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Causes of Tooth Extraction in Patients at a University Dental Clinic in Acapulco, Mexico

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Abstract

Introduction: Exodontia is a mechanical surgical procedure intended for the extraction of teeth. **Objective:** To describe the causes of exodontia and identify associated factors in patients at a university dental clinic in Acapulco, Mexico. **Material and methods:** Case series study design with information of 192 patients treated during the school period from 2017 to 2019. Through the clinical record, sociodemographic data, pathological and non-pathological personal history and the cause of tooth extraction were collected. Through a multivariate analysis, a factor associated with dental loss due to conditions was identified with the odds ratio (OR) along its

95% confidence interval (CI95%) as association estimators. **Results:** The main cause of dental extractions was caries with 68% (131/192). The procedure was more frequent in female patients with 59% (114/192). 31% (60/192) of the cases were in the 36 to 45 years age group. Molars were the most extracted teeth with 90% (173/192). Regarding the quadrant, 33% (62/192) of the extractions were of the lower left first molar. A factor was identified in the sense of risk for dental loss due to conditions, which was belonging to the rural area (ORa=10.47; CI 95%a=2.62-34.01). **Conclusion:** The greatest dental loss in adults occurs due to oral conditions, where cavities represent the greatest morbidity in different age groups. Knowing the risk factor, it is necessary to implement community prevention campaigns that promote health education.

Keywords: Maxillofacial Surgery, exodontia, molars, dental schools, Mexico.

INTRODUCTION

Exodontia is a common procedure performed by general dentists and specialists in oral and maxillofacial surgery[1,2]. Tooth loss reflects dental disease, availability and accessibility to dental services[3]. Globally, the number of people with untreated oral conditions is estimated to be 3.5 billion, with a 64% increase in disability-adjusted life years[4]. The population between 65 and 74 years of age are the most affected by the loss of all their natural teeth in developing countries[5].

According to the World Health Organization, caries is a non-communicable and costly disease that affects the world's population[6]. Its progressive development infects the pulp tissue, produces fractures by weakening tooth walls and pain[7-9]. In Asian and Middle Eastern countries, it is reported that cavities occupy 52% to 85% of the causes of tooth extraction in university and hospital dental centres[10-12]; in Europe, range of 50% to 64% in primary health centres[13,14], and in Latin America of 10% to 71% in health centres and university clinics[7,15,16]. In Mexico, the Epidemiological Surveillance System for Oral Pathologies (*SIVEPAB* for its acronym in Spanish) establishes that the proportion of patients between 35 and 44 years of age with untreated cavities is 83%, which has an impact on the progressive destruction of the tooth and ends with its loss[5,17].

Exodontia is reported to be common in men aged 65 to 74 years with periodontal disease and caries[8,11]. Some other studies document that orthodontic exodontia is common during the second decade of life[13]. Some research describes that women are the ones who most frequently undergo exodontia in different age groups[7,10,12,14]. Habits such as smoking, and the presence of systemic diseases lead to tooth loss related to periodontopathies[15].

Preventing tooth loss is an important factor for functional, psychological and economic reasons. Sociodemographic, economic and cultural determinants help avoid tooth extraction[9,15]. Human development and access to dental services influence the decrease in tooth extraction rates[18].

To carry out adequate preventive and therapeutic strategies for oral diseases, information is required about the aetiology involved in performing an exodontia. It is necessary to know the availability of dental treatments, and the patients' disposition towards extractions, which is crucial for planning dental health services. In Mexico, the Ministry of Health (SSA for its acronym in Spanish), based on the Official Mexican Standard (NOM for its acronym in Spanish) *NOM-013-SSA2-2015*, carries out education and prevention actions to promote and improve

oral health among the population by age groups[19]. Health promotion aimed at the population in primary care centres, private offices and educational care centres instil the importance of preserving teeth[20,21]. This research aims to describe the causes of exodontia and identify associated factors in patients at a university dental clinic in Acapulco, Mexico.

MATERIAL AND METHODS

Case series study design in patients who attended a dental clinic at a private university in Acapulco, Mexico. For convenience, the information of 229 patients who attended exodontia procedures during the school period of 2017 to 2019 was recorded. A total of 37 patients were excluded due to third molar extraction and dental anomalies, so the analysis took 192 patients into account. Information was collected through the clinical record, which included sociodemographic data, pathological and non-pathological personal history.

The information about the cause of the exodontia was taken through the diagnosis of the tooth with the corresponding auxiliary means described in the clinical record. The dependent variable was the reported cause of exodontia derived of oral diseases (cavities and periodontopathies). The clinical diagnostic description causing the first exodontia performed on the patient was taken as a case. It was measured with two nominal categories, dental loss due to conditions (cavities, periodontal disease) and loss due to therapeutic planning (prosthetics, orthodontics). For the description of the teeth, it was established based on the nomenclature of the FDI World Dental Federation[22]. Information on personal medical history collected data on systemic diseases. Concerning non-pathological personal history, oral hygiene habits were recorded: frequency of brushing, use of toothpaste, use of oral hygiene aids and frequency of visits to the dentist. The patient's harmful habits, such as alcohol intake and smoking, were also included.

Data on the variables of interest were captured with EpiData version 3.1 software[23] (EpiData software, The EpiData Association, Odense, Denmark). The CIETmap software[24] (CIETmap, CIET International, New York, USA) was used for statistical analysis of the data. A univariate analysis was performed to obtain simple frequencies of the study variables. Using contingency tables, a bivariate analysis was carried out with the odds ratio (OR) along its 95% confidence interval (95% CI) as a measure of association between factors associated with tooth loss due to conditions and Pearson's X^2 test with a p value <0.05[25]. Finally, an explanatory multivariate analysis of factors associated with tooth loss due to diseases was carried out with the simultaneous analysis of the Mantel-Haenszel test[26]. The initial saturated model included all the variables that had a significant association in the bivariate analysis and were eliminated one by one with the backward elimination technique until those that were significant remained. The final model was adjusted for a variable considered by biological plausibility criteria.

The project had authorisation of the University's Dentistry Degree Coordination. The regulatory guidelines of the clinical record in undergraduate educational institutions are governed by the Official Mexican Standard *NOM-004-SSA3-2012*[27], so it was guaranteed that the personal and sensitive data of the patients were protected in accordance with the Regulation of the General Health Law Regarding Health Research. According to the data collection through secondary registries, the research was considered risk-free, in accordance with the ethical principles of the World Medical Association's Declaration of Helsinki[28].

RESULTS

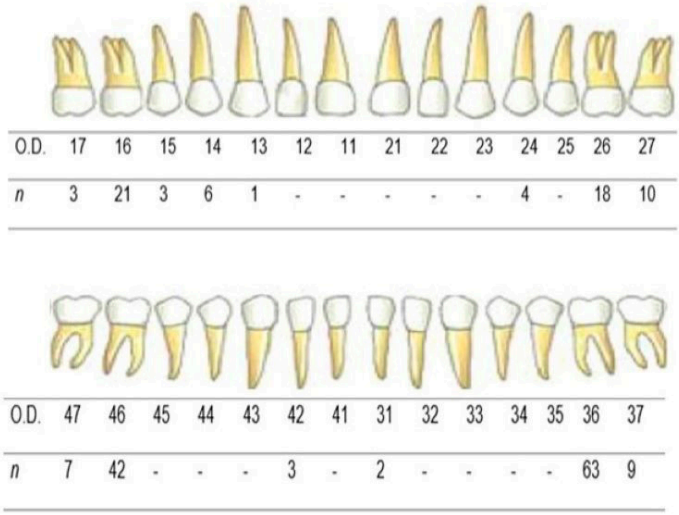
The age range of the patients was 18 to 68 years with a mean of 43.79 ± 11.90. 54% (104/192) were located in rural areas and the rest in urban areas. A low distribution has social security (30%; 57/192). 90% (172/192) of patients reported suffering systemic diseases and the rest were apparently healthy. Among the systemic diseases described, diabetes accounted for 32% (56/172), hypertension accounted for 24% (41/172), and the rest of the patients simultaneously suffered both pathologies. About oral hygiene, 47% (91/192) brush their teeth three times a day, 35% (68/192) twice and the rest once. The 71% (137/192) use toothpaste for oral hygiene, 21% (41/192) only use water and the rest use other ingredients. The 45% (87/192) do not use hygiene aids and 27% (51/192), 19% (37/192) and 9% (17/102) use toothpicks, oral rinse and dental floss, respectively. In respect of the history of visiting dental services, 59% (113/192) reported that it was their first time in the last three years, 33% (65/192) their second time and the rest had never attended an evaluation. In relation to harmful habits, 32% (61/192) and 46% (88/192) smoke and consume alcohol, respectively.

Caries accounted for 68% (132/192) of the causes of exodontia, followed by periodontopathy with 19% (36/192), 9% (16/192) by prosthetic plan and 4% (8/192) by orthodontics. Furthermore, women report a greater number of extractions with 59% vs 41% in men. When stratifying age groups by tooth loss due to infectious conditions (cavities and periodontopathies), 31% (60/192) of the extractions were in the 36-to-45-year group (Table 1). The teeth with the highest frequency of extraction were molars with 90% (173/192) of the cases, followed by premolars with 7% (13/192) and the rest anterior teeth. Concerning the quadrant, the left mandibular first molar was the tooth with the most occurrence of extraction with 33% (63/192), followed by the right mandibular and right maxillary first molar with 22% (42/192) and 11% (21/192) of the cases, respectively (Figure 1).

Table 1.
Causes of exodontia by age group.

Age groups (years)	Caries and Periodontopathy		Prosthetic plan and orthodontics	
	n	%	n	%
18 – 25	3	2%	8	4%
26 – 35	47	24%	7	4%
36 – 45	60	31%	-	-
46 – 55	35	18%	3	2%
56 – 65	23	12%	6	3%
Total	**168**	**87%**	**24**	**13%**

The bivariate analysis identified five factors associated with tooth loss due to caries and periodontopathies. Table 2 shows the unadjusted odds ratio with its 95% confidence interval and the significance level of the estimator. The significant variables in the bivariate model were included in an initial multivariate saturated model, adjusted for the gender variable. The systemic disease variable was discarded since, when stratified, it turned out to be an effect modifier. In the final model, only one variable was kept in the sense of risk, which was the place of rural origin (Table 3).



O.D.	17	16	15	14	13	12	11	21	22	23	24	25	26	27
n	3	21	3	6	1	-	-	-	-	-	4	-	18	10

O.D.	47	46	45	44	43	42	41	31	32	33	34	35	36	37
n	7	42	-	-	-	3	-	2	-	-	-	-	63	9

Figure 1. Frequency of extraction per tooth.
OD = tooth, based on the nomenclature of the World Dental Federation.
n= frequency of extractions per tooth.

DISCUSSION

Cavities accounted for 68% of the causes of tooth extraction in patients between 18 and 65 years of age at a university dental clinic in Acapulco, Mexico. Molars are the teeth with the highest occurrence of extractions with a distribution of 90%. Regarding the quadrant, the left mandibular first molars were the most extracted with 33%. It was found that loss due to caries and periodontal disease was associated with rural origin.

Being a case series study, it is evident that the results are typical of the population that attends the reference site and is not representative of the region. At the same time, there is a limitation related to the temporality criterion, especially in modifiable variables. We must mention that a small number of patients were candidates for multiple dental extractions due to diseases or therapeutic plan; however, only the first extraction performed by the treating student was counted. Given this scenario, the research reflects an underestimation of the frequency of extractions, so it was not possible to associate multiple losses.

Concerning the associated factor, belonging to a rural area, it is possible that it is in accordance with the lack of access to health services, which is why individuals with ailments allow oral conditions to progress and the outcome is tooth loss. Cunha *et al.* mention that tooth loss rates tend to increase in some municipalities in Brazil with a lower human development index[18]. It will be necessary to include other variables related to geographic determinants in order to plan community strategies that prevent dental loss. A study documented that the level of education of patients influences the decision to preserve teeth[15]. This study did not address the educational level. Therefore, it will be essential to carry out follow-up studies in the future to investigate potential factors that lead to tooth extraction. Another missing piece of information was the socioeconomic level, but it is likely that patients go to university clinics due to lack of resources because they cannot afford private health care expenses that allow conservative treatments.

Table 2.
Bivariate analysis of factors associated with tooth loss due to caries and periodontopathies.

Factor	Category	Loss due to conditions		Loss due to therapeutic plan		uaOR	95% CI	*p*
		n=168	(%)	n=24	(%)			
Gender	Man(ref)	69	(36)	9	(5)	1.16	0.48 – 2.80	0.739
	Woman	99	(51)	15	(8)			
Place of origin	Rural (ref)	101	(53)	3	(1)	10.55	3.02 – 36.77	0.0002*
	Urban	67	(35)	21	(11)			
Social insurance	Yes (ref)	51	(26)	6	(4)	1.31	0.50 – 6.97	0.591
	No	117	(61)	18	(9)			
Systemic disease	Presence (ref)	159	(82)	13	(7)	16.92	5.79 – 49.43	< 0.0001*
	Absence	9	(5)	11	(6)			
Brushing	< 3 times(ref)	96	(50)	5	(3)	5.07	1.95 – 13.19	0.002*
	3 times	72	(37)	19	(10)			
Use of toothpaste	Doesn't use(ref)	53	(28)	2	(1)	5.06	1.14 – 22.35	0.032*
	Uses	115	(60)	22	(11)			
Hygiene auxiliaries	Doesn't use(ref)	80	(42)	7	(3)	2.20	0.87 – 5.60	0.095
	Uses	88	(46)	17	(9)			
Dental visit in the last 3 years	1st - never(ref)	119	(62)	8	(5)	4.85	1.95 – 12.08	0.0007*
	2nd	49	(25)	16	(8)			
Smoking habit	Smokes(ref)	57	(30)	4	(2)	2.56	0.83 – 7.86	0.098
	Does not smoke	111	(58)	20	(10)			
Alcohol consumption	Drinks(ref)	78	(41)	10	(5)	1.21	0.51 – 2.88	0.661
	Doesn't drink	90	(47)	14	(7)			

uaOR= Unadjusted Odds Ratio. 95% CI = 95% Confidence Interval. p= Pearson's X^2 test significance level.

Table 3.
Final multivariate model of factors associated with tooth loss due to caries and periodontopathies.

Factor	aOR	95% aCI	X^2 het	p
Place of origin: Rural	10.47	2.62 – 34.01	1.10	0.997

aOR= Adjusted Odds Ratio. 95% aCI= Adjusted 95% Confidence Interval. X^2 het= Chi squared of heterogeneity to identify effect modification. p= Pearson's X^2 test significance level of heterogeneity. The initial saturated model included the variables place of origin, brushing, use of toothpaste and visit in the last 3 years, adjusted for the gender variable.

When asking about social security, 30% of patients have access to it. However, they go to university clinics due to socio-affective relationships with students, and also because of the limitations of dental procedures in the public sector and inter-institutional agreements. It is possible that sociodemographic determinants in co-direction with sociocultural factors and socioeconomic level have an influence in the decision to keep or lose teeth. Based on the clinical record, we describe that six out of ten patients lose teeth due to cavities. This fact is like those of other studies on patients who attend health centres and university clinics[14-16]. Our results are close to the report of sentinel health institutions of the country's public sector, described in the *SIVEPAB* report[17]. Cavities are a non-communicable multifactorial disease, which represents a public health problem with economic burden in various countries[29,30].

Regarding gender, women were the ones who underwent the procedure most frequently, as other research shows[7,10,12,14]. This variable was included due to biological plausibility criteria in the final multivariate model, but no association was found. Lee *et al.*[11] establish that women extract teeth due to cavities and periodontal disease. Yoshino *et al.*[8] document that dental extractions with vertical fracture aetiology increase with age progression in men.

With respect to age groups, extractions were frequent among those aged 36 to 45 years, similar to the study by Villares-López *et al.*[14]. In other investigations, the difference between the age group and the cause of extraction is reported, for example, the aetiology due to caries, periodontal disease, fractures and prosthetic plan is common in patients 45 years or older[8,10-13]. Cardona *et al.*,[13] report that exodontia due to orthodontic plan is common in patients aged 20 years. It is worth mentioning that in this study, dental losses due to conditions were taken as a negative criterion, since those planned for therapy have a history of a diagnosis made by a clinician for improvements in oral health.

A worrying fact in the study was that 90% of the patients suffer systemic diseases. These figures are influenced by the agreements of the university with health agencies, which functions as a system of counter-referral of cases for comprehensive treatments. Delgado-Perez *et al.*,[15] showed that type 2 diabetes in adults increases five times the risk of losing teeth due to periodontopathy. In our study, it was found that when the diseases were separated, diabetes served as an effect modifier, and when stratified, no association was found.

Relating to harmful habits, 32% of patients described smoking and 46% consuming alcohol. It is necessary to associate these variables in subsequent analytical studies, since their frequency was not addressed. Perhaps, establishing an estimate of their consumption over a time interval will serve to obtain a dose-response criterion that leads to causal relationships between these habits and tooth loss due to diseases.

In relation to the most extracted teeth, the left mandibular first molar occurs more frequently during the procedure, a similar result to other studies[10,12,16]. Other researchers report the canines and third molars[8,11,13,14]. Our study excluded third molars and dental alterations in number or shape, because these procedures are referred to the oral surgery clinic. These results show the neglect of permanent teeth over time, so it is a priority to promote oral health education in the population.

We accept that one of the main disadvantages of choosing convenience sampling is that it compromises the external validity of the study, making it impossible to extrapolate the results. Even so, the study provides valuable initial information in the region, especially when there are no fundamental reasons that differentiate the information of the patients reviewed among those that make up the total population. Furthermore, it is the first study in the region that investigates causes and factors associated with tooth loss in a university dental clinic, therefore it provides data of interest to human resources in training.

CONCLUSION

Oral health involves the integration of therapeutic alternatives aimed at procedures to prevent the progressive development of oral conditions. Exodontia is an indicator that helps to know the causes that precede tooth loss. The study revealed the causes that led to the extraction of multiple teeth in patients treated at a private dental university. Cavities was the main cause of tooth loss in different age groups. Knowing the risk factor, it is necessary to implement community prevention campaigns that promote health education about the importance of preserving teeth.

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