Prevalence of Abutment Teeth for Conventional Fixed Prostheses in a Brazilian Subpopulation

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ABSTRACT

The purpose of this cross-sectional study was to evaluate the prevalence of abutment teeth for conventional fixed prostheses in a Brazilian subpopulation. Panoramic radiographs for a total of 1,401 patients taken from August 2002 to September 2007 were randomly selected from the database of the Radiological Center of Orofacial Images of Cuiabá (Cuiabá, Brazil). A total of 1,401 radiographs were examined to determine the frequency of abutment teeth for conventional fixed prostheses. Data concerning age, sex, and dental group were recorded. Frequency distribution and the chi-square test were used for statistical analysis. The level of significance was set at $\alpha = 5\%$. Of the 29,467 teeth included in the evaluation, 4,967 (16.8%) were abutments for conventional fixed prostheses. A high prevalence of abutment teeth for conventional fixed prostheses was observed in individuals aged between 46 and 60 years (49.9%). Maxillary canines and second premolars were the teeth most often involved in rehabilitation (10.5% and 10.3%). Missing teeth were identified in 24.8% of the sample. The prevalence of abutment teeth for conventional fixed prostheses was 16.8%, and the teeth most frequently used were maxillary canines and maxillary second premolars.

Keywords: Fixed partial denture, epidemiology, prevalence, dental prosthesis.

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Prevalência de Dentes Pilares de Prótese Fixa Convencional em Subpopulação Brasileira

RESUMO

O objetivo deste estudo transversal foi avaliar a prevalência de dentes pilares de próteses fixas convencionais em uma subpopulação brasileira. Radiografias panorâmicas de um total de 1.401 pacientes, realizadas entre agosto de 2002 e setembro de 2007, foram aleatoriamente selecionadas do banco de dados do Centro de Radiologia e Imagens Orofaciais de Cuiabá (Cuiabá, MT, Brasil). Um total de 1.401 imagens radiográficas foram examinadas para a determinação da prevalência de dentes pilares de prótese fixa convencional. Dados referentes a idade, gênero e grupo dentário foram coletados e tabulados. O tratamento estatístico analisou os dados frente à distribuição de frequência e o teste qui-quadrado. O nível de significância foi de $\alpha = 5\%$. Foram avaliados 29.467 dentes, dos quais 4.967 (16,8%) eram pilares de prótese fixa convencional. Elevada prevalência de dentes pilares de prótese fixa convencional foi observada em indivíduos da faixa etária de 46-60 anos (49,9%). Caninos superiores e segundos pré-molares superiores foram os dentes mais frequentemente envolvidos nas reabilitações: 10,5 e 10,3%, respectivamente. Ausências dentárias foram identificadas em 24,8% da amostra. A prevalência de dentes pilares associados com prótese fixa convencional foi de 16,8%, sendo mais frequente em caninos superiores e segundos pré-molares superiores.

Palavras-chave: Prótese parcial fixa, epidemiologia, prevalência, prótese dentária.

INTRODUCTION

Several factors may lead to tooth loss, including dental caries, periodontal disease, maxillofacial trauma, and other dental pathologies. These conditions and events may cause physical, biological, or even emotional problems for the patient including difficulty in mastication, speech impairment, muscle imbalance, or an esthetically negative appearance(1).

Different treatments have been described for rehabilitation using dental prostheses(2). One or more missing teeth can create problematic spaces and thereby determine the need for intervention with a dental prosthesis to rehabilitate and restore both function and visual esthetics (3).

Since the 1960s, there has been a reduction in reported dental caries for a wide variety of reasons: the use of fluoride toothpastes, the fluoridation of public water supplies, improved living conditions, access to dental care information, changes in dietary patterns, changes in diagnostic criteria for caries, and improved access to oral health care services, have all played a role in this decrease (4).

Estimates indicate that in 1986 10% of all Brazilians aged 34 years had already lost all their teeth. These percentage increased to 20 to 30% among Brazilians between the ages of 41 and 48 years, and progressively increased after that age, as follows: 40% at 53 years; 50% at 58 years; 60% at 63 years; 70% at 68 years; and 80% at 70 years. These epidemiological data describe tooth loss resulting from now-avoidable causes, such as dental caries and periodontal disease (5).

A report concerning the oral health of Brazilians between 2002 and 2003, issued by the Brazilian Ministry of Health, indicated that 12-year-old children and adolescents aged 15-19 years had, on average, between 2.8 and 6.2 teeth with caries. In these same age groups, the lowest rates of caries were found in the southern and southeastern regions of Brazil, whereas the highest averages were found in the Brazilian northeast and central west. Regional differences in the use of dental prostheses are striking, and the northern and northeastern regions showed the greatest need for certain types of dental prostheses (6).

The oral health and masticatory capacity of 5,124 elderly individuals (65-74 years of age) from 250 Brazilian towns were evaluated during home visits that included both a dental examination and an interview. Poor mastication was reported by 2,546 individuals (49.7%), and associated with the following variables: black skin color, low income, toothache in the last few months, never having visited the dentist, never having received preventive guidelines, missing teeth, untreated caries, full or partial dentures, and conditions requiring partial or full dental prostheses. Of the 1,662 individuals (32.5%) who had experienced no prosthetic intervention, there were 1,029 (61.9%) individuals with poor mastication ability (7).

A fixed prosthesis has proved to be a common alternative to other kinds of rehabilitation that meet adequate esthetic and functional standards (8-9). Choosing oral rehabilitation through dental prostheses and dentures over the alternative of implants must, above all, offer both satisfaction and comfort to the patient (10).

Longitudinal studies have confirmed the viability of prostheses over implants as a rehabilitation treatment. Implants, together with fixed prostheses over implants, are superior to prosthetic rehabilitation over teeth for functional, esthetic and psychological reasons (11). However, a national survey on the use of and access to dental services found that economic conditions play a key role in access to care as well as in the type of treatment ultimately prescribed (12).

Epidemiological studies conducted to collect information about our social and economic realities should also contribute toward the planning and implementation of prevention strategies and interventions at oral health services. Radiographs are important sources of information, and panoramic radiographs have been used in epidemiological studies to evaluate the condition of patients' teeth, restorations, implants, prosthetic crowns, and root canal treatments (13-16).

Epidemiologic knowledge has also contributed to the diagnosis of different conditions, which provides an overview of frequency, distribution, risk factors, and disease severity. Clinical examinations are not sufficient to predict behavior, but the epidemiological investigation of the socio-economic reality of the target population may help indicate the most favorable approach for establishing preventive and therapeutic activities (3, 14, 16-18). Data from the Ministry of Health (6) concerning the prevalence of dental caries suggest that the prevalence of abutment teeth for fixed prostheses should be investigated in Brazilian subpopulations.

This study evaluated the prevalence of abutment teeth for fixed prostheses in a Brazilian subpopulation.

METHODOLOGY

In this cross-sectional study, panoramic radiographs of 1,401 male and female patients obtained from August 2002 to September 2007 were assessed. The images were consecutively selected from the database of the Radiological Center of Orofacial Images of Cuiabá (Cuiabá, Brazil). The radiological criteria for detection of abutment teeth for conventional fixed prostheses were: teeth with radiopaque restorative material covering the tooth crown, and/or the presence of pontics. Third molars and prostheses supported by dental implants were not included. The frequency of prostheses was recorded in tables according to sex, age, and tooth number. This study was approved by the Ethics in Research Committee of Federal University of Goiás (protocol no. 311/11).

Two dentists, one endodontist and one prosthodontist (each with more than five years of clinical experience) discussed interpretation criteria before examining the radiographs. Approximately 10% of the samples were initially examined by the observers for calibration and standardization of evaluation criteria. The images were analyzed using image analysis software (Planimp software, Radiological Center of Orofacial Images of Cuiabá Cuiabá, Brazil) running on a workstation using Microsoft Windows XP Professional SP-1 (Microsoft Corp., Redmond, WA).

Statistical Analysis

Frequency distribution and a chi-square test were used for statistical analysis using the Statistical Package for the Social Sciences (SPSS) for Windows 19.0 (SPSS Inc., Chicago, IL). The level of significance was set at $\alpha = 5\%$.

RESULTS

According to the inclusion criteria (n = 28 teeth per individual) and based on the subpopulation studied (n = 1,401), there should be a total of 39,228 teeth, but 9,761 teeth (24.8%) were missing.

Of the 29,467 teeth evaluated, 4,967 (16.8%) had received conventional fixed prostheses. Of these, 3,419 (68.8%) had a single conventional prosthesis, and 1,548 (31.2%) had abutment teeth for multiple conventional prostheses. There was a higher prevalence of abutment teeth for conventional fixed prostheses in individuals aged 46-60 years (49.9%) (Table 1). The highest prevalence rates of teeth used as abutment for conventional fixed prostheses were found for maxillary canines (10.5%) and

maxillary second premolars (10.3%) (Table 2). The prevalence of abutment teeth for conventional fixed prostheses in the maxilla (59.0%) was higher than in the mandible (41.0%).

In our study, the highest prevalence of conventional fixed crowns was found among individuals aged 46-60 years (48.6%), followed by those in the 31-45-year age group (25.3%). The analysis of abutment teeth for multiple conventional fixed crowns revealed that the highest prevalence was in the 40-60-year age group (52.8%), followed by individuals older than 60 years (28.9%) (Table 3). Maxillary first premolars (10.8%) and maxillary second premolars (10.5%) were the teeth with the highest prevalence of conventional fixed crowns, whereas maxillary canines (17.2%) and maxillary second premolars (10.1%) had the highest prevalence of multiple conventional fixed prostheses (Table 2). The highest percentage of missing teeth was found in individuals aged 46-60 years.

TABLE 1 – Prevalence of abutment teeth for conventional fixed prostheses according to sex and age group.

	Number (percentage) of abutment teeth for conventional fixed prostheses (n = 4,967)	**Percentage of abutment teeth for conventional fixed prostheses in relation to total number of teeth evaluated (N = 29,467)**	**p**
Sex			
Female	3,039 (61.2)	10.3	
Male	1,928 (38.8)	6.5	p < 0.001
Total	4,967 (100.0)	16.8	
Age group			
≤ 30 years	105 (2.1)	0.4	
31-45 years	1,123 (22.6)	3.8	
46-60 years	2,478 (49.9)	8.4	p < 0.001
> 60 years	1,261 (25.4)	4.2	
Total	4,967 (100.0)	16.8	

n = number of abutment teeth for conventional fixed prostheses; N = total number of teeth evaluated.

TABLE 2 – Prevalence of abutment teeth for conventional fixed crowns and multiple conventional fixed prostheses according to tooth number.

Teeth	Abutment for conventional fixed crowns (n = 3,419)		Abutment for conventional multiple fixed prostheses (n = 1.548)		p
	n (%)	N = 29,467	n (%)	N = 29,467	
11	173 (5.1)	0.5%	38 (2.5)	0.1%	
12	152 (4.4)	0.5%	42 (2.7)	0.1%	
13	133 (3.9)	0.5%	135 (8.7)	0.4%	
14	190 (5.6)	0.6%	60 (3.9)	0.2%	
15	175 (5.1)	0.6%	82 (5.3)	0.3%	
16	137 (4.0)	0.5%	72 (4.7)	0.2%	
17	99 (2.9)	0.3%	57 (3.7)	0.2%	
21	161 (4.7)	0.5%	40 (2.6)	0.1%	
22	165 (4.8)	0.5%	38 (2.5)	0.1%	
23	126 (3.7)	0.4%	132 (8.5)	0.4%	
24	182 (5.3)	0.6%	73 (4.7)	0.2%	
25	184 (5.4)	0.6%	75 (4.8)	0.2%	
26	150 (4.4)	0.5%	69 (4.5)	0.2%	
27	99 (2.9)	0.3%	63 (4.1)	0.2%	
31	21 (0.6)	0.0%	7 (0.5)	0.0%	p < 0.001
32	28 (0.8)	0.0%	13 (0.8)	0.0%	
33	66 (1.9)	0.2%	26 (1.7)	0.0%	
34	137 (4.0)	0.5%	52 (3.4)	0.1%	
35	150 (4.4)	0.5%	68 (4.4)	0.2%	
36	113 (3.3)	0.4%	21 (1.4)	0.0%	
37	106 (3.1)	0.3%	69 (4.5)	0.2%	
41	24 (0.7)	0.0%	5 (0.3)	0.0%	
42	30 (0.9)	0.0%	6 (0.4)	0.0%	
43	65 (1.9)	0.2%	32 (2.1)	0.1%	
44	142 (4.2)	0.5%	66 (4.3)	0.2%	
45	149 (4.4)	0.5%	87 (5.5)	0.3%	
46	135 (3.9)	0.4%	39 (2.5)	0.1%	
47	127 (3.7)	0.4%	81 (5.0)	0.3%	
Total	3,419 (100.0)	10.8%	1,548 (100.0)	4.4%	

N = total number of teeth evaluated (percentage in relation to total).

TABLE 3 – Prevalence of abutment teeth for conventional fixed crowns and multiple conventional fixed prostheses according to sex and age group.

	Abutment for conventional fixed crowns (n = 3,419)		Abutment for multiple conventional fixed prostheses (n = 1.548)		p
	n (%)	N = 29,467	n (%)	N = 29,467	
Gender					
Female	2,139 (62.6)	7.2%	900 (58.1)	3.1%	
Male	1,280 (37.4)	4.4%	648 (41.9)	2.2%	p < 0.001
Total	3,419 (100.0)	11.6%	1,548 (100.0)	5.3%	
Age group					
≤ 30 years	82 (2.4)	0.3%	23 (1.6)	0.1%	
31-45 years	864 (25.3)	3.0%	259 (16.7)	0.9%	
46-60 years	1,660 (48.6)	5.6%	818 (52.8)	2.8%	p < 0.001
> 60 years	813 (23.7)	2.7%	448 (28.9)	1.5%	
Total	3.419 (100.0)	11.6%	1,548 (100.0)	5.3%	

N = total number of teeth evaluated (percentage in relation to total).

DISCUSSION

This cross-sectional study revealed that 16.8% of the teeth evaluated had received fixed prostheses as a rehabilitation treatment. Most abutment teeth were used for conventional fixed crowns (68.8%), followed by multiple conventional fixed prostheses (31.2%). The highest prevalence of abutment teeth was found in individuals aged 46-60 years (Table 1).

Esthetic rehabilitation and the functional restoration of mastication minimize many biological, physiological, and emotional concerns resulting from missing teeth. Tooth loss is a serious health problem regardless of its cause, be it the result of dental caries, periodontal disease, endodontic failure, root fracture, maxillofacial trauma, or dental pathologies, among others. Our study found a 24.8% frequency of missing teeth in the Brazilian subpopulation assessed.

The analysis of teeth with fixed prostheses demonstrated that patients in the 46-60-year age group had nearly half the number of prostheses found in the group older than 60 years, suggesting a correlation with data reported in a previous study by Dias-da-Costa *et al*. (7). Those authors analyzed the prevalence of unsatisfactory mastication and associated factors among individuals aged 65-74 years. Of the 5,124 seniors surveyed, 49.7% reported poor mastication, essentially associated with tooth loss, a high prevalence of dental caries, and periodontal disease.

Maxillary canines and maxillary second premolars were the teeth most frequently used as abutment for conventional fixed prostheses, whereas mandibular central and lateral incisors were the teeth with the lowest prevalence of prostheses. Hollanda *et al*. (15) analyzed the prevalence of endodontically treated teeth in a

Brazilian subpopulation and found that premolars and maxillary molars were the teeth receiving the majority of treatment. Mandibular incisors were the group with the lowest prevalence.

According to the Brazilian Ministry of Health (19), for individuals undergoing clinical examination in the central western region of Brazil (aged between 15 and 19 years), 13% have a need for some kind of dental prosthesis. In the elderly (65-74 years), 23% have a need for a denture in one arch, while 15% require dentures in both arches.

Before the consolidation of osseointegration of dental implants, the multiple-tooth-supported fixed prosthesis was the best treatment for patients with partial tooth loss. It was undoubtedly the type of prosthesis that best reestablished masticatory function while providing satisfactory cosmetic results. However, tooth-supported fixed prostheses may require considerable reduction of healthy tooth structure, have a high cost, and may demand greater patient efforts to control plaque (20).

The current state of implant development, associated with its greater popularity, may considerably reduce the prevalence of abutment teeth for fixed prostheses. Ortega-Lopes *et al*. (20) examined clinical records to evaluate patients treated with dental implants retrospectively over a period of seven years. Women (65.75%) aged 40-49 years (29.63%) who had a fixed crown (50.23%) had the highest prevalence rates in comparison with the other patients. Most patients reported that implant treatment was necessary because of esthetic and functional reasons (39.35%), followed by function (23.84%) and esthetics (20.83%) alone.

However, treatments using dental implants may have complications or contraindications. Nóia *et al*. (21) evaluated the index of trans- and postoperative complications in patients who underwent osseointegrated dental implant placement in the Department of Oral and Maxillofacial Surgery of the School of Dentistry of Piracicaba, Unicamp, Brazil, from June 2001 to July 2008. The overall complication rate was 13.75%, resulting from the sum of transoperative (3.60%) and postoperative (9.75%) complications, whereas 86.58% of the cases had no complications.

To better achieve success, the appropriate choice of rehabilitation treatment should be planned based upon differing individual characteristics. The indications and contraindications of an implant-supported or a tooth-supported fixed prosthesis should be carefully considered to ensure the longevity of oral health.

Within this context, treatment with implant-supported prostheses should be the current option whenever possible, as it offers excellent opportunities for virtually all partial and fully edentulous patients.

The placement of osseointegrated dental implants avoids the use of teeth to support fixed partial prosthesis, thereby encouraging the manufacture of prostheses that provide immediate esthetic improvement, a better biological option, in addition to greater predictability and clinical longevity.

This cross-sectional study employed methods that are similar to those described in previous studies (15). A randomized sample of images from a database was examined to calculate the number of abutment teeth for fixed prostheses. Panoramic radiographs, frequently used in epidemiological analyses (7, 14-15, 18, 22), have shown advantages over full-mouth periapical radiographs. With this technique, all teeth can be examined, the radiation dose to the patient is kept low, and results can be obtained quickly and conveniently. All these factors have motivated the performance of epidemiological studies (23).

Notwithstanding, the implications and limitations of the method used should also be analyzed. Extrapolation of data obtained for our Brazilian subpopulation should be done with care, as the purpose of this study was to determine the prevalence of abutment teeth for fixed prostheses, regardless of the quality of rehabilitation treatment or the number of fixed prostheses per individual.

Recent studies using three-dimensional images (14, 22, 24) have demonstrated that the success of endodontic treatment has been overestimated and that epidemiological studies based on conventional radiographs should be reviewed. The prevalence of apical periodontitis in endodontically treated teeth may be higher than previously believed and may affect teeth that might otherwise be used as abutments for fixed prostheses; or they might even require extraction.

Further studies should analyze the association between rehabilitation with fixed prostheses and tooth loss that may result from root or crown fractures which, in turn, are the result of an incompatibility between the hardness of the restorative materials or retainers and the hardness of dentin.

CONCLUSION

In our Brazilian subpopulation, the prevalence of abutment teeth for conventional fixed prostheses was 16.8%, and the teeth most frequently used were maxillary canines and maxillary second premolars.

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