Primary Reason for Tooth Extraction in a Brazilian Adult Population

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Purpose: To identify the primary reasons for tooth extraction in a Brazilian adult population.

Materials and Methods: Interviews and oral examinations were conducted with 466 subjects aged from 18-76 years in the city of Maceió, Brazil. Frequency distributions, means and medians were calculated and the chi-square test was used to determine the level of significance. A logistic regression model was used to evaluate the variables associated with reasons for tooth extraction.

Results: Of the 466 extractions, 295 (63.3%) were due to dental caries, 61 (13.1%) due to periodontal disease, 56 (12.0%) for orthodontic reasons, 32 (6.9%) at the patient's request, 15 (3.2%) for pre-prosthetic reasons, four (0.9%) due to pericoronitis, two (0.4%) due to trauma and one (0.2%) for other reasons. Tooth extraction due to caries and other causes (excluding periodontal disease) shows a significant association with family income, toothache, type of health centre (public or private), educational level ($P < 0.001$) and marital status ($P = 0.002$). The logistic regression model has shown that patients undergoing treatment at a public health centre, those suffering from toothache or with an incomplete secondary education were more likely to lose their teeth due to caries, with educational level as the strongest indicator. For tooth extraction due to periodontal disease and other causes (excluding dental caries) the variables age, family income, type of health centre, tooth types (anterior or posterior), educational level ($P < 0.001$) and toothache ($P = 0.006$) were statistically significant, and age was the only associated variable in the logistic regression model.

Conclusion: Dental caries was the main cause of tooth extraction in the study group, following tooth extraction due to periodontal disease.

Key words: tooth extraction, adults, dental caries

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In Brazil tooth loss is a serious public health problem. In 1986 (the last year for which figures are available) the percentage of adults aged from 35-44 years with total tooth loss was 15.9%. Tooth loss is affected by a number of factors including irregular attendance at the dentist's, ineffectiveness of dental services, age, household income, anxiety, the function and strategic importance of tooth status and domestic conditions. There is copious evidence that there are wide variations in toothlessness, reflecting differences in socioeconomic status, in adults, in all societies (Caldas et al, 2000).

In Brazil a number of research studies have been performed to determine the reasons for tooth loss (Caldas et al, 2000; Gubeissi et al, 1995 Guimaraes and Marcos, 1995; Jovino-Silveira et al, 2002; Leite et al, 1975; Machado et al, 1973), all of which have shown tooth decay to be the major reason for

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tooth extraction. Periodontal disease is not prevalent in the Brazilian population, but few studies have been carried out to determine the prevalence of periodontal diseases in Brazil. In the population aged 50-59 years, 72% of urban dwellers were edentulous in one arch; since periodontal diseases are particularly common in the sixth decade of life, the condition cannot be detected in these patients.

In several countries studies have been carried out on the reasons for tooth loss, some of which have shown dental caries to be the main reason (Chestnutt et al, 2000; Hull et al, 1997; Jovino-Silveira et al, 2002; Mccaul et al, 2001; Morita et al, 1994; Niessen and Weyant,1989; Pizarro et al, 1997; Taani, 2003; Trovik et al, 2000) while other studies, some of them from the same countries as the ones referred to above, have shown periodontal diseases to be more prevalent (Haddad et al, 1999; Murray et al, 1996; Odusanya, 1987, Phipps and Stevens, 1995). It is therefore not possible to state that any one reason is predominant in all countries. There is no doubt that caries and periodontal disease are the major reasons for tooth extraction, but it is necessary to undertand the reasons for tooth loss, because it is a culmination of a variety of factors (Caldas et al,2000). There are many reasons for tooth extraction, among which are toothache (Hiidenkari et al, 1996), tooth decay (Klock and Haugejorden, 1991; Stephens et al, 1991), periodontal diseases (Murray et al, 1996; Stephens et al, 1991), pulpitis and apical periodontitis (Eckerbom et al, 1992), tooth mobility (Hiidenkari et al, 1996), orthodontic treatment (Cahen et al, 1985), prosthetic treatment (Hiidenkari et al, 1996), trauma (Reich and Hiller, 1993) and tooth impaction (Angelillo et al, 1996).

The purposes of this study were to identify the primary reasons for tooth extraction in a Brazilian adult population and to verify whether there is a relationship between the reason for tooth extraction and family income, gender, educational level, tooth type (anterior or posterior), toothache, type of health centre (private or public), marital status and age.

MATERIALS AND METHODS

A cross-sectional study was conducted in 2003 to identify the primary reason for tooth extraction in the city of Maceió, the state capital of Alagoas, northeast Brazil, with an estimated population of 797,759, mainly from a poor socioeconomic background. The size of the sample was calculated to attain accuracy when estimating the prevalence of reasons for extraction and to achieve statistical power for testing the associations. The 95% confidence level and a prevalence of tooth loss of 50% due to tooth decay were used for calculating the size of the sample in order to maximize the evaluated sample, and a correction factor of 1.2 was applied for greater accuracy. As a result, a total of 461 patients was estimated to be the minimum sample size for satisfying the requirements of the study.

In the city of Maceió there are 45 health centres belonging to the municipality and 22 run by private health insurance companies. A probabilistic sample in accordance with the number of public and private health centres was thus obtained. Thirty public and seven private health centres were randomly selected to take part in the study. All the health centres received letters informing them of the proposed survey. To take part in the study the patients had to be over 18 years of age and to have at least one tooth to be extracted. A total of 466 subjects over 18 years of age were invited to participate, informed consent being obtained from each participant. All those agreeing to participate had sought treatment on their own initiative and were examined. Once the minimum predicted number had been reached, it was decided not to conduct any further examinations. The clinical reason for tooth loss was assessed on the basis of the criteria proposed by Kay and Blinkhorn (1986), using a flat front-surface mouth mirror and a blunt probe. An interview was carried out to collect data on family income, gender, educational level, tooth type (anterior or posterior), toothache, type of health centre, marital status and age.

The Statistical Package of Social Sciences (SPSS) version 11.0 was used for determining frequency distributions, means and medians and the chi-square test for calculating the level of significance. The reasons for extraction were compared in relation to the variables sex, age, educational level, family income, tooth type, toothache, marital status and type of health centre. A logistic regression model was used to evaluate the variables associated with reasons for tooth extraction, considering tooth extraction due to caries and other causes (excluding extraction resulting from periodontal disease) and tooth extraction due to periodontal disease and other causes (excluding extraction as a result of caries). The significance level was set at 5%. Multivariate analyses were used to identify predictors of reasons for tooth

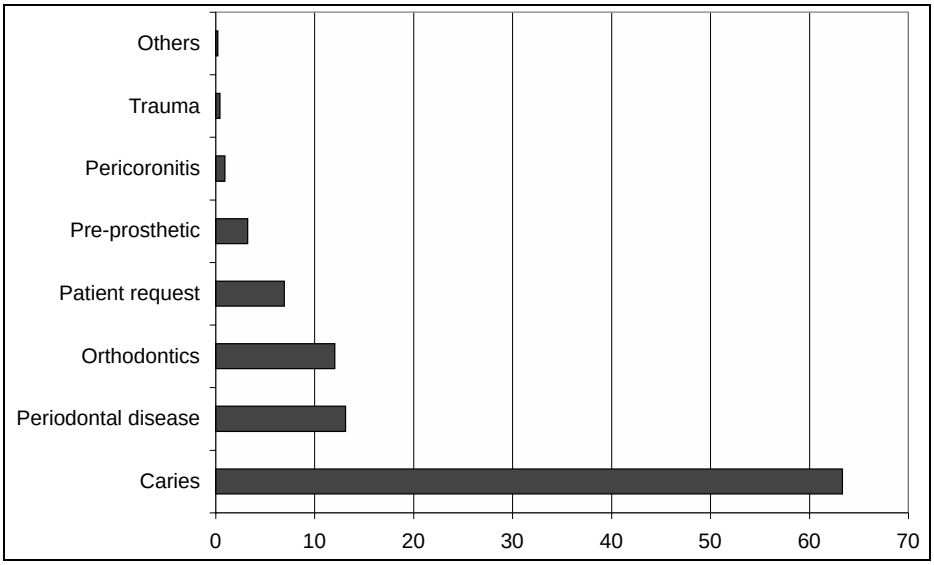

Fig 1 Distribution of reasons for tooth extractions in a sample of 466 Brazilian adults.

extraction. The variables in the bivariate analyses that presented statistical significance of up to 20% ($P < 0.20$) were included in a model of logistic regression, using a backward stepwise technique based on the Wald chi-square statistic.

RESULTS

All the centres and patients agreed to participate in the study. The sample comprised 252 (54.1%) women and 214 (45.9%) men, with those aged from 18-39 years representing 70.6% of the total sample. Most of the patients (79.2%) had not completed their secondary school education and 82.6% had a family income no greater than four times the minimum wage (approximately US$ 72).

Toothache was present in 295 (63.3%) patients, and the vast majority of extractions (77.3%) were posterior teeth. Of the 466 extractions, 63.3% were performed because of caries and its sequelae; 13.1% because of periodontal disease; 12.0% for orthodontic reasons; 6.9% at the patient's request; 3.2% for pre-prosthetic reasons; 0.9% due to pericoronitis; 0.4% due to trauma and 0.2% for other reasons (Fig 1).

Tooth loss due to caries was more frequent in males (65.0%) than in females (61.9%), but the difference was not statistically significant ($P = 0.612$). Patients aged 18-39 years showed a greater proportion of loss due to caries (71.4%) compared with subjects over 40 years old (43.8%), which was a statistically significant relationship ($P < 0.001$). The highest proportion of tooth loss due to caries was observed among the subjects with an incomplete secondary education (70.8%), followed by illiterate individuals (55.3%) and those who had completed their secondary education, with or without some degree of higher education (42.3%), a relationship also shown to be statistically significant ($P < 0.001$). With regard to family income, a greater rate of tooth loss due to caries was found in those with incomes up to four times the minimum monthly wage (approximately US$ 288.00) compared to those with incomes higher than that (66.8% and 46.9%, respectively), again with statistical significance ($P < 0.001$). Both posterior and anterior teeth were lost due to caries, but the former (65.8%) showed more losses than the latter (54.7%), a difference that was statistically significant ($P < 0.001$). Toothache showed a significant relationship with reason for tooth loss, the subjects with toothache (70.2%) having lost more teeth due to caries than those without it (51.5%), which was statistically significant ($P < 0.001$). Marital status was related to reason for tooth extraction, married or cohabiting subjects (68.6%) showing more losses due to caries those who were single, widowed or separated (57.6%), a statistically significant difference ($P = 0.008$). In relation to the type of health centre, the teeth extracted at the public centres showed far more tooth losses due to caries (70.0%) than those extracted at centres belonging to private health insurance companies (49.7%), and this relationship was statistically significant ($P < 0.001$). The results are presented in Table 1.

Table 1 Reasons for tooth extraction by gender, age, educational level, family income, tooth type, toothache, marital status and nature of dental office in a sample of 466 Brazilian adults

Variable	Reason for extraction			P value*	Total
	Caries n (%)	Periodontitis n (%)	Others** n (%)		n(%)
Sex					
Male	139 (65.0)	29 (13.6)	46 (21.5)	0.612	214 (45.9)
Female	156 (61.9)	32 (12.7)	64 (25.4)		252 (54.1)
Age					
18–39	235 (71.4)	5 (1.5)	89 (27.1)	< 0.001	329 (70.6)
40–76	60 (43.8)	56 (40.9)	21 (15.3)		137 (29.4)
Educational level					
Illiterate	26 (55.3)	14 (29.8)	7 (14.9)	< 0.001	47 (10.1)
Incomplete secondary education	228 (70.8)	44 (13.7)	50 (15.5)		322 (69.1)
Completed secondary education or higher	41 (42.3)	3 (3.1)	53 (54.6)		97 (20.8)
Family income					
Up to 4x minimum wage	257 (66.8)	55 (14.3)	73 (19.0)	< 0.001	385 (82.6)
More than 4x minimum wage	38 (46.9)	6 (7.4)	37 (45.7)		81 (17.4)
Toothache					
No	88 (51.5)	21 (12.3)	62 (36.3)	< 0.001	171 (36.7)
Yes	207 (70.2)	40 (13.6)	48 (16.3)		295 (63.3)
Nature of dental office					
Private	76 (49.7)	12 (7.8)	65 (42.5)	< 0.001	153 (32.8)
Public	219 (70.0)	49 (15.7)	45 (14.4)		313 (67.8)
Tooth type					
Anterior	58 (54.7)	28 (26.4)	20 (18.9)	< 0.001	106 (22.7)
Posterior	237 (65.8)	33 (9.2)	90 (25.0)		360 (77.3)
Marital status					
Single/widowed/separated	129 (57.6)	28 (12.5)	67 (29.9)	0.008	224 (48.1)
Married/cohabiting	166 (68.6)	33 (13.6)	43 (17.8)		242 (51.9)

* P value for chi-square test of significance
** Other reasons – orthodontics, pre-prosthetics, trauma, pericoronitis, patient request and others.

Regression analyses

The final logistic regression model identified the variables associated with tooth loss due to caries, namely type of health centre (P = 0.043), odds ratio 0.54 (95% CI = 0.30, 0.98), toothache (P = 0.008), odds ratio 0.51 (95% CI = 0.31, 0.84) and educational level, divided into the categories illiteracy (P = 0.050), odds ratio 2.82 (95% CI = 1.00, 7.02), incomplete secondary education (P < 0.001), odds ratio 3.20 (95% CI = 1.71, 6.00), and a complete secondary or some degree of higher education. Level of education was the best predictor of tooth loss due to caries (Table 2). For tooth loss due to periodontal disease the regression logistic model identified only one predictor, namely age (P < 0.001), which was significantly associated with tooth extraction resulting from periodontal diseases, odds ratio 0.02 (95% CI = 0.01, 0.07) (Table 3).

DISCUSSION

Dental caries was the most important reason for extractions in the sample of 466 Brazilian adults, which confirms that caries remains a problem in adulthood. This finding is in agreement with many research studies on the reasons for tooth loss (Angelillo et al, 1996; Cahen et al, 1985; Caldas et al, 2000; Chestnutt et al, 2000; Gubeissi et al, 1995; Guimaraes and Marcos, 1995; Haddad et al, 1999; Hull et al, 1997; Kay and Blinkhorn,

Table 2 Logistic regression for tooth extraction due to caries and other causes (excluding extraction resulting from periodontal disease)

Variables included	Variables selected	Parameter estimates	P value	OR and CI of 95,0%
• Nature of dental office	Constant	0.91	0.014 *	
– Private				
– Public	• Nature of dental office			
	– Private	– 0.61	0.043*	0.54 (0.30–0.98)
• Family income	– Public			
– Up to 4x the minimum wage				
– More than 4x the minimum wage				
	• Toothache			
• Toothache	– No	– 0.68	0.008*	0.51 (0.31–0.84)
– No	– Yes			
– Yes				
	• Educational level		< 0.001*	
• Educational level	– Illiterate	1.03	0.050	2.82 (1.00–7.92)
– Illiterate	– < Secondary level	1.16	< 0.001*	3.20 (1.71–6.00)
– Incomplete secondary education	– Secondary level or more			
– Complete secondary education or higher				
	• Marital status			
• Marital status	– Unmarried/widowed/separated	– 0.39	0.120	0.68 (0.41–1.11)
– Single/widowed/separated	– Married/cohabiting			
– Married/cohabiting				

(*) – Significance of parameter set at 5.0%

1986; Klocks and Haugejorden, 1991; Leite et al, 1975; Machado et al, 1973; Morita et al, 1994; Pizarro et al, 1997; Stephens et al, 1991; Taani, 2003; Trovik et al, 2000). In the present study periodontal disease was the next most frequent reason, a few studies having shown it to be the main reason (Bouma et al, 1985; Haddad et al, 1999; Murray et al, 1996; Odusanya, 1987; Phipps and Stevens, 1995). In previous studies carried out in Brazil periodontal disease has presented a low prevalence (Caldas et al, 2000; Gubeissi et al, 1995; Guimaraes and Marcos, 1995; Jovino-Silveira, 2002; Leite et al, 1975; Machado et al, 1973), corroborating the findings of this study. The methodology for classifying extractions used in the present study has been used in others (Caldas et al, 2000; Chestnutt et al, 2000; Hull et al, 1997; Jovino-Silveira, 2002; Mccaul et al, 2001; Murray et al, 1996), so the results are comparable. Dental caries was the most prevalent reason for tooth loss in all the studies with the exception of the Ontario study (Murray et al, 1996), in which periodontal disease was the prime cause.

There were proportionately more extractions for caries in males than in females, a finding in agreement with other studies[4,14,18,27], but this difference was not statistically significant. A significantly greater number of teeth extracted for dental caries occurred in subjects aged between 18 and 39 years, while only 1.5% in this age group had tooth loss due to periodontal disease. However, in the subjects aged between 40 and 76 years dental caries remained percentually more prevalent, which is at variance with the findings of many studies (Guimaraes and Marcos, 1995; Kay and Blinkhorn, 1986; Murray et al, 1996; Odusanya, 1987; Taani, 2003; Vignarajah, 1993). In this population the patient's age significantly influenced the reason for tooth extraction.

The patient's educational level influenced the reason for tooth loss. Subjects with a complete secondary education with or without some degree of higher education had more tooth losses due to caries than those with an incomplete secondary education and illiterate persons. This relationship was statistically significant, agreeing with other studies in which tooth loss was associated with a

Table 3 Logistic regression for tooth extraction due to periodontal disease and other causes (excluding extraction as a result of caries)

Variables included	Variables selected	Parameter estimates	P value	OR and CI of 95,0%
• Age 18–39 40–76	Constant	0.23	0.696	
	• Age 18–39 40–76	– 3.73	< 0.001*	0.02 (0.01–0.07)
• Nature of dental office – Private – Public				
	• Family income – Up to 4x the minimum wage – More than 4x the minimum wage	0.87	0.156	2.39 (0.72–7.95)
• Family income – Up to 4x the minimum wage – More than 4x the minimum wage				
• Toothache – No – Yes				
• Tooth type Anterior Posterior				

low level of education[4,10,25]. Family income showed a statistically significant relationship with reason for tooth loss: subjects earning up to four times the minimum monthly wage had more tooth losses due to caries than those in higher income brackets, a finding in agreement with findings from the city of Recife, Brazil (Caldas et al, 2000).

Analysis by tooth type showed that both the posterior and anterior teeth were extracted due to caries, but the former showed a slightly higher rate of tooth loss due this condition. The anterior teeth were, proportionally, more frequently extracted as a result of periodontal disease. Statistical significance was seen between reason for tooth loss and tooth type. This finding is at variance with previous ones that showed periodontal disease to be the principal cause of tooth loss in anterior teeth (Cahen et al, 1985; Caldas et al, 2000; Morita et al, 1994; Odusanya, 1987; Taani, 2003). In the present study the anterior teeth were most frequently extracted due to dental caries, a result also found in one of the Scottish studies (Mccaul et al, 2001).

Pain is an intervening factor in the reason for tooth loss, so many patients gave it as the most frequent cause of tooth extraction (Odunsanya, 1987; Reich and Hiller, 1993), and it is possible that dentists assigned teeth extracted at the patient's request to a specific pathology (Kay and Blinkhorn, 1986). In this study a history of oral pain showed a statistical correlation with reason for tooth loss, patients with this symptom having a higher rate of teeth extracted due to dental caries. Married or cohabiting subjects had more losses due to caries, and this relationship was statistically significant. At the public health centres more tooth loss was observed due to caries than in the private sector. The patients treated in the public health service do not have the same access to restorative and preventive treatment as those using a private health clinic.

Studies on tooth loss have generally considered only one or very few factors associated with missing teeth. Most of these studies have used a bivariate association of each risk indicator with missing teeth, but in this study several risk indicators of tooth loss were considered. The logistic regression model showed educational level to be the best predictor of tooth loss due to dental caries and age that of tooth loss due to periodontal disease. In previous studies the data has been collected retrospectively, mainly by mailed questionnaires or direct from the patient record cards, but in this study the researcher (RC) evaluated the reason for

tooth loss on the spot, by means of a clinical examination of all the patients before tooth extraction. Research on the criteria used by dentists for tooth extractions would help separate disease-specific risk factors from professional treatment decisions.

This study confirmed that dental caries was the primary reason for tooth loss in a Brazilian adult population in the city of Maceió, and many associated factors were found. The best predictors of tooth loss due to dental caries and periodontal disease were, respectively, level of education and age. There is a need to analyze the reasons for the statistics of tooth extraction and to verify its cause. The retention of a complete set of teeth throughout life should be the ideal of both dental surgeons in general and all professionals working in the public health services.

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