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Original article

Analysis of the causes of permanent tooth extraction in a Primary Health Care Centre dental practice

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ABSTRACT

Background

This study seeks to understand the causes of tooth extraction in the Dentistry Practice of the Juncal Primary Care Health Centre (Torrejón de Ardoz), evaluate which teeth are more likely to be removed, the number of extractions according to age and sex, the frequency of extractions in the immigrant population and the burden of tooth extractions as part of the daily healthcare pressure in the Oral Health Unit.

Method

A descriptive, observational, cross-sectional epidemiological field study in patients older than 6 years attending the Primary Care dentistry practice who had one or more permanent teeth extracted.

Results

773 tooth extractions, 48% male and 52% female, mean age 46.72 years, the group with the highest number of extractions was between 60-69 (21.73%). Tooth decay was the most common cause of tooth extraction (63.9%), followed by periodontal disease (17.6%) and alteration of the eruption of wisdom teeth (6.7%).

Conclusions

Dental prevention should be promoted in children aged 6-15 in Primary Care and oral hygiene activities implemented in adults to decrease the rate of tooth extractions in Oral Health Units.

KEYWORDS

Dental extraction; Tooth extraction; Primary health care; Causes of tooth extractions.

BACKGROUND

Dental care was included as part of the work performed by Primary Care (AP) Health Centres (CS) in the Community of Madrid. The coordination of dentistry, oral medicine and dental hygienists with other CS members is very important to enhance the oral health of the reference population, especially in the promotion of prevention measures in children.

Among these measures, dental hygiene is as important as dietary evaluation in controlling dental disease, including advice and instructions on food choices and dietary habits to prevent caries and periodontal disease. Check-ups by dentists and oral health practitioners are also important to assess, for example, periodontal status, bacterial control or dental plaque, perform periodontal probing, determine tooth mobility and update medical and dental history.

An AP dental practice mainly implements health promotion and disease prevention measures. Much of the effort of dentists and dental hygienists in the AP Oral Health Units (USB) is aimed at promoting qualitative changes in living habits and attitudes related to oral health. Nevertheless, performing extractions represents a high percentage (37-66%) of the activity in an AP dentistry, and constitutes almost 90% of the surgical treatments^{1,2}. As Donado suggests, you can be sure that extraction is the basis of oral surgery³.

Despite the existing prevention and promotion measures in the Madrid Community AP Standardised Services Portfolio⁴ and modern repair techniques and dental reconstruction, tooth extraction is still the most common procedure performed and in certain social media it is the only dental treatment received, contributing to the sometimes unnecessary increase in the edentulous population. This has an impact on the quality of life of the patient, because the mouth cavity is used to talk, smile, kiss, touch and taste, so that changes in the mouth can hinder performance at school, work, and in the family; it may also be responsible for thousands of lost hours annually in both the workplace and school, causing a high psychosocial impact⁵⁻⁷.

The 2010 oral health survey in Spain⁸ found the number of edentulous people to be 16.7% in the 65-74 years age group and zero in the 35-44 age group, with an average of 26.6 teeth each for this group (in an analysis of 28, excluding third molars); while the 65-74 age group had an average of 16.11 teeth present.

The immigrant population needed 4 times more extractions than native Spaniards; as they had both a greater number and more serious cases of caries, which meant their treatment was also more complex.

The General Council of Dentistry and Oral Medicine in Spain stated that the main indications for extraction were⁹: a high degree of deterioration of a tooth which could not be restored or rehabilitated; changes in the position or dental situation due to other changes that could not be resolved by other means and orthodontic, prosthetic or surgical reasons.

Most studies in the general population identified caries and periodontal disease as the main causes of tooth removal¹⁰⁻¹³. A low socio-economic and education status and poorer standards of hygiene were other factors that influenced the appearance of the above causes¹⁰. Tooth extraction due to periodontal disease or prosthetic considerations was more common with increasing age¹⁰⁻¹³.

Therefore, an analysis of the different causes affecting tooth extraction needs to be performed, due to the importance of maintaining teeth for aesthetic, functional and psychological reasons; because most studies published on this topic are prior to 2000 and conducted in a private or public/private setting, and not specifically in the public sector, such as AP; and to increase interest in this field of study.

Knowing the prevalence of causes of tooth extractions performed in AP USB could help in preparing specific plans to increase oral health and the quality of oral tissue. It may also be necessary to offer conservative dentistry of decreasing complexity and substantially increasing minimally invasive restorative treatments in the youth population, with a growing complexity of treatments in the adult population, including senior citizens.

The CS Oral and Dental Health Centre of El Juncal, belonging to the Eastern Care Management (DAE) of the Primary Care Management (GAP) of Madrid Community, was concerned about the impact of extractions on the health of our population. It therefore conducted a study mainly to determine the proportion of individuals in AP who were indicated extractions and their causes. This was to be merged with one of the objectives of the Oral and Dental Health in Spain for the year 202014 to reduce tooth loss and the percentage of edentulous people in cohorts of adults; thus increasing average number of functional teeth and strengthening the promotion and prevention measures to be implemented, mainly in children. The distribution by age, sex and nationality of the number and causes of tooth extraction; the possible association of the number and causes of tooth extraction with these variables; and evaluation of which teeth are the most likely to be extracted were also intended to be studied.

MATERIAL AND METHODS

Design, scope and study population

An observational, descriptive, cross-sectional epidemiological field study was designed with these objectives in mind, in routine clinical practice at the Juncal CS, Torrejón de Ardoz, which has a reference population of 78,050 users over 5 municipal areas.

The study population was patients over 6 years of age attending the AP dentistry practice, on their own initiative or after referral by a family doctor, who were indicated extraction, during April - November 2014.

Patients not amenable to treatment in an AP outpatient clinic were excluded (patients with severe systemic disorders or mental disorders, as well as for services not covered in the AP services portfolio⁴), as were those patients who refused to participate in the study.

Sample size and selection

All patients who met the aforementioned selection criteria were included, and the sample size calculated by the descriptive studies sample calculation formula, whose main variable is categorical and defined in a finite population for a subsidiary extraction population of 3,356 users (the prevalence of extractions in the study period was 4.3%)⁸, with a confidence level of 95% and accuracy of 1.62%, resulting in an estimated sample size of 510 individuals. No patient refused inclusion.

Variables

The number of extractions performed in the study with the variables described below were recorded:

Dependent variables

- **Cause of tooth extraction:** 6 categorías³ were chosen, according to the criteria of the General Council of Dentistry and Oral Medicine in Spain⁹:
- **Dental caries:** Conservative treatment or its failure were not indicated.
- **Periodontal disease:** Advanced, with marked dental mobility and the presence of periodontal abscesses preventing conservative surgical treatment is a common indication for tooth extraction.
- **Mixed:** Dental caries and periodontal disease.
- **Trauma (acute or chronic):** Preservation of the tooth is allowed, providing it is not infected **and is usable for correct occlusion.**
- **Orthodontic indications.**
- **Other reasons not included in the previous sections:** Prosthetic, attrition, malposition, impaction or eruption problems.
- **Number of extractions per patient:** Quantitative discrete variable (single/multiple). Multiple considered as more than one tooth extracted in the same visit.

Independent variables

- **Age:** Quantitative continuous variable.
- **Sex:** Dichotomous categorical variable (**male/female**).
- **Tooth extracted:** Categorical variable with 32 categories, according to the International Dental Federation¹⁵.
- **Country of birth:** Dichotomous categorical variable (native / immigrant).
- **Total number of consultations (on demand) performed in a day:** Discrete quantitative variable.

Data collection

Patients in the study were diagnosed and treated by a single investigator (dentist) with extensive professional experience. He performed the examination, diagnosis, treatment and routine clinical practice, with help from a dental hygienist and dental student for treatment and registration. The dentist decided whether to perform the extraction of one or more permanent teeth, following the General Council of Dentistry and Oral Medicine in Spain criteria⁹, and specified the cause.

Analysis

The mean and standard deviation (SD) of the quantitative variables were calculated; and the frequencies and percentages calculated for the categorical variables. Student's t-test for independent samples was used to compare means.

The data were recorded and then analysed statistically using the SPSS 19.0 program.

Ethical aspects

Informed consent to be included in the study was requested from the patients, or the patient's mother, father or legal guardian in the case of minors. The confidentiality of patient data was guaranteed as no personally identifiable information needed to be recorded.

The study was approved by the Local Research Commission of the Eastern Care Management belonging to the Madrid Community AP management.

RESULTS

A total of 1,587 patients attended El Juncal USBD CS in the study period, at an average of 15.8 patients per day.

Of these patients treated at the USBD during the study period, 510 patients (32.1%) were indicated tooth extraction. Thus, tooth extraction was performed in nearly one in 3 users seen in the USBD.

The mean age of the patients who underwent one or more extractions was 46.78 years (SD 16.62). There were 248 (48.6%) males and 262 (51.4%) women; 419 (82.2%) of Spanish nationality and 91 immigrants (17.8%), with the most common country of origin being Romania (5.3%), followed by Morocco (3.9%) and Peru (1.4 %).

A total of 773 dental extractions were performed on 371 (48%) males and 402 patients (52%) women; 81.6% of the extractions were performed on the native population and 18.4% on immigrants. There were no statistically significant differences in the average number of extractions by sex or nationality. Figure 1 shows the distribution of tooth extractions by age group. No extraction was performed in the 6-13 year age group, while the group with the largest number of extractions (168, 21.73%) was the 60-69 years group. Multiple extractions were performed in 79 patients (15.5%). The total number of teeth extracted in multiple extractions was 258, representing an average of 3 teeth (SD 3) in each multiple extraction.

Caries was the cause in 63.9% of tooth extractions and periodontal disease in 17.6%, with a mixed cause in 5.6%. The other causes were trauma 1.3%, orthodontics 0.1% and for other reasons, comprising prosthetic, wisdom teeth, elongation, wounds and Impaction, in 11.5%. Extraction due to alteration of the eruption of wisdom teeth accounted for 6.7%,

which was the 3rd most common cause (Table 1).

The mean patient age per tooth extraction cause can be seen in Table 2; for caries this was 47.02 years (SD 17.25) and periodontal disease was 60.34 years (SD 12.5), which was a statistically significant difference ($p < 0.0001$).

The extraction cause per sex distribution can be seen in Table 3. Caries occurred in 70.88% of the total cases of men and 57.46% of women. Periodontal disease was the second most common cause in men, with 15.03% of tooth extractions and 19.4% in women.

The causes of tooth extraction per country of origin are shown in Table 4 and show no statistically significant differences between causes of tooth extractions in the immigrant population and in the native population. The most frequent cause was caries (70.4%) in the immigrant population followed by periodontal disease (16.9%).

Figure 2 shows the percentage of total extractions per tooth, while referring to the most frequent cause of extraction and the average age. The posterior section had a frequency higher than the anterior section (82.6% and 17.4%, respectively); while the average age of extraction was 46.66 years (SD 16.84), and tooth 18 the one removed most often (6.9%). Wisdom teeth were the type of tooth removed most often (23.6%), with the average age of extraction being 41.26 years (SD 14.15). The most common cause of tooth extraction in the posterior section was caries (66.24%) followed by periodontal disease (13.81%) and alteration of the eruption of wisdom teeth (8.16%). In the anterior section, the average age of extraction was 63.88 years (SD 10.16); the main cause was caries (52.94%) but there was a higher proportion due to periodontal disease (35.29%) as a cause of tooth extraction. The tooth removed the most due to periodontal disease was number 31 (80% removed due to periodontal disease), followed by numbers 41 (50%) and 21 (50%).

DISCUSSION

Knowledge of the causes of tooth extractions in the population is key to assessing both the implementation of corrective measures of prevention and promotion and as an indirect indicator of intermediate health outcomes to assess the impact of previous performances.

The prevalence of each, depending on the age of onset, sex and tooth affected, means different health strategies can be designed in the population served.

Most of the studies in the literature refer to services provided in mixed (public and private) health systems. The only study in our scope to be used as a reference, at the national level and provided in the public sector exclusively for people over 6 years old was the Cardona study¹⁰. There are other studies in the public health system, but only in the adult^{16,17} or male¹⁸ population.

During the 8-month study, the care load due to tooth extractions in the practice was over 40% of those services, taking into account the average extractions per day (6) and the time dedicated to daily consultation (180 minutes). Extractions were performed in 1 in every 3 of those appearing in consultation (32.1%), which has been declining in recent years (66-37%)^{1,2}, due mainly to cultural changes in the AP USBD, where the main objective of its service portfolio is the deployment of promotion and prevention measures.

Although no significant differences were found in the gender distribution of tooth extractions performed, it was higher in women (52%) than in men (48%), as was observed in the study conducted in Greece (Chrysanthakopoulos¹³) and contrary to that observed in the Cardona¹⁰ and Ainamo¹⁹ studies. Multiple extractions were similar across the sexes (15.72% in males and 15.26% in women), and the mean number of teeth extracted in each multiple extraction surgery was also similar (3.17 in men and 3.35 in women). These data support a greater demand for dental extraction in women in our population.



Figure 1. Distribution of extractions by age group

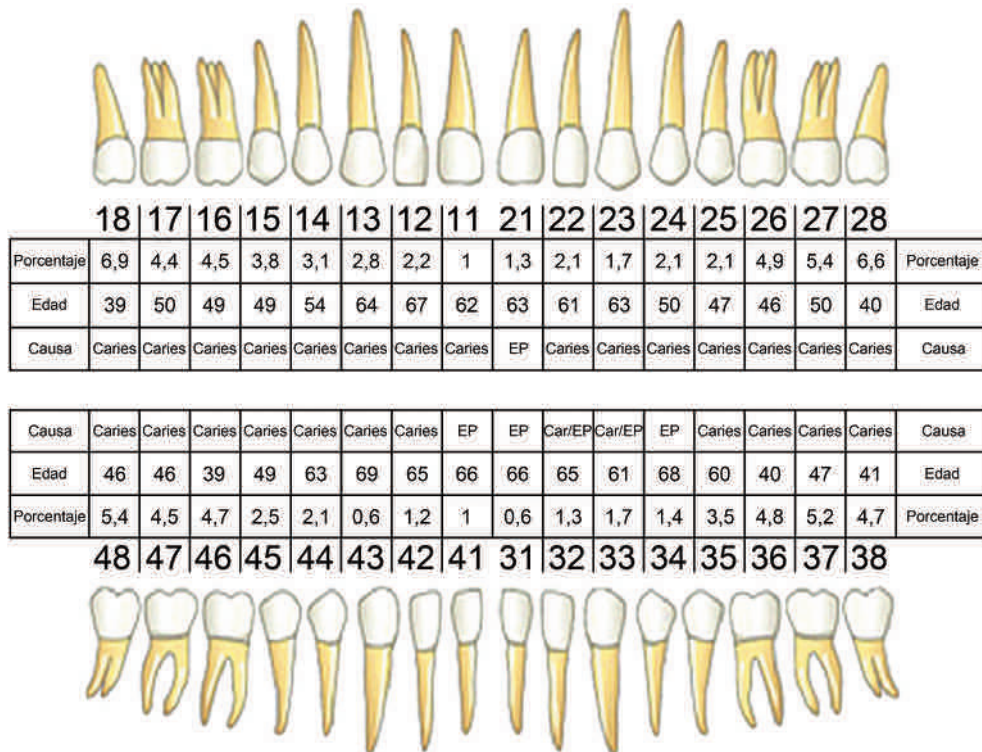


Figure 2. Tooth extraction frequency, average age and cause.

One relevant fact of this study was related to patient age, in that there is no record of extractions in the age range 6-13 years. The youngest recorded patient was 14 years old, which may be influenced by the prevention activities performed in our child population of 6-15 years as part of the service portfolio in

this AP USBD. The highest percentage of tooth extractions was performed in the 30-49 year group (41.2%); indicating the need to continue health education activities in this age bracket.

The main cause of tooth extraction was caries (Table 1), as was found in most studies analysed^{10-13,17,18,21}.

Table 1. Reasons for tooth removal

	Frequency	Percentage
Caries	494	63.9
Periodontal disease	136	17.6
Mixed	43	5.6
Trauma	10	1.3
Orthodontics	1	0.1
Prosthetic	29	3.8
Wisdom teeth	52	6.7
Elongation	3	0.4
Wounds	1	0.1
Impaction	4	0.5
Total	773	100

No study from 2000 was found with periodontal disease as the most common cause of tooth extraction.

Caries was the main cause of extraction in all age groups, especially the 40-49 age range, after which the frequency decreases due to the rise of periodontal disease in this age group^{20,21}, with the greatest impact after 58 years, due to a greater presence of systemic diseases and harmful habits, among others. This aspect also supports the mixed causes having a greater frequency between 50 and 59 years.

Trauma as a cause of tooth extraction appears in the elderly population from 50 years as a result of chronic trauma (e.g. attrition, abrasion and abfraction).

Within the group of "other causes" are those due to prosthetic reasons and alteration of the eruption of wisdom teeth. Prosthetic reasons for tooth extractions have a higher incidence in the 60-69 year group, perhaps due to increased prosthetic treat-

Table 2. Mean age for reasons of tooth extraction (in years)

Variables	Average age ± SD
Caries	47.02 ± 17.25
Periodontal disease	60.34 ± 12.50
Mixed	54.35 ± 11.16
Trauma	61.00 ± 15.11
Prosthetic	65.34 ± 12.75
Wisdom teeth	33.88 ± 9.40
Elongation	42.67 ± 2.30
Impaction	47.33 ± 23.46

ments in the elderly population and the need for specific oral care to help in chewing facilitate and promoting the patient aesthetics²². The average age for alteration of the eruption of wisdom teeth as a cause of tooth extraction was 32.53 years (SD 9.41) and the third most frequent cause of extraction after caries and periodontal disease. This is relevant in an AP USBD, as until recently it was a reason for referral to specific hospital maxillofacial surgery services for resolution.

One of the specific objectives in our study was to identify the teeth most often extracted. The data show that the upper third molars are most often extracted, with the upper right wisdom tooth being more frequent than the left (6.9% compared to 6.6%); and caries being the most frequent cause of extraction in each.

Analysis of the specific data related to each tooth (Figure 2) shows that tooth loss usually begins with the wisdom teeth (mean age 41.26 years), and progresses towards the midline as age increases. From the fifth decade of life (63.49 years), tooth extrac-

Table 3. Distribution of causes of tooth extraction by gender

	Male (%)	Female (%)	Total
Caries	263 (70.88)	231 (57.46)	494
Periodontal disease	58 (15.63)	78 (19.40)	136
Mixed	14 (3.77)	29 (7.21)	43
Trauma	6 (1.62)	4 (0.99)	10
Orthodontics	0 (0)	1 (0.24)	1
Other	30 (8.08)	59 (14.67)	89
Total	371	402	773

Table 4. Distribution of reasons by origin

	Nationality		Total
	Spanish (%)	Foreign (%)	
Caries	394 (62.44)	100 (70.42)	494
Periodontal disease	112 (17.75)	24 (16.90)	136
Mixed	38 (6.02)	5 (3.52)	43
Trauma	9 (1.43)	1 (0.7)	10
Orthodontics	1 (0.16)	0 (0)	1
Other	77 (12.20)	12 (8.45)	89
Total	631	142	773

tions are more frequent in the anterior group, and the most frequent cause is caries. However, periodontal disease has a greater relevance, especially in the lower central incisors and in the upper left central incisor. Once again, these data show the importance of oral hygiene, which is most difficult in the posterior section which manifests as tooth decay at younger ages. The ease of oral hygiene in the front group influences the delay of caries in these teeth, and therefore the indication for tooth extraction at older ages. As mentioned previously, the increased presence of periodontal disease in the anterior group at an advanced age is due to lifestyle habits (e.g. smoking and drinking alcohol), immune disorders due to age and systemic affectations (e.g. diabetes mellitus)²³.

CONCLUSIONS

Caries is the most common cause of tooth extraction in our study population, followed by periodontal disease and alteration of the eruption of wisdom teeth. This requires oral hygiene promotion to be maintained in the Health Centre, led by USBD professionals; and with greater emphasis on the female population, as the study showed extraction was more frequent in this group than the male.

The teeth extracted the most were upper third molars, which reflects the greater specificity in the work of the USBD; thus avoiding referrals to specialised care. This also facilitates the resolution of the clinical

process to the user and saving both the time lost in travelling to the hospital and delay in treatment.

The posterior teeth are affected at an earlier age leading to the consequent teeth loss and the need to provide ongoing oral health support in the young adult population. The involvement of dentists and dental hygienists in the Health Centre training plan for health professionals is key to promoting health education activities aimed at this group of users, who can also suffer chronic diseases that affect their oral health.

There was no difference in the causes of tooth extractions in the native and immigrant population, so the actions to be taken in both populations must be the same.

Promoting dental care service activities in children of 6-15 years in AP and the involvement of all CS professionals in maintaining oral hygiene activities in adults is essential to reducing the rate of extractions in daily USBD consultations and thus increasing the oral health and general health of patients. The results obtained in our study show the association between age and the reason for tooth extraction, with periodontal disease having more effect on tooth decay with increasing patient age.

Given the results of this study and its possible significance on the oral health of the population, the need to implement it in AP in the Madrid Community is clearly understood.



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