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Clinical and sociodemographic evaluation of peri-implant health of implant retained prostheses fabricated with an immediate oclusal loading protocol

Avaliação clínica e sociodemográfica da saúde peri-implantar de próteses retidas em implantes fabricadas com um protocolo de carga oclusal imediata

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RESUMO

Introdução: A terapia de implantes dentais, quando bem planejada, pode contribuir para a qualidade de vida do paciente e é uma ferramenta importante para solucionar um sério problema de saúde pública em várias partes do mundo. **Objetivo:** Este estudo investigou a saúde peri-implantar em implantes fixos apoiados por uma técnica de carga imediata e associou esses resultados a condições sociodemográficas. **Material e método:** Após a desmontagem das próteses sobre implantes com o "Modelo de Branemark", a avaliação peri-implantar de 93 pacientes foi avaliada por meio do índice de placa dental (IPD), profundidade de sondagem (PS), sangramento à sondagem (SS), níveis clínicos de fixação (NCF) e presença de hiperplasia gengival. Os pacientes também responderam a um questionário sobre sexo, idade, nível socioeconômico (Associação Brasileira de Empresas de Pesquisa - ABEP), saúde geral e tabagismo. **Resultado:** Os achados clínicos mais constantes foram a presença de placa, seguida de hiperplasia gengival e periimplantite, que esteve associada à progressão da doença. A maioria dos pacientes do estudo era do sexo feminino, caucasiana e com idade inferior a 60 anos, com próteses localizadas na arcada inferior, pertencentes às classes sociais A e B. **Conclusão:** A presença de biofilme dentário ocorreu em quase todos os implantes e não foi relacionado à presença de periimplantite. A progressão da peri-implantite com perda óssea foi relacionada ao sangramento subgengival. As características sociodemográficas do estudo não apresentaram grandes correlações com as variáveis clínicas dos implantes dentários estudados.

Descritores: Implantes dentários; prótese parcial; próteses e implantes.

ABSTRACT

Introduction: Dental implant therapy, when well planned, can contribute to the patient's quality of life and is an important tool for solving a serious public health problem in various parts of the world. **Objective**: This study investigated peri-implant health in fixed implants supported by an immediate loading technique and to associate those outcomes with sociodemographic conditions. **Material and method**: After the disassembly of the prostheses on implants with the "Branemark Model" the peri-implant health of 93 patients was evaluated using dental plaque index (DPI), probing pocket depths (PPD), bleeding on probing (BOP), clinical attachment levels (CAL), and presence of gingival hyperplasia. Patients also answered a questionnaire about their gender, age, socioeconomic status (Brazilian Association of Research Companies - ABEP), general health and tobacco use. **Result**: The most constant clinical findings were the presence of plaque, followed by gingival hyperplasia and periimplantitis, which was associated with disease progression. Most of the patients in the study were female, Caucasian, and under 60 years of age, with prostheses located in their lower arch, and they belonged to social classes A and B. **Conclusion**: The

presence of dental biofilm occurred in almost all implants and was not related to the presence of periimplantitis. The progression of periimplantitis with bone loss was related to sub gingival bleeding. The sociodemographic characteristics in the study did not present great correlations with the clinical variables of the dental implants studied.

Descriptors: Dental implants; denture; partial; prostheses and implants.

INTRODUCTION

Implants placed in a single session are a quick technique reduces costs and if properly explained, patients can have great benefit[1]. There are studies in the immediate implant literature with longitudinal follow-up[2], but there is still a need for greater scientific maturity on the subject.

Dental implants provide great benefits for the population[3]. This therapy, when well planned, can contribute to a patient's quality of life and is an important tool for solving a serious public health problem in several parts of the world[4].

To verify stability (absence of crestal bone loss associated with inflammatory signs), dental implants should be evaluated primarily through clinical and/or radiographic studies to understand the prevalence, extent, and associated risk factors[5].

Another factor that may interfere with the findings of absence of height loss in marginal bone ridges would be the surgical technique performed on the patients. Nowadays, it perceived that the technique of placing implants immediately or not, obtains close results[6]. Another aspect is the type of bone. The data used in this study obtained good results, similar to the literature[7].

Implantology is a new science that has evolved quickly, which has made it difficult to standardize information such as the variability of implant systems, surgeons' ability to perform the surgical procedures, occlusal stability, bone quality standardization, modifying factors and the rehabilitation of implants in the presence of remaining teeth or implants[8].

Searching for understanding and modulation of the repair process at the interfaces of dental implants and bone tissue is a quickly expanding field of research[9]. In this regard, it appears that treated surfaces, implant anatomy and operator ability have made significant gains in time reduction and an increase in diversity of indications[10]. Studies that seek methodological standardization with the objective of evaluating the prevalence and extent of peri-implant tissue health through immediate loading protocols for implants provide valuable information for clinicians and researchers.

The irregularity of oral health maintenance among patients who come to the dentist can lead to serious health damage. Additionally, poor oral health further aggravates patients' self-esteem, which discourages patients from returning to the dentist and enhances the likelihood they will develop a serious disease in their oral cavity[11]. It was been established that satisfactory oral hygiene after the end of a dental treatment is critical for maintaining health[12].

The objective of this study was to investigate the peri-implant health in fixed implants supported by the immediate loading technique and to associate those outcomes with sociodemographic variables.

MATERIAL AND METHOD

The project for this manuscript was submitted to the ethics and research committee of the University of Cuiaba (number of protocol, 2011/037).

The study had a cross-sectional design and was carried out at Dentistry Clinics of the University of Cuiabá, Cuiabá-MT, Brazil. After surgical procedure and placement of the supported implant prostheses, the patients were called to the return of periodic maintenance between March of 2013 and December of 2014.

The sample population included 93 subjects in which 496 implants were inserted in 93 prostheses implants. Patients with masticatory function were included if they had their prostheses for a minimum of 12 months and a maximum of 120 months without maintenance. The mean age of the patients was 61.53 ± 9.04 (range 40-87).

The inclusion criteria were individuals who had at least 1-year of functional time with the prostheses, absence of dental care, who hadn't received antibiotics for 3 months prior and who didn't have an acrylic resin prostheses with a metallic structure supporting it. Exclusion criterions were maxillary sinus lift, bone graft, adverse systemic conditions, parafunctional habits, and unsatisfactory occlusal forces were excluded from the study.

The implant types were conic and cylindrical with those available for study limited to diameters of 3.75 and 4 mm and lengths ranging from nine to 15 mm. On average, participants had 5.18 ± 0.78 overall implants per person, 5.43 ± 0.87 at the maxilla, and 5.05 ± 0.70 at the mandible. The minimum number of implants per subject was four, and the maximum was 12. The implants were inserted using the immediate loading technique, with a maximum period of 96 hours between the placement of the implants and the installation of the prostheses.

In this study, the patients completed a questionnaire regarding their general health status, gender, skin color/race, and socioeconomic status, which was divided into the categories A, B, C and D (Brazilian Association of Research Companies - ABEP). Intraoral exams were performed by a single examiner, who had a concordance of 88% for probing pocket depth (PPD) and 97% for clinical attachment level (CAL) performed in two exams with one week between them in 10% of patients. The clinical criteria for evaluating peri-implant health in the supragingival region were evaluated at four sites per implant (buccal, mesial, lingual and distal).

Additionally, in the subgingival region, they were evaluated at six sites per implant (buccal, mesiobuccal, distobuccal, lingual, mesiolingual, distolingual). The supragingival index: Dental plaque index (DPI) and presence of gingival hyperplasia, which was measured at 3 mm above the implant border, were dichotomous, yes/no[13]. In the subgingival parameters[14], probing pocket depth (PPD), which was the distance of the mucosa margin to the deepest portion of the groove or pocket. The clinical attachment level (CAL), which was the deepest level for each implant, were registered in millimeters, bleeding on probing (BOP), which was evaluated with a dichotomous yes/no scale, was evaluated, and the presence of gingival hyperplasia, was evaluated.

For peri-implant tissues to be considered healthy, the clinical loss of insertion had to be ≤2mm. Periimplantitis was defined as 2 or more interproximal sites with CAL ≥3mm and 2 or more interproximal sites with PPD ≥4mm (not in the same implant) or a site with PPD ≥5mm in any part of the implant[15].

The data processing was performed in the Excel program and analysis in the program in the SPSS (Statistical Package for the Social Sciences) V17. In this analysis, the dependent variables were number of pockets, perimplant and plaque index (PI). In the statistical analysis, descriptive statistics were used using tables and observed frequencies and percentages. In the inferential analysis, the Chi square test was used, the prevalence ratio with its respective confidence intervals and p values. In the multiple analysis, a Robust Poisson Regression model was used. In all tests a significance of 5% and 95% confidence intervals were considered.

RESULT

In the total analyzed population, four patients were excluded due to general health, and 27 cases did not wish to receive periodic maintenance.

The results in Table 1 are related to sociodemographic and clinical variables. In this table, confidence intervals of variable categories that did not intersect were considered to have significant differences. Clinically, 61.29% of site presented PPD smaller than 2mm, and 69.89% of subjects presented

periimplantitis. The majority of individuals, 93.5%, showed visible plaque index (PI) on the surfaces of their implant. There was presence of gingival hyperplasia in 37.63% of cases. Most cases had (69.89%) five or four implants. Regarding bleeding from probing, it occurred in 59.14% of the subjects. Regarding the position in the arch of the supported implant prostheses, the majority of patients had the lower ones, 62.37%. The maintenance period for the majority of patients was 12 months, 69.89%.

Table 1. Frequency (n), percentage (%), 95% confidence interval and p values of sociodemographic and clinical variables measured in 93 patients, 2014

Variable	Category	n	%	IC (95%)
Number of periodontal pockets	≥3 and10≤	36	38.71	(28.78 ; 49.38)
	≤2	57	61.29	(50.62 ; 71.22)
Periimplantitis	Presence	65	69.89	(21.03 ; 40.50)
	Absence	28	30.11	(59.50 ; 78.97)
Visible Plaque Index	30 - 100%	87	93.55	(86.49 ; 97.60)
	0 - 29%	6	6.45	(2.40 ; 13.52)
Hyperplasia	Presence	35	37.63	(27.80 ; 48.28)
	Absence	58	62.37	(51.72 ; 72.20)
Number of implants	6 - 8	28	30.11	(21.03 ; 40.50)
	4 - 5	65	69.89	(59.50 ; 78.97)
Bleeding from probing (%)	1 - 100%	55	59.14	(48.46 ; 69.23)
	0%	38	40.86	(30.77 ; 51.54)
Location of Protocol	Upper jaw	35	37.63	(27.80 ; 48.28)
	Lower jaw	58	62.37	(51.72 ; 72.20)
Period without maintenance (in months)	24 - 132	28	30.11	(21.03 ; 40.50)
	12 - 23	65	69.89	(59.50 ; 78.97)
Gender	Male	28	30.11	(21.03 ; 40.50)
	Female	65	69.89	(59.50 ; 78.97)
Middle Age (60)	>60	40	43.01	(32.79 ; 53.69)
	≤60	53	56.99	(46.31 ; 67.22)
Skin color	White	63	67.74	(57.25 ; 77.07)
	Non-White	30	32.26	(22.93 ; 42.75)
Social Class	A and B	51	54.84	(44.17 ; 65.19)
	C and D	42	45.16	(34.81 ; 55.83)
Smoker	Yes	13	13.98	(7.66 ; 22.72)
	No	80	86.02	(77.28 ; 92.34)
Diabetic	Yes	12	12.90	(6.85 ; 21.45)
	No	81	87.10	(78.54 ; 93.15)

n: Number of individuals per category; IC 95%: Confidence interval 95%.

The majority of the sample population was female, 69.89%, and most of them were under 60 years old, 56.99%. Patients were divided into white and non-white skin color groups, with the majority (67.74%) in the white group. For grouping by social class into A, B and C, D, the majority of patients were in A and B (54.84%). Smokers and diabetics represented a minority of the sample at 13.98% and 12.90%, respectively.

Table 2, which contains the dependent variables and number of peri-implant pockets, shows that there was a greater number of pockets related to the presence of periimplantitis, with a gross prevalence ratio of 15.08 (2.17-104.68).

Table 2. Frequency (n), prevalence ratio (PR), 95% confidence interval and p values of the periodontal pocket quantity associated with sociodemographic and clinical variables in 93 patients, 2014

Variable	Category	Upper (n)	Lower (n)	n	PR	CI (95%)	*P*
Periimplantitis	Presence	35	30	65	15.08	2.17 - 104.68	**<0.001**
	Absence	1	27	28	1.00		
Visible Plaque Index	30 - 100%	35	52	87	2.41	0.40 - 14.71	0.399FE
	0 - 29%	1	5	6	1.00		
Hyperplasia	Presence	13	22	35	0.94	0.55 - 1.60	0.810
	Absence	23	35	58	1.00		
Number of implants	6 - 8	9	19	28	0.77	0.42 - 1.42	0.393
	4 - 5	27	38	65	1.00		
Bleeding from probing	1 - 100%	25	30	55	1.57	0.88 - 2.79	0.108
	0%	11	27	38	1.00		
Location of Protocol	Upper jaw	14	21	35	1.06	0.62 - 1.78	0.843
	Lower jaw	22	36	58	1.00		
Period without maintenance (in months)	24 - 132	10	18	28	0.89	0.50 - 1.59	0.697
	12 - 23	26	39	65	1.00		
Gender	Male	11	17	28	1.02	0.59 - 1.78	0.940
	Female	25	40	65	1.00		
Middle Age (60)	>60	17	23	40	1.19	0.71 - 1.97	0.514
	≤60	19	34	53	1.00		
Skin Color	White	26	37	63	1.00	0.45 - 1.45	0.463
	Non-White	10	20	30	0.81		
Social Class	A and B	19	23	42	1.36	0.81 - 2.26	0.241
	C and D	17	34	51	1.00		
Smoker	Yes	8	5	13	1.76	1.04 - 2.97	0.068
	No	28	52	80	1.00		
Diabetic	Yes	4	8	12	0.84	0.36 - 1.96	0.761FE
	No	32	49	81	1.00		

PR: Prevalence Ratio; **n:** Number of individuals per category; **CI:** Confidence Interval; ***P*:** Value of Pearson's chi-square test (χ^2); **Bold Text:** Presence of a significant difference at the level of 5%; **FE:** Fisher Exact Test.

Table 3 shows the associations between periimplantitis, which was the dependent variable, with sociodemographic and clinical variables. In this case, there was a statistically significant association between this dependent variable and the number of pockets and bleeding variables (RPb: 1.85 (1.44-2.38) and 1.35 (1.01 to 1.83), respectively).

Table 3. Observed Frequency (n), prevalence ratio (PR), confidence interval 95% and p values of periodontitis associated with sociodemographic and clinical variables in 93 patients, 2014

Variable	Category	Upper (n)	Lower (n)	n	PR_b	CI (95%)	*P*
Number of periodontal pockets	≤2	35	1	36	1.85	1.44-2.38	**<0.001**
	>3 ≤10	30	27	57	1.00		
Visible plaque index	30-100%	62	25	87	1.42	0.63-3.21	0.361FE
	0 - 29%	3	3	6	1.00		
Hyperplasia	Presence	27	8	35	1.18	0.91-1.53	0.236
	Absence	38	20	58	1.00		
Number of implants	6-8	18	10	28	0.89	0.65-1.22	0.439
	4-5	47	18	65	1.00		
Bleeding from probing (%)	1 - 100%	43	12	55	1.35	1.01-1.83	**0.036**
	0%	22	16	38	1.00		
Local of Protocol	Upper Jaw	26	9	35	1.11	0.85-1.44	0.473
	Lower Jaw	39	19	58	1.00		
Period without maintenance (in months)	24-132	18	10	28	0.89	0.65-1.22	0.439
	12-23	47	18	65	1.00		
Gender	Male	19	9	28	0.96	0.71-1.29	0.779
	Female	46	19	65	1.00		
Middle Age (60)	> 60	31	9	40	1.21	0.93-1.57	0.165
	≤ 60	34	19	53	1.00		
Skin Color	Non-White	20	10	30	0.93	0.69-1.26	0.640
	White	45	18	63	1.00		

Table 3. Continued…

Variable	Category	Upper (n)	Lower (n)	n	PR_b	CI (95%)	*P*
Social Class	A and B	27	15	42	0.86	0.65-1.14	0.285
	C and D	38	13	51	1.00		
Smoker	Yes	11	2	13	1.25	0.95-1.65	0.331FE
	No	54	26	80	1.00		
Diabetic	Yes	7	5	12	0.82	0.50-1.34	0.501FE
	No	58	23	81	1.00		

PR: Prevalence ratio; **n:** Number of individuals per category; **CI:** Confidence interval; ***P*:** p value of Pearson's chi-square test (χ^2); **Bold Text:** Presence of significant differences at the level of 5%; **FE:** Fisher's Exact Test.

Table 4 shows the three regression models of Robust Multiple Poisson (number of pockets (model 1), peri-implant (model 2) and plaque index (PI) (model 3), associated with the sociodemographic and clinical variables. In model 1, there was a significant association with the presence of peri-implants (aPR: 15.08 (2.17-104.68)). For model 2, periimplantitis was associated with the amount of periodontal pockets (aPR: 1.85 (1.44-2.38)). When considering model 3, for the plaque index (PI), there were relationships with the number of implants (aPR: 1.12 (1.02-1.23)), race color (aPR: 1.11 (1.02-1, 20)) and smoking (aPR: 1.12 (1.02-1.22)).

Table 4. Variables of 3 final models and adjusted prevalence ratio (aPR) for multiple robust Poisson regression associated with sociodemographic and clinical variables, with their respective confidence intervals (CI) of 95% and p Value, in 93 patients, 2014

Models	Variable independents	Categories	aPR	CI 95%	*P*
Number of periodontal pockets (Model 1)	Periimplantitis	Presence	15.08	(2.17 ; 104.68)	**<0.001***
		Absence	1.00		
Periimplantitis (Model 2)	Quantity of periodontal pocket	≤ 2	1.85	(1.44 ; 2.38)	**<0.001***
		> 3 - ≤10	1.00		
Visible Plaque Index (Model 3)	Number of implants	6 - 8	1.12	(1.02 ; 1.23)	**0.014***
		4 - 5	1.00		
	Skin color	White	1.00	(1.02 ; 1.20)	**0.014***
		Non-White	1.11		
	Smoker	Yes	1.12	(1.02 ; 1.22)	**0.017***
		No	1.00		

aPR: adjusted prevalence ratio for a multiple robust Poisson model with selection of variables using reverse methods. CI: Confidence interval. *P*: p value.
*Presence of significant difference at the level of 5%.

DISCUSSION

The inclusion criteria in the study were very selective, which allows inferring that under favorable conditions, there is a safe use of dental implants along with the immediate prosthesis. These data are already found in the literature[16].

The maintenance of dental implant therapy involves observation if the patient's overall health is not influencing peri-implant health in addition to local factors. The local items observed should be the soft tissues around the implants, the oral biofilm index, probing depth, mobility, clinical insertion level and probing bleeding[17]. However, there was a high index of visible plaque around the implants. The relevant amount of gingival hyperplasia and the presence of periimplantitis demonstrated the need for dentists to be attentive not only in the quality and precision of the planning and placement technique but also in the maintenance of oral health to avoid implant loss or disease in certain regions.

It is known that the etiological agent of peri-implantitis is oral biofilm. Oral hygiene plays a key role in disease progression and health maintenance. In case of maintenance done by dentists the presence of biofilm becomes relevant for measures to be taken in relation to maintenance. In this study it was noticed a large accumulation of biofilm that occurred due to hygiene difficulty that occurred because these prostheses and implants had areas that were difficult to access with hygiene instruments.

Despite the high amount of biofilm, the success rate for this type of prostheses was quite high, as shown in this study and by other researchers[18].

Variables such as race, smoking, diabetes and age are associated with greater progression of oral diseases, that is, it makes the individual more susceptible[19]. It is clear that the etiological agent of the peri-implant disease is the presence of dental biofilm[20], but its presence did not seem to be a factor that defined the progression of periimplantitis[21] as presented in this study.

There was an association between the presence of periimplantitis and the number of periodontal pockets. In addition, it was shown that there was an association between subgingival bleeding and the presence of periimplantitis, which agrees with previous results from the literature[22,23].

The presence of gingival hyperplasia in dental implants is a constant[24]. In this sense, the clinical examination revealed great number of patients, and it was located in the maxilla for most of them. It is important to illustrate that gingival hyperplasia was considered in the study as when the mucosa was observed 3 mm above the edge of the implant.

There was an attempt to correlate the presence of diabetes and tobacco use with periimplantitis in this study. However, there was no association with diabetes. In smokers, multivariate analysis showed an association (plaque - smoker), yet no other statistical associations were found. When looking at the literature, there was a similar result for the presence of diabetes and bone loss[23]. Despite the findings, it is important to illustrate that the population of diabetics and smokers was small, which may have interfered with the results. Another interesting thing to consider is that there are reviews and clinical trials linking diabetes and tobacco use as risk factors for bone height loss[23].

Social class and gender were also factors that were considered in the statistical analysis; however, no relevant findings were found. Studies of periodontal health have correlated greater disease progression with gender, age, social class and race[25]. Most of the prostheses were inserted in the mandible and most of the patients were female. Despite these differences, there are no relevant considerations in the literature in this regard[8].

One of the great challenges in implant dentistry is to establish clinical criteria for defining periimplantitis. In this study, we sought to use criteria that are recognized and widely cited by other authors[15].

A relevant factor is that the surgeons were different for many of the cases; however, experienced teachers in the clinic and classroom always supervised them. This could be a potential factor that affected our results, but the technique even when performed by less experienced professionals has been shown to be reliable. It should be emphasized that the techniques for fixed implants on immediate prostheses with a “protocol model” have the greatest difficulty for managing the case from the initial molding to semi-adjustable articulator assembly and production of the surgical guides.

CONCLUSION

The presence of dental biofilm occurred in almost all implants and was not related to the presence of periimplantitis. The progression of periimplantitis with bone loss was related with subgingival bleeding. The sociodemographic characteristics in the study did not present great correlations with the clinical variables of the dental implants studied.

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CONFLICTS OF INTERESTS

No potential conflict of interest relevant to this article was reported.

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