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The impact of restorative treatment on tooth loss prevention

Impacto do tratamento restaurador na prevenção da perda de dentes

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ABSTRACT: A cross-sectional study was carried out to analyze tooth loss resulting from caries in relation to the number of times the extracted tooth had been restored, the type of caries diagnosed (primary or secondary), and socioeconomic indicators of patients from the city of Recife, Brazil. Ten public health centres and ten centres associated with health insurance companies were randomly selected. The size of the sample was calculated using a standard error of 2.5%. A confidence interval of 95% and a 50% prevalence of reasons for extractions were used for calculating the sample. The minimum size of the sample for meeting these requirements was 381 patients. Patients were randomly selected from the list of adults registered at each centre. A total of 410 patients were invited to take part in the study. The response rate was 100%, but 6 patients were excluded due to incompleteness of data in the questionnaire applied. An assessment was made to obtain the number of decayed, missing or filled teeth (DMFT index) and the reasons for extraction. The results showed a highly significant ($p < 0.001$) relationship between the number of times the tooth indicated for extraction had been restored and the reason for extraction being caries. Furthermore, the majority of teeth extracted due to caries had been restored two or more times. A highly statistically significant association was also observed between one indicator of use of dental services (F/DMFT) and extraction due to caries ($p < 0.001$). The findings questioned the belief that tooth loss can be prevented in the general population by merely providing restorative treatment.

DESCRIPTORS: Dental caries; Dental health services; Tooth loss; Socioeconomic factors; Dental restoration failure.

RESUMO: Um estudo transversal foi conduzido com o objetivo de analisar a perda dentária, pela razão cárie, em relação ao número de vezes que o dente extraído foi restaurado, tipo de cárie diagnosticada (primária ou secundária) e indicadores socioeconômicos de pacientes na cidade de Recife, Brasil. Dez centros do Sistema Público de Saúde e dez pertencentes a empresas de convênios foram sorteados. O tamanho da amostra foi calculado utilizando-se um erro padrão de 2.5%. O intervalo de confiança de 95% e uma prevalência de razões de extração na ordem de 50% foram usados para o cálculo da amostra. Uma amostra mínima requerida de 381 pacientes foi calculada, sendo examinados um total de 410 pacientes sorteados da lista de atendimento dos postos. 100% dos pacientes concordaram em participar da pesquisa, contudo, seis pacientes foram excluídos do estudo por apresentarem dados incompletos no questionário aplicado. Os pacientes foram examinados para a obtenção do CPOD e da razão das extrações. Cárie foi a principal razão para exodontia ($p < 0,001$). Analisando-se a relação entre o número de vezes que o dente foi restaurado e a razão da exodontia, observou-se um valor altamente significativo ($p < 0,001$), indicando que a maioria dos dentes extraídos pela razão cárie foram restaurados duas ou mais vezes. Foi observada uma relação altamente significativa estatisticamente entre um indicador de uso de serviços (O/CPOD) e exodontia devido a cárie ($p < 0,001$). Os achados demonstraram que é errônea a crença de que a perda dentária pode ser prevenida na população simplesmente pela restauração do dente.

DESCRITORES: Cárie dentária; Serviços de saúde bucal; Perda de dente; Fatores socioeconômicos; Falha de restauração dentária.

INTRODUCTION

Tooth loss in Brazil and in the world as a whole continues to be a major public health problem. An epidemiological survey[2] carried out in 1986 showed that 15.9% of adults aged between 35 and 44 years had lost all their teeth. A review of the literature[3] revealed that, among the 24 articles on the subject published from 1980 to 1999, 20 reported that caries had been the main reason for extraction. Findings from the aforementioned study confirmed that caries disease was the most frequent reason for the extractions performed at all ages, which suggests that it is a big problem

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among the Brazilian population studied[3]. It remains to be ascertained whether tooth loss is the result of a lack of access to an effective dental health services or to the excessive use of services that cannot treat effectively the population.

In the United Kingdom[5] there was a small, albeit acceptable, amount of unnecessary dental treatment and at the same time it pointed out that a large proportion of dentists adopted an out-of-date philosophy of treatment. Likewise in Brazil, in the city of Recife[19], unsuitable restorative treatments with an imprecise diagnosis and an inappropriate restorative technique have probably increased the repetitive cycle of restorations over the past 50 years. This fact may possibly be explained by the difficulty in diagnosing such lesions, especially since it is linked to factors related to both patients and professionals. The factors related to the professionals, for instance, can be mentioned as the use or non-use of radiographs for complementing the diagnosis, the site of the carious lesion and criteria established in formulating the diagnosis[10,11,16,17]. These factors also influence the decision as to whether to replace the restoration presenting a secondary carious lesion. They are of a subjective nature and related to the dentist's interpretation of the condition of the restoration, professional skills, the condition of the tooth and the criterion used to define the defect[1,7].

Thus, the main purpose of the present study was to analyze tooth loss due to caries in relation to the number of times the extracted tooth had been restored.

MATERIAL AND METHODS

A cross-sectional study was carried out in the city of Recife, state of Pernambuco, Brazil. The size of the sample was calculated using a standard error of 2.5%. A confidence interval of 95% and a 50% prevalence of reasons for extractions were used for calculating the sample[12]. The minimum size of the sample for meeting these requirements was 381 patients. In view of the fact that the present study was also intended to test the null hypothesis that extraction due to caries and the restoration of the extracted tooth were not associated, the power at the test was calculated. The above sample size made it possible to identify, with a test power of 80%, a 15% difference of magnitude between extractions due to caries and those performed for other reasons as statistically significant at 5%.

A list of all health centres was obtained from the Oral Health Division of Recife City Council for the random selection of ten centres to be used in the study. In addition, with the aim of obtaining a population with a higher family income, a further random selection was made of the same number of health centres belonging to health insurance companies and consequently used by persons who do not rely on the government-funded SUS (Sistema Único de Saúde) health system. In each group ten centres were randomly selected as reserves in the event of the initially chosen centre being unable to take part in the study. All the centres were sent a letter explaining the purpose of the study and requesting permission for carrying out the survey.

A randomization table was employed for selecting the patients on the list of new patients seen at each centre on specific days, also randomly chosen. The patient's written consent was obtained after the appropriate explanations on the aim and methodology of the study. Moreover, the Ethical Committee of the University of Pernambuco approved the project of this research. A total of 410 patients aged over 18 years were invited to take part in the study. Only patients who fell into the following two socioeconomic categories were admitted to the study: the group whose family income was no more than the equivalent of five times the minimum wage (those attending the city council's health centres) and the group whose family income was more than five but no more than ten times the minimum wage (those using the clinics of the health insurance companies). At the time of the study the minimum wage was 151 Brazilian reals.

All patients seen by the dentists of the clinics and that needed tooth extractions were examined by the researcher prior to surgery. An assessment was made of the index of the patients' decayed, filled and missing teeth (DMFT) and the reasons for the extraction. The World Health Organization (WHO[18], 1997) criterion was used to determine the DMFT. A plane front-surface mouth mirror and blunt probe were employed in the examination of the patients. Implants were recorded as missing teeth. The criteria to justify extraction proposed by Kay, Blinkhorn[9] (1986) were adopted (caries, periodontal disease, pre-prosthetic reasons, orthodontic reasons, trauma, removal of third molars, the patient's wish and other reasons). The present study also classified the carious lesions as primary, secondary (restored tooth with carious le-

sion adjacent to the restoration) and those with pulpal involvement.

Whenever there was an association of two or more reasons for the extraction, it was classified under "other reasons". A questionnaire was prepared to collect the patients' personal particulars, namely age, gender, educational level, place of residence, occupation, family income in relation to the minimum wage and the number of times the tooth had been restored.

The SPSS (Statistical Program for Social Science, SPSS® Inc., Chicago, IL, USA) was used to calculate the frequency distributions and means for the bivariate analysis. The chi-squared and Mann-Whitney tests were used in calculating the level of statistical significance of the associations tested, since the data did not show a normal distribution.

The sample consisted of 404 patients, of whom 52.7% were females and 47.3% males. Most of the participants (82.4%) were between 18 and 39 years of age. The sample presented a high percentage of individuals (82.9%) who had not completed their secondary education.

Practically all (93.1%) the patients had only one extracted tooth. For this reason the results were analyzed on the basis of the reason for the first extraction. Of the 404 extractions, 70.3% were due to caries and its sequelae, 15.1% to periodontal disease, 6.4% performed for pre-prosthetic reasons, 3.7% were third molars, 2.5% performed for orthodontic reasons, 1% as a result of trauma and the remaining 1% because of the patient's wish.

RESULTS

All those in charge of the health centres, as well as the dentists and patients, allowed the study to be carried out. Six patients were excluded from the data analysis as they failed to answer all the items on the questionnaire.

Caries was the main reason for extraction at all ages, irrespective of the patient's gender or socioeconomic situation (Table 1), and the difference between caries and other reasons for extraction was statistically significant ($p < 0.001$).

Table 1 shows the number of patients who had had teeth extractions due to caries according to age, sex, income and level of education. A statistically significant difference was observed for different ages ($p = 0.002$) and levels of education ($p < 0.001$).

Table 2 shows the frequency distribution of the number of times that extracted teeth had been restored according to the type of caries presented (primary or secondary). An analysis of the 284 patients who had had tooth extractions due to caries revealed that 77.8% of those teeth had already undergone restorations. Only 63 teeth (22.2%) presented primary caries lesions and were therefore extracted without having received any kind of restorative treatment. In addition, of the 221 patients presenting secondary caries as the reason for extraction, 158 (71.5%) had had their tooth restored at least twice.

The analysis of the association between tooth extracted due to caries and the number of times

TABLE 1 - Frequency distribution of tooth extraction due to caries and other reasons by age, sex, income and level of education in a sample of 404 residents in the city of Recife.

Variables		Base	Extractions due to caries		Extractions for other reasons		Level of significance
			n	%	n	%	(p value)
Age	Up to 39 years	333	245	73.6	88	26.4	(p = 0.002)
	40 and over	71	39	55	32	45	
Sex	Male	190	130	68.4	60	31.6	(p = 0.252)
	Female	214	154	72	60	28	
Income (m. s.)	Up to 5	208	149	71.6	59	28.4	(p = 0.619)
	Over 5	196	135	68.9	61	31.1	
Education	< secondary level	335	249	74.3	86	25.7	(p = 0.000)
	> secondary level	69	35	50.7	34	49.3	

m. s. = minimum salary.

TABLE 2 - Frequency distribution of the number of times that extracted teeth had been restored according to the type of caries (primary or secondary) in a sample of 404 adults resident in the city of Recife.

No. of restorations	No. of teeth		With pulpal involvement		Without pulpal involvement	
	n	%	n	%	n	%
None (primary caries)	63	22.2	5	1.8	58	20.4
One (secondary caries)	63	22.2	35	12.3	28	9.9
Two or more (secondary caries)	158	55.6	68	23.9	90	31.7
	($p < 0.001$)					
Total	284	100	108	38.0	176	62.0

TABLE 3 - Relationship between the number of times that the teeth had been restored and the reason of extraction.

Reason for extraction	n	Mean rank	Level of significance
Caries	284	189.57	$p = 0.001$
Other reasons	120	233.11	

the tooth had been restored (Table 2) showed that the difference observed was statistically highly significant ($p < 0.001$), thereby confirming that most teeth extracted due to caries had been restored at least once. A highly significant association (Table 3) was also found between an indicator of the use of services (proportion of filled teeth in relation to the total value of the DMFT index) and extraction due to caries ($p = 0.001$). This association showed that the patients who had teeth extracted due to dental caries presented a larger number of restorations in comparison with those whose teeth had been extracted for other reasons, which indicates that the former used the dental services more than the latter (Table 3).

DISCUSSION

In order to achieve the purpose of the present study, the authors interviewed the patients with the aim of ascertaining the number of times the tooth to be extracted had been restored. This step, in principle, could generate a memory bias. However, at medical facilities where no data are available in the form of filed records, as in the case of the public health posts in Recife, the patient is the only source of information. According to Haugejorden, Nielsen[8] (1987), data concerning the type of treatment received by the patient may be obtained by directly questioning the patient when there are no records on file at the health facility. The authors also emphasize that the direct questioning of the patients constitutes the best source of information concerning the frequency of treatments such as extractions, number of restorations, fixed prostheses, crowns or total prostheses.

It was observed that the majority (77.8%) of the teeth extracted due to caries had been restored, which suggests that opting for restorative dentistry may not guarantee the preservation of the tooth. Moreover, a statistically significant association was found between extraction due to caries and a larger proportion of filled teeth in relation to the total value of the DMFT index, thereby confirming that the patients whose teeth had been extracted due to caries made greater use of the dental services.

These findings may reflect the cumulative effect of defects in the restorations or their current life span as a cause of tooth loss at more advanced ages, as suggested by a number of authors in similar studies[4,9,13]. The study of Elderton[5] (1993), based on the data of dental services in the United Kingdom, showed that restorative dentistry, on the whole, suffers from a number of characteristic shortcomings.

The repetitive cycle of restorations[6] becomes apparent when one observes in Table 2 that most teeth extracted due to caries had already been restored two or more times (55.6%), compared with the 22.2% that had been restored only once and the 22.2% that had never been restored.

A number of studies in Brazil and other countries have conclusively shown that patients are submitted to too many restorative treatments[6,14,15,19]. In private dental clinics in Recife there is strong evidence that teeth are restored for reasons unrelated to the health of the patient[19].

CONCLUSIONS

The findings of the present study should be interpreted with caution. The population studied is not necessarily representative of the Brazilian population and variations in the quality and philosophy of treatment among dentists are frequently reported in the literature. Nevertheless, the findings of this study are of great importance because they call into question the belief that dental caries can be effectively treated in the general population by simply restoring the tooth and that such treatment would prevent tooth loss and automatically promote the population's oral health. A change in philosophy is urgent in which emphasis is laid on the prevention of the appearance and progression of the disease rather than invasive restorative treatment. It is also important to question the belief that tooth loss among the Brazilian population is due to a lack of access to dental health services.

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