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Frequency and Distribution of Root Canal Treated Teeth and Missing Teeth from a Sample of Erbil Citizens –RetrospectiveIn-vivoStudy

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Abstract
Root canal treatment is a viable option to save a tooth which has quite a number of indications. Though it also depends upon the awareness of people, access to quality treatment, socio-economic condition…etc. which enables a population to go for saving the tooth or extracting the tooth which could have been saved. The current study uses radiographic evaluation, Orthopantomogram (OPG) to evaluate the population of Erbil city of Iraq to have an idea of prevalence of Root Canal Treatment and Missing Tooth either due to extraction or natural reasons. In this study the mean and mean rank of number of teeth with root canal treatment as well as missing teeth in females are more than males and the study also emphasizes that elderly citizens of Erbil have more root canal as well as missing teeth compare to other countries.

Keywords: *Frequency and Distribution, Root Canal Treatment, Missing Teeth, Rdiographic Evaluation, Orthopantomogram (OPG)*

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I. Introduction

When a tooth is painful and the dental pulp is inflamed or infected or when the tooth badly broken, the patient is usually faced with a choice of extraction or saving the tooth (Hui et al., 2005). The pain that results from inflammation is mostly caused by micro-organisms in dental caries (Dummer et al., 1980). Which drive endodontic treatment to be planned according to the disease progression. At the same time majority of studies have reported that caries is the main reason for overall tooth loss as well(Klock and Haugejorden, 1991, Corbet and Davies, 1991, Cahen et al., 1985). Even though there are many other reasons for extraction of permanent teeth including caries, periodontal disease, orthodontic treatment, traumatic injuries, prosthetic indications, and tooth impaction(Peterson, 2003). Or the tooth may be congenitally missing due to developmental anomalies(Moyers, 1988).

Many studies worldwide have been done to assess the frequency and distribution of root canal treated teeth and missing or tooth loss. Because assessment of tooth mortality data in different parts of the world is essential for evaluating the adequacy of dental care and preventive oral health programs.(Kressin et al., 2003).

Information regarding the dental health of population is based on the number of epidemiological studies, where data on dental health status and treatment needs have been interpreted (Grabowski & Bertram 1975, Schwarz & Pedersen 1983, Petersen 1983, Kirkegaard et al. 1986, Østergaard 1987, Helm 1988).

The root canal therapy and periapical condition of the tooth are important factors for the tooth to stay and serve in the mouth. Information on these factors may help predict future needs for dental treatment in the growing generations of the population. It may also be a useful tool in the evaluation and planning of future under- and postgraduate dental education (Kirkevang et al., 2001). Although the number of edentulous patients has been reported to be on the decline in many developed countries(Brown, 1994, Steele et al., 2000, Hiidenkari et al., 1996), but still tooth loss continues to be a major public health problem worldwide.

The aims of this study is to assess the frequency and distribution of root canal treated teeth and missing teeth from a sample of Erbil citizens.

II. Materials and Methods:

This epidemiologic study included a total of randomly selected1000 samples of OPG that were collected from archives of Department of Oral Diagnosis and Radiology, Faculty of Dentistry, Tishk International University in Erbil city.OPG images were from Erbil citizens who took OPG as part of their dental examination, diagnosis or treatment planning during 2019. Access to information regarding age and gender was provided. Which from 1000 patients 479 of them were male (47.9%) and 521 (52.1%) of them were female. Their mean age ± SD was 37.50 ± 13.78 years, ranging from 17 – 85 years. The median was 35 years. All panoramic radiographs were taken by the same radiographer, who used a digital panoramic unit. Panoramic exams were performed according to manufacturer's instructions, using a NewTOM GIANO "2D" (Verona, Italy), with a magnifying factor of 1 to 1.1. The patient is in standing position in Panoramic radiography. The occlusal plane of the mandible was oriented horizontally, and the midline was centered corresponding to the midsagittal laser of the unit. The mandibles were held in place with a prefabricated jig to ensure reproducible positioning and no movement during the exposure. The images were acquired at 60-90 kVp, 1-10mA with a 9.1 s exposure time and were captured digitally with instantaneous reconstruction time.Two examiners (an oral radiologist and an endodontic clinic supervisor) evaluated the radiographs. The OPG images were selected for enrollment in this investigation if the age was above 17 years regardless the overall dentate condition and the number of remaining natural teeth. The images were examined using an image-analysis software (NT software, Windows Photo Viewer, Microsoft Corp., Redmond, WA, USA). In a PC workstation running Microsoft Windows 10 Home (Microsoft Corp., Redmond, WA, USA).Teeth were categorized as endodontically treated if they had been filled with a radiopaque material in the pulp chamber and/or in the root canal(s). And teeth were considered as missing if they were not present in the OPG which the missing could be from extraction due to any reasons or they may be congenitally missing. The teeth with root canal treatment as well as the missing teeth were identified and statistical analysis have been performed for the epidemiological study that was planned.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Normality of data was tested using the Shapiro-Wilk test. The Mann Whitney test was used to compare the mean ranks of two groups, and the Kruskal Wallis test was used to compare the mean rank of more than two groups. A p value of ≤ 0.05 was considered statistically significant. Statistical analysis Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Normality of data was tested using the Shapiro-Wilk test. The Mann Whitney test was used to compare the mean ranks of two groups, and the Kruskal Wallis test was used to compare the mean rank of more than two groups. A p value of ≤ 0.05 was considered statistically significant. Statistical analysis Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Normality of data was tested using the Shapiro-Wilk test. The Mann Whitney test was used to compare the mean ranks of two groups, and the Kruskal Wallis test was used to compare the mean rank of more than two groups. A p value of ≤ 0.05 was considered statistically significa Statistical analysis Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Normality of data was tested using the Shapiro-Wilk test. The Mann Whitney test was used to compare the mean ranks of two groups, and the Kruskal Wallis test was used to compare the mean rank of more than two groups. A p value of ≤ 0.05 was considered statistically significant Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Normality of data was tested using the Shapiro-Wilk test. The Mann Whitney test was used to compare the mean ranks of two groups, and the Kruskal Wallis test was used to compare the mean rank of more than two groups. A p value of ≤ 0.05 was considered statistically significant.

III. Results

From one thousand cases in the study. Their mean age ± SD was 37.50 ± 13.78 years, ranging from 17 – 85 years. The median was 35 years. Table 1 shows that the majority of the sample were young, and the highest proportion (27.3%) were aged 17-26 years, and 24% were aged 27-36 years. More than half (52.1%) of the sample were females.

Table 1. Age and gender distribution of the studied sample.

	No.	(%)
Age		
17-26	273	(27.3)
27-36	247	(24.7)
37-46	208	(20.8)
47-56	171	(17.1)
57-66	74	(7.4)
≥ 67	27	(2.7)

Gender		
Male	479	(47.9)
Female	521	(52.1)
Total	1000	(100.0)

Results showed that out of 32000 teeth examined, RCT was done for 1073 teeth (3.35% of all examined teeth). And out of 1000 patients, 466 patients (46.6%) had done at least one RCT or more. Regarding the missing teeth, out of 32000 teeth, 5003 teeth were missing (15.65% of all examined teeth). Again out of 1000 patients, 821 (82.1%.) patients had at least one missing tooth or more.

The commonest sites for root canal were as follows: maxillary right second premolar (94), maxillary left second premolar (78), mandibular left first molar (75), maxillary right first molar (70), mandibular right first molar (63), maxillary left first molar (59), maxillary right first premolar (55), and mandibular right second premolar (53). The other less common sites are presented in Table 2.

It is evident in Table 3 that the maxillary right third molar tooth was missing in 45.4% of the patients and the maxillary left third molar tooth was missing in 43.4% of the patients. The other missing teeth were as follows: mandibular left third molar (39.8%), mandibular right third molar (37%), mandibular left first molar (32.5%), mandibular right first molar (29.4%), maxillary left first molar (22.3%), maxillary right first molar (21.2%), maxillary left second premolar (17.8%), and mandibular right second molar (17.2%). While the least common missing tooth was the mandibular left canine (2.8%). The other missing teeth are presented in Table 3.

Table 2. Rate of root canal by teeth location.

	No. of teeth	**(%) Out of 1000 patients**	**(%) Out of 1073 teeth**
Maxillary right second premolar	94	(9.4)	(8.76)
Maxillary left second premolar	78	(7.8)	(7.27)
Mandibular left first molar	75	(7.5)	(6.99)
Maxillary right first molar	70	(7.0)	(6.52)
Mandibular right first molar	63	(6.3)	(5.87)
Maxillary left first molar	59	(5.9)	(5.50)
Maxillary right first premolar	55	(5.5)	(5.13)
Mandibular right second premolar	53	(5.3)	(4.94)
Maxillary left first premolar	49	(4.9)	(4.57)
Mandibular left second premolar	43	(4.3)	(4.01)
Maxillary right second molar	41	(4.1)	(3.82)
Maxillary right central Incisor	41	(4.1)	(3.82)
Mandibular left second molar	38	(3.8)	(3.54)
Mandibular right second molar	38	(3.8)	(3.54)
Maxillary left central incisor	36	(3.6)	(3.36)
Maxillary right lateral Incisor	34	(3.4)	(3.17)
Mandibular left first premolar	33	(3.3)	(3.08)
Maxillary left lateral incisor	30	(3.0)	(2.80)
Maxillary left second molar	30	(3.0)	(2.80)
Maxillary right canine	28	(2.8)	(2.61)
Mandibular right first premolar	25	(2.5)	(2.33)
Maxillary left canine	24	(2.4)	(2.24)
Mandibular left canine	9	(0.9)	(0.84)
Mandibular left central incisor	6	(0.6)	(0.56)
Mandibular right canine	6	(0.6)	(0.56)
Mandibular right central incisor	4	(0.4)	(0.37)
Mandibular left third molar	3	(0.3)	(0.28)
Mandibular right lateral incisor	3	(0.3)	(0.28)
Maxillary left third molar	2	(0.2)	(0.19)
Mandibular right third molar	2	(0.2)	(0.19)
Mandibular left lateral incisor	1	(0.1)	(0.09)
Maxillary right third molar	0	(0.0)	(0.00)

Table 3. Rate of missing teeth by teeth location.

	No. of teeth	**(%) Out of 1000 patients**	**(%) Out of 5003 teeth**
Maxillary right third molar	454	(45.4)	(9.07)
Maxillary left third molar	434	(43.4)	(8.67)
Mandibular left third molar	398	(39.8)	(7.96)
Mandibular right third molar	370	(37.0)	(7.40)
Mandibular left first molar	325	(32.5)	(6.50)
Mandibular right first molar	294	(29.4)	(5.88)
Maxillary left first molar	223	(22.3)	(4.46)

Maxillary right first molar	212	(21.2)	(4.24)
Maxillary left second premolar	178	(17.8)	(3.56)
Mandibular right second molar	172	(17.2)	(3.44)
Maxillary right second premolar	169	(16.9)	(3.38)
Mandibular left second molar	164	(16.4)	(3.28)
Maxillary left second molar	149	(14.9)	(2.98)
Maxillary right first premolar	148	(14.8)	(2.96)
Maxillary left first premolar	148	(14.8)	(2.96)
Mandibular left second premolar	143	(14.3)	(2.86)
Maxillary right second molar	136	(13.6)	(2.72)
Mandibular right second premolar	129	(12.9)	(2.58)
Maxillary left lateral incisor	81	(8.1)	(1.62)
Maxillary right lateral Incisor	70	(7.0)	(1.40)
Mandibular left first premolar	70	(7.0)	(1.40)
Maxillary left canine	62	(6.2)	(1.24)
Mandibular right first premolar	61	(6.1)	(1.22)
Maxillary right canine	59	(5.9)	(1.18)
Maxillary right central Incisor	57	(5.7)	(1.14)
Maxillary left central incisor	56	(5.6)	(1.12)
Mandibular left central incisor	53	(5.3)	(1.06)
Mandibular right central incisor	50	(5.0)	(1.00)
Mandibular left lateral incisor	37	(3.7)	(0.74)
Mandibular right canine	37	(3.7)	(0.74)
Mandibular right lateral incisor	36	(3.6)	(0.72)
Mandibular left canine	28	(2.8)	(0.56)

The mean and the mean rank of the number of teeth with root canal were more among females than males but the difference was not significant ($p = 0.072$). The mean number of missing teeth among females (5.15) was higher than that of males (4.84), and the mean rank of females was significantly higher than that of males ($p = 0.015$) as presented in table 4.

Table 4. Number of teeth with root canal and number of missing teeth parameters of males and females.

	Mean	(±SD)	Median	Min.	Max.	Mean rank	P*
No. of teeth with root canal							
Males	0.96	(±1.53)	0.00	0.00	9.00	484.83	0.072
Females	1.17	(±1.68)	0.00	0.00	10.00	514.91	
No. of missing teeth							
Males	4.84	(±6.24)	3.00	0.00	32.00	477.50	0.015
Females	5.15	(±5.82)	4.00	0.00	32.00	521.65	

*Comparing the mean ranks by Mann Whitney test.

Table 5 shows that there is significant association between the mean and mean rank of number of teeth with root canal and age ($p < 0.001$) but there was no consistent manner where in general the mean number of root canal treated teeth is low in the age group 17-26 years and the age group 57-66 years, while the highest mean (1.67) was among patients aged ≥ 67 years. The mean rank of teeth with root canal was low in the age group 17-26 and there were significant differences with the mean ranks of the age group 27-36 ($p = 0.009$), age group 37-46 ($p < 0.001$), and age group 47-56 ($p < 0.001$). The other associations between the age groups are presented in Table 5.

Table 5. Mean number of teeth with root canal by age.

Age groups	Mean No. of teeth with root canal	(±SD)	P*	Post hoc test groups	p (of post hoc test)	Post hoc test groups	p (of post hoc test)
A)17-26	0.63	(±1.15)		A X B	0.009	B X E	>0.999
B)27-36	1.05	(±1.51)		A X C	< 0.001	B X F	>0.999
C)37-46	1.42	(±1.86)		A X D	< 0.001	C X D	>0.999
D)47-56	1.42	(±1.91)	< 0.001	A X E	>0.999	C X E	0.026
E)57-66	0.78	(±1.30)		A X F	0.092	C X F	>0.999
F)≥ 67	1.67	(±2.06)		B X C	0.433	D X E	0.045
Total	1.07	(±1.61)		B X D	0.774	D X F	>0.999
						E X F	0.555

*By Kruskal Wallis test.

Table 6 shows that, in general, the more the age, the more the mean of the number of missing teeth, and the difference was significant ($p < 0.001$) in the mean ranks of the different age groups. All the differences between group A and the other groups, and group B with the other groups were significant ($p < 0.001$). Also the

difference between group C and F was significant (p = 0.001). The highest tooth extraction rate per patient was seen in the 57-66-year age group (13.46 (±9.21)) and the ≥ 67-year age group (12.59 (±9.21)).

Table 6. Mean number of missing teeth by age.

Age groups	Mean No. of missing teeth	(±SD)	p	Post hoc test groups	p (of post hoc test)	Post hoc test groups	p (of post hoc test)
A)17-26	1.31	(±1.89)		A X B	< 0.001	B X E	< 0.001
B)27-36	3.01	(±2.62)		A X C	< 0.001	B X F	< 0.001
C)37-46	5.05	(±3.73)		A X D	< 0.001	C X D	< 0.001
D)47-56	8.86	(±7.10)	< 0.001	A X E	< 0.001	C X E	< 0.001
E)57-66	13.46	(±9.21)		A X F	< 0.001	C X F	0.001
F)≥ 67	12.59	(±8.35)		B X C	< 0.001	D X E	0.218
Total	5.00	(±6.02)		B X D	< 0.001	D X F	>0.999
						E X F	>0.999

*By Kruskal Wallis test.

IV. Discussion

The study cases consisting of patients visited to Tishk International University Faculty of Dentistry and does not represent a random sample of Erbil population. However, the data that we got from the study provide useful information for assessingthe frequency and distribution of root-canal treatment and missing teeth in Erbil. As no survey on the frequency and distribution of root canal treated and missing teeth in Erbil population has been published at the time of writing this paper.

Panoramic radiographs are often used in epidemiological studies. Taking the advantage of all teeth can be seen on one radiograph, the relatively low patient radiation dose and the convenience and speed with which these kind of radiographs can be exposed, are the reasons for choosing it over full-mouth sets of periapical radiographs (Lupi- Pegurier et al., 2002).Previous studies have also used panoramic radiographs(Gulsahi et al., 2008, De Moor et al., 2000, Lupi- Pegurier et al., 2002).

The results of this study are similar to those of previous studies, in which the mean and the mean rank of the number of teeth with root canal are moreamong females than males but in our study the difference was not significant (p = 0.072). At the same time the results regarding the rate of missing teeth are vice versa with this studies in which males had significantly fewer remaining natural teeth than females but in our study the mean number of missing teeth among females (5.15) is higher than that of males (4.84).(Kirkevang et al., 2001, Lupi- Pegurier et al., 2002, Hollanda et al., 2008, Jafarian and Etebarian, 2013).

The results showed that 3.35% of the teeth had been root filled, which is coincidence with other studies (Gulsahi et al., 2008, De Moor et al., 2000, Jiménez- Pinzón et al., 2004, Lupi- Pegurier et al., 2002), but lower than that in other investigations (Kirkevang et al., 2001, Kabak and Abbott, 2005).However, we have to clarify that we included the third molars in our study as well unlike this studies, which may have slight influence to the results. In the present study, there were significantly more root-filled teeth in the maxilla (62.6%) than in the mandible (37.4%) (P < 0.001), and more premolars and molars than anterior teeth were root filled. These findings support those from other studies (Kabak and Abbott, 2005, Kirkevang et al., 2001, Georgopoulou et al., 2005).The total percentage of missing teeth was (15.65%) which it is high compared to some of the findings in other countries (Jafarian and Etebarian, 2013, Al-Shammari et al., 2006, Angelillo et al., 1996, Caldas Jr et al., 2000). This phenomenon can be explained by first, the fact that the survey population was not representative of the whole country. The patients who visit the dental schools usually come from low socio-economic backgrounds and generally have poorer oral health. Second, the lacking of awareness of the population regarding maintain their dentition and oral health.

Most endodontically treated teeth were found in ≥ 67-year-olds with the mean number of (1.67). And not surprisingly the least were among 17-26-years age group (0.63). It was interesting that both age groups 37-46 and 47-56 with 1.42 mean number were higher than 57-66 –year-old-age group. Usually elderly patients have more root canal treated teeth (Eriksen, 1991), most probably due to of the longer exposure to caries and subsequent operative procedures which may lead to an increased need for root-canal treatment. And in fact eventually 57-66 age group showed to have the highest missing teeth among all age groups with mean number (13.46) which is super high comparing to the findings in this ages group in other countries (Jafarian and Etebarian, 2013, Al-Shammari et al., 2006, Angelillo et al., 1996, Brown, 1994, Caldas Jr et al., 2000). That means the citizens tend to have less remaining natural teeth as they are getting older compare to other countries. Coming to a point that more preventive and educational strategies about oral health and maintain natural dentition are necessary for Erbil citizens.

V. Conclusion

Epidemiological studies are essential for all populations in order to assess the health status as well as direct future plan accordingly. Panoramic radiograph shows to be good tool for this purpose when it comes to evaluate the frequency and distribution of root canal treated teeth and missing teeth. When the results show high numbers of the incidence the topic should be taken in consideration seriously in order to decrease the impact of it in the overall health status of the population.

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