all age groups, other percentages of their extractions were as the following: 30-40:22%; 41-50:19.5%; and ≥51:23.8%.(Table 12).

Extracted Tooth Types and Gender: T-Test showed that there was an insignificant difference in the mean number of extracted teeth between males and females p=0.735>0.05 (Table 13).

Reasons for Tooth Extractions and Gender: Chi-Square Test showed that there was a statistically significant relationship between the reasons for tooth extractions and the gender of the patient (male/female) p=0.000<0.05 (df=6, a=5% (one side test, right), with referring to Chi-Square statistical tables, $\square^2$ tab=12.592 < $\square^2$ cal=45.422) (Table 14). The Contingency Coefficient value was 16.0% with p=0.000 <0.05 (Table 15). Therefore, when comparing males with females, it was observed that tooth extractions were more in females than in males due to caries n=783(64.4%) females and n=433(35.6%) males, orthodontics n=78 (78.8%) females and n=21(21.2%) males, prosthodontics n=22 (68.8%) females and n=10 (31.2%) males, trauma n=6 (60%) females and n=4(40%) males, eruption problems n=154 (69.4%) females and n=68 (30.6%) males, and pericoronitis n=23 (85.2%) females and n=4 (14.8%) males. However, tooth extractions were more in males than in females due to periodontal disease n=75(58.1%) males and n=54(41.9%) females. On the other hand, when comparing the reasons for tooth extractions within the same gender category, it was observed that, of all reasons for tooth extractions, caries was the predominant reason in males (70.4%). Also, when comparing the reasons for tooth extractions in the same gender category, it was observed that, of all reasons for tooth extractions, caries was the predominant reason in females (69.9%).

DICSUSSION

The results of this study were consistent with literature which considered dental caries and periodontal disease major reasons for tooth loss (Caldas *et al*., 2000; Baqain *et al*., 2007; Murray *et al*., 1996; Sayegh *et al*., 2004; Richards *et al*., 2005; Brennan *et al*., 2001; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia, 2013; Murray *et al*., 1997). In addition, of all reasons for tooth extractions, this study with almost all studies indicated to dental caries as the main and leading cause of tooth extractions (Caldas *et al*., 2000; Baqain *et al*., 2007; Sayegh *et al*., 2004; Richards *et al*., 2007; Chrysanthakopoulos, 2011; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb, 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Safadi *et al*., 2018). Although Murray *et al*. found that periodontal disease was the leading cause of tooth extractions, the study considered caries as an important cause of tooth loss at all ages (Murray *et al*., 1996; Murray *et al*., 1997).

Furthermore, of all age groups, the present study was in accordance with literature and observed that tooth extractions because of caries were more in patients ≤ 40 years of age than in patients > 40 years of age (Caldas *et al*., 2000; Baqain *et al*., 2007; Sayegh *et al*., 2004; Brennan *et al*., 2000; Reich, 1993; Al-Shammari, 2006; Montandon, 2012; Saheeb, 2013; Anand, 2009), while tooth extractions because of periodontal disease were more in patients >40 years of age than in patients ≤ 40 years of age (Caldas *et al*., 2000; Baqain *et al*., 2007; Sayegh *et al*., 2004; Khalifa *et al*., 2012). In accordance with the results of the present study, two other studies done in Canada and Germany found that third molars were the most frequently extracted teeth (Reich, 1993; Murray *et al*., 1997). Also, in accordance with literature, this study found that mandibular third molars were more frequently extracted than maxillary third molars (Baqain *et al*., 2007; Khalifa *et al*., 2012; Alaboudi *et al*., 2016; Alesia, 2013), and mandibular first molars were more frequently extracted than maxillary first molars (Baqain *et al*., 2007; Sayegh *et al*., 2004; Chrysanthakopoulos, 2011; Khalifa *et al*., 2012; Corraini *et al*., 2009; Alaboudi *et al*., 2016; Alesia *et al*., 2013; Safadi *et al*., 2018). In addition, this study found with four other studies done in Greece, Kuwait, Nigeria, and Sudan that molars (lower molars) were the most frequently extracted teeth, while canines (lower canines) were the least frequently extracted teeth (Chrysanthakopoulos, 2011; Al-Shammari *et al*., 2006; Saheeb *et al*., 2013; Khalifa *et al*., 2012); also, in the United Arab Emirates, molars were found to be the most frequently extracted teeth, while canines were the least commonly extracted teeth (Bano *et al*., 2014). In the same context, the present study along with many studies mentioned that molars were mainly extracted due to caries (Caldas *et al*., 2000; Baqain *et al*., 2007; Chrysanthakopoulos, 2011; Reich *et al*., 1993; Al-Shammari *et al*., 2006; Montandon *et al*., 2012; Saheeb *et al*., 2013; Anand *et al*., 2009; Khalifa *et al*., 2012; Alaboudi, 2016; Alesia, 2013; Murray *et al*., 1997) whereas canines were extracted due to prosthodontic[2,4,12]and periodontal disease reasons (Al-Shammari *et al*., 2006; Anand, 2009). Furthermore, this study found with two other studies donein Jordan by Baqain *et al*. and Sayegh *et al*. that extractions because of orthodontic reasons mostlyinvolved the premolars, whereas mandibular incisors were mainly and most

commonly extracted because of periodontal disease (Baqain *et al*., 2007; Sayegh *et al*., 2004). Also, in India, Anand *et al*. found that first premolars were mainly extracted because of orthodontic treatments, and maxillary premolars were mainly extracted because of caries besides orthodontics; this result was consistent with the present study. Moreover, this study agreed with literature that tooth extractions because of orthodontics were more in young patients ≤ 30 years of age than in patients > 30 years of age (Al-Shammari *et al*., 2006; Montandon, 2012; Saheeb, 2013; Anand *et al*., 2009; Alesia *et al*., 2013). In addition, in Jordan, Sayegh *et al*. agreed with the present study that maxillary incisors were the most commonly extracted tooth type due to trauma (Sayegh *et al*., 2004); also, in Nigeria, Saheeb *et al*. indicated that trauma mainly accounted for extraction of anterior teeth (Saheeb, 2013). In accordance with the present study, in Kuwait and Greece, Al-Shammari *et al*. and Chrysanthakopoulos found that anterior teeth of both jaws (canines and incisors) were more commonly extracted due to periodontal desease (Chrysanthakopoulos, 2011; Al-Shammari, 2006); also, in Sudan, Khalifa *et al*. referred to periodontal disease as the main reason for mandibular incisors loss (Khalifa *et al*., 2012); in addition, in Brazil, Caldas *et al*. found that mandibular incisors were more often removed because of periodontal disease (Caldas, 2000). Furthermore,the present study agreed with the two studies done in Kuwait and Greece that females lost more teeth due to caries, while males lost more teeth due to periodontal disease in Greece (Chrysanthakopoulos, 2011); females lost more teeth due to caries and orthodontics, while males lost more teeth due to periodontal diseasein Kuwait (Al-Shammari *et al*., 2006).

The present study was consistent with Alesia *et al.* (2013) study done in Saudi Arabia (patients aged from 10 to >70 years) as the following:

- The highest percentage of extractions was observed in young subjects aged 10-29 years (present study) and 10-30 years (Alesia *et al*.).
- The four most common reasons for tooth extractions were: caries, eruption problems, periodontal disease, and orthodontics; caries was the main and leading reason for tooth extractions.
- Molar teeth were mainly extracted because of dental caries.
- Anterior teeth were extracted due to caries, periodontal disease, and prosthodontics.
- The most commonly extracted tooth type was the molars, followed by premolars, and anterior teeth.
- Third molars were the most frequently extracted teeth and were mainly extracted due to caries, followed by eruption problems, such as impaction; the majority of third molars extractions occurred in young age groups 10-29 years (present study) and 21-30 years (Alesia *et al*.).
- Premolars were the common tooth type extracted due to orthodontic reasons and were most frequently extracted in young age groups 10-29 years (present study) and 10-20 years (Alesia *et al*.).
- Maxillary lateral incisors were among the least frequently extracted teeth: the second least frequently extracted teeth (0.9%) (present study)and the least frequently extracted teeth (0.77%) (Alesia *et al*.).
- Mandibular third and first molars were more frequently extracted than maxillary third and first molars, while maxillary first premolars were more frequently extracted than mandibular first premolars.
- Tooth extractions because of caries were more in females compared with males.

Conclusion

The results of this study indicate that dental caries was the most common reason for tooth extractions, and it was the main cause of molars extractions; also, mandibular first and second molars were the most commonly extracted teeth due to caries. The higher tooth extractions percentages due to caries in females might reflect difficulties in commitment to periodical visits to dentist office. Therefore, it's important to intensify efforts towards dental sealants and fluoride application. Tooth extraction should ideally be the last alternative choice among dental treatment options, and clinicians should be careful in deciding whether a tooth especially a healthy tooth should ever beremoved.[20] Therefore, dentists must consider ethical principles and acceptable standards and protocols of diagnosis and treatment in the sense that the best interest of the patient has to be the driving force for the decision of extracting a tooth.[20] In this context, dentists hold responsibility for educating the public in general and women in particular about oral hygiene instructions and the importance of natural dentition through dental educational symposia and programs where women receive education on how to perceive beautiful smile for the purpose of ceasing tooth extractions due to prosthodontic and orthodontic reasons that might be unnecessary.

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REFERENCES

Alaboudi AK, Aboalshamat KT, Mahfouz A, Alobodi A, Abualfaraj A.Reasons for teeth extraction in governmental hospitals inMadinah City, Saudi Arabia. *J Dent Med Sci.*2016; 15(7):1-5.

Alesia K, Khalil HS. Reasons for and patterns relating to the extraction of permanent teeth in a subset of the Saudi population. *ClinCosmetInvestig Dent.* 2013;5:51-56.

Al-Shammari KF, Al-Ansari JM, Al-Melh MA, Al-Khabbaz AK. Reasons for tooth extraction in Kuwait. Med PrincPract. 2006;15(6):417-422.

Anand PS, Kuriakose S. Causes and patterns of loss of permanent teeth among patients attending a dental teaching institution in south India.*J Contemp Dent Pract*. 2009;10(5):058-068.

Bano A, Jawad RS, Abubakar KM, Khan ZA, Johnson J, Al Sharbatti S. Prevalence of missing teeth in patients attending GMC Dental Speciality Center, Ajman, UAE. *Gulf Med J*. 2014;3(S1):S134-S141.

Baqain ZH., Khraisat A., Sawair F., Ghanam S., Shaini FJ., Rajab LD. 2007. Dental extraction for patients presenting at oral surgery student clinic. *CompendContinEduc Dent*., 28(3):146-150.

Brennan DS, Spencer AJ, Szuster FSP. Provision of extractions by main diagnoses. *Int Dent J*. 2001;51(1):1-6.

Caldas Jr AF., Marcenes W., Sheiham A. 2000. Reasons for tooth extraction in a Brazilian population. *Int Dent J*., 50(5):267-273.

Chrysanthakopoulos NA. Reasons for extraction of permanent teeth in Greece: a five-year follow-up study. *Int Dent J*. 2011;61(1):19-24.

Corraini P, Baelum V, Pannuti CM, Pustiglioni AN, Romito GA, Pustiglioni FE. Tooth loss prevalence and risk indicators in an isolated population of Brazil. *ActaOdontol Scand*. 2009;67(5):297-303.

Fernández-Barrera MÁ, Medina-Solís CE, Casanova-Rosado JF, Mendoza-Rodríguez M, Escoffié-Ramírez M, Casanova-Rosado AJ, Navarrete-Hernández JdJ, Gerardo Maupomé G.Contribution of prosthetic treatment considerations for dental extractions of permanent teeth. *PeerJ*. 2016;4(e2015):1-10.

Khalifa N, Allen PF, Abu-bakr NH, Abdel-Rahman ME. Factors associated with tooth loss and prosthodontic status among Sudanese adults. *J Oral Sci*. 2012;54(4):303-312.

Montandon AAB, Zuza EP, de Toledo BEC. Prevalence and reasons for tooth loss in a sample from a dental clinic in Brazil. *Int J Dent*. 2012;2012:1-5.

Murray H, Clarke M, Locker D,Kay EJ. Reasons for tooth extractions in dental practices in Ontario, Canada according to tooth type. *Int Dent J*. 1997;47(1):3-8.

Murray H., Locker D., Kay EJ. 1996. Patterns of and reasons for tooth extractions in general dental practice in Ontario, Canada. *Community Dent Oral Epidemiol*. 24(3):196-200.

Reich E, Hiller KA. Reasons for tooth extraction in the western states of Germany.Community Dent Oral Epidemiol. 1993;21(6):379-383.

Richards W., Ameen J, Coll AM, Higgs G. Reasons for tooth extraction in four general dental practices in South Wales. *Br Dent J*. 2005;198(5):275-278.

Safadi R, Al-Safadi R, Al-Safadi R, Al-Ghamdi E, Al-Mozayen H, Al-Farraj S, Binsaleh W, Al-Mutawa Y, Al-Dossari G. Prevalence of first permanent molar loss in a population of Saudi adolescents and young adults. *Int J Emerg Trends Sci Technol*. 2018;5(4):6577-6584.

Saheeb BD, Sede MA. Reasons and pattern of tooth mortality in a Nigerian Urban teaching hospital. *Ann Afr Med*. 2013;12(2):110-114.

Sayegh A., Hilow H., Bedi R. 2004. Pattern of tooth loss in recipients of free dental treatment at the University Hospital of Amman, Jordan. *J Oral Rehabil*., 31(2):124-130.

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