PERI-IMPLANT STATUS IN PARTIALLY EDENTULOUS INDIVIDUALS SUBJECTED TO DENTAL IMPLANT REHABILITATION

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Palavras-chave: Implantes Dentários. Doença Periodontal. Doença Peri-implantar

RESUMO

Objetivo: A reabilitação oral com o emprego de implantes dentários é uma rotina na clínica odontológica. Entretanto, as doenças peri-implantares podem se estabelecer ao redor dos implantes dentários com o passar do tempo. O objetivo deste estudo foi avaliar a saúde peri-implantar de indivíduos submetidos a tratamento com implantes dentários comparados a indivíduos com saúde periodontal e periodontite. **Métodos**: Os participantes do estudo foram submetidos a questionários anamnésicos e exame periodontal/ peri-implantar completo. Foram incluídos 20 indivíduos Portadores de Implantes Dentários (45% mulheres; idade média de 57,2 anos), 35 indivíduos com Saúde Periodontal (28,6% mulheres; idade média de 24,1 anos) e 25 indivíduos com Periodontite (20% mulheres; idade média de 47,5 anos). Estes últimos não possuíam implantes dentários. Diferenças significativas foram analisadas através dos testes Wilcoxon, Qui-quadrado e Kruskal-Wallis. **Resultados**: O grupo Portadores de Implantes Dentários possuía uma média de 3,9 implantes com tempo médio de instalação de 5,1 anos. Doença peri-implantar foi detectada em 75% dos indivíduos com implantes dentários, sendo 70% mucosite peri-implantar. Implantes dentários apresentaram profundidade de sondagem e nível clínico de inserção significativamente maior quando comparado a dentes dos mesmos indivíduos (p d" 0,004), ou de indivíduos com saúde periodontal (p < 0,0001). Apesar de implantes apresentarem menor acúmulo de biofilme dental, apresentaram maiores porcentuais de sangramento à sondagem comparado a dentes (nos mesmos indivíduos; p = 0,002) e a indivíduos com saúde periodontal (p < 0,0001). **Conclusão**: A população estudada apresenta uma relativamente alta prevalência de doença peri-implantar. Além disto, foi possível constatar que as características clínicas do tecido peri-implantar se assemelharam àquelas de indivíduos com periodontite.

Keywords: Dental Implants. Periodontal Disease. Peri-implant Disease.

ABSTRACT

Objective: Oral rehabilitation with dental implants has become a daily routine in dental clinics. However, peri-implant diseases can affect the tissues around dental implants over time. The aim of this study was to evaluate peri-implant health status in partially edentulous individuals rehabilitated with dental implants in comparison with either periodontally healthy individuals or those with periodontitis. **Methods:** Study participants were subjected to anamnestic questionnaires and full periodontal/ peri-implant examination. Twenty-five dental implant carriers (45% women; mean age, 57.2 years), 35 periodontally healthy individuals (28.6% women; mean age, 24.1 years), and 25 subjects with periodontitis (20% women; mean age, 47.5 years) were included. Those in the healthy and periodontitis groups had no dental implants. Significant differences were analyzed by Wilcoxon, Chi-square, and Kruskal-Wallis tests. **Results:** The dental implant carriers had an average of 3.9 implants with an average time of 5.1 years since insertion. Peri-implant disease was detected in 75% of individuals in the Dental Implant Carriers group (70% had peri-implant mucositis). Dental implants presented probing depths and clinical attachment levels significantly higher when compared with those of unaffected teeth from the same individuals (pd"0.004), or with teeth from periodontally healthy individuals (p<0.0001). Although implants presented less dental biofilm, they presented higher percentages of bleeding on probing compared with unaffected teeth in the same individuals (p=0.002) and with teeth in periodontally healthy individuals (p<0.0001). The population studied had a relatively high prevalence of peri-implant disease. **Conclusion:** It is possible to verify that the clinical characteristics of the peri-implant tissues resembled those of individuals with periodontitis.

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INTRODUCTION

The discovery of osseointegration facilitated the development of stable implants that can replace diverse body structures. In dentistry, in particular, the use of dental implants presents highly predictable outcomes over the long term.[1] Moreover, in some cases, dental implants are the only viable solution for rehabilitation.[2]

However, complications may arise due to factors such as surgical trauma, inadequate surgical procedures, inadequate use of antibiotics in the pre- and post-operative periods, pressure exerted by the prosthesis during healing, bacterial infection during or after surgery, improper initial loading, incorrect prosthesis planning, occlusal overload, and parafunctional activity.[2] Furthermore, peri-implant inflammation may develop, leading to two types of diseases, peri-implant mucositis and peri-implantitis.[3,4] Clinically, peri-implant mucositis is reversible inflammation concentrated in peri-implant soft tissues.[4,5] Conversely, peri-implantitis indicates that marginal bone loss is present around dental implants, which can result in implant loss.[3,4] Progression from peri-implant mucositis to peri-implantitis has been studied retrospectively.[6] It has been found that the onset of peri-implantitis may occur in most cases 3 years after dental implant insertion, when signs of bone loss can be detected.[6]

The estimation of the prevalence of peri-implant mucositis is around 48% for dental implants with 9 to 14 years of insertion.[3] In terms of peri-implantitis, its prevalence may vary from 6.6% to 36.6% in dental implants with 10 years of insertion.[3,7] In smokers, this prevalence might be higher, since smoking is a risk factor for peri-implantitis.[8]

Many factors can contribute to the increased risk of peri-implant disease, especially peri-implantitis.[2] A previous history of periodontitis may be considered the main factor.[3,7] In those studies, classification of periodontitis was based on the 1999 American Academy of Periodontology definition,[9] and most studies do not differentiate aggressive from chronic periodontitis.[8] Eradication of periodontitis in partially edentulous individuals is essential to avoid the presence of a reservoir of pathogenic species that can infect peri-implant sites.[10,11] Conversely, even patients with no history of periodontitis, particularly young individuals, may need follow-up and periodic peri-implant evaluation after final prosthesis insertion to prevent eventual peri-implant diseases that can occur late in life.[1,3,7] The lack of a maintenance program for those individuals, especially those treated at dental schools, may lead to negative peri-implant outcomes.[8] Therefore, the aim of this study was to evaluate peri-implant health status in partially edentulous individuals rehabilitated with dental implants in comparison with periodontally healthy individuals and those with periodontitis.

MATERIALS AND METHODS

Study population

This cross-sectional study was carried out from March 2014 to March 2015. The study population consisted of individuals treated at the Dental Clinic of the School of Dentistry and in the Implantology Specialization Clinic of UNIGRANRIO Duque de Caxias. Individuals rehabilitated with dental implants were treated between 2008 and 2013. Patients had no history of periodontitis at the time of dental implant insertion. Included individuals read and signed an informed consent explaining the study protocol, which was approved by the Research Ethics Committee of UNIGRANRIO (# 481.082).

Selection of individuals treated with dental implants to comprise the case group (Dental Implant Carriers group) was initially based on 316 dental records in the Post-Graduation Clinic archive from 2008 to 2013. After being screened, 74 individuals presented characteristics that were in accordance with the inclusion criteria of the present study. Due to telephone contact problems, it was possible to contact only 20 individuals, who underwent clinical examination (Figure 1). None of the participants in the Dental Implant Carriers group was in a maintenance program. Screening of participants without dental implants to comprise control groups (Healthy, N=35, and Periodontitis, N=25) was performed among individuals seeking treatment at the School of Dentistry Clinic. Participants in the Healthy and Periodontitis groups were included before treatment initiation.

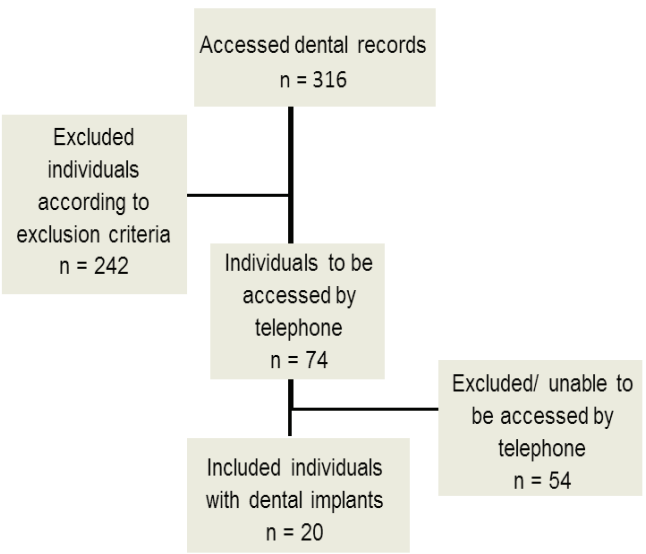


Figure 1: *Flow chart of the inclusion of individuals with dental implants.*

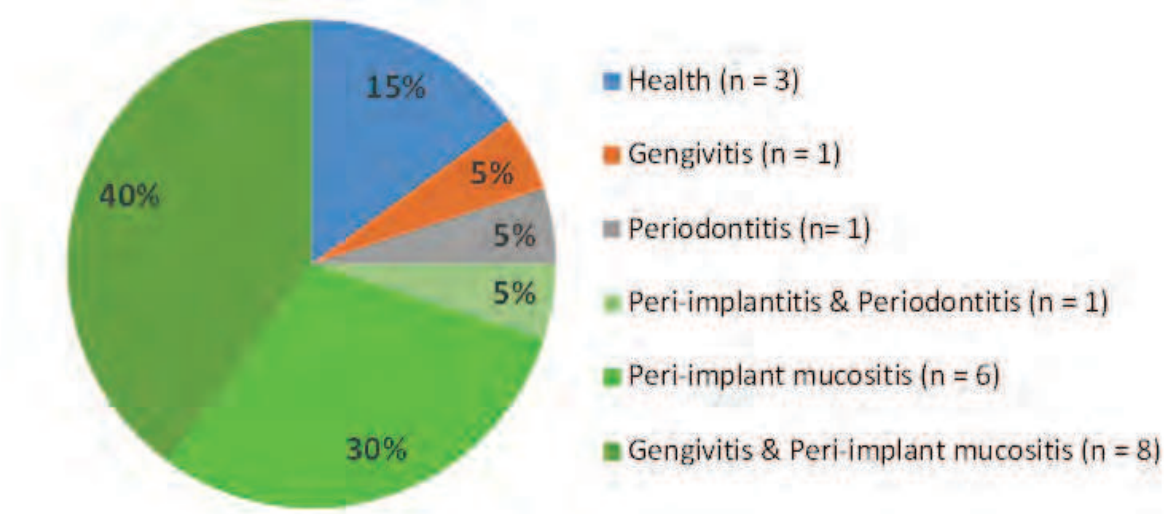


Figure 2: *Evaluation of the peri-implant tissue conditions in the individuals in the Dental Implant Carriers group.*

Inclusion criteria specified that individuals should be adults (> 18 years) with at least 14 teeth and/or dental implant(s). In addition, patients with dental implants should have had them inserted for at least 3 years prior to examination. Individuals with the following conditions were not included in the study: localized aggressive periodontitis; known diseases of the immune system (e.g. HIV-positive); diabetes; pregnant or breastfeeding; needing chemoprophylaxis for dental care; and having received periodontal treatment in the preceding year.

Included individuals were subjected to anamnestic questionnaires to register gender, skin color (race), general and oral health, and time of implant placement for Dental Implant Carriers.

Clinical examination

Clinical examinations were performed by a calibrated examiner who double-measured probing depths (PD), and clinical attachment levels were taken at one-week intervals in 5 patients from the Periodontitis group. The intracorrelation coefficient for clinical attachment level was 0.91 and that for PD was 0.87. In addition to registering the numbers of teeth and implants present, the clinical examination included dichotomized records of the presence of dental biofilm, bleeding on probing (BOP), suppuration on probing, and measurement in mm of PD and clinical attachment level. PD measured the distance between the gingival/mucosal margin and the most apically probable portion, in mm,[12,13] while clinical attachment level measured the distance from the implant/crown or enamel junction to the most apically probable portion, also in mm.[12,13] Periodontal examination was performed at six sites per tooth/implant, excluding third molars, by means of the Carolina do Norte probe (Hu-Friedy; Chicago) for teeth and the Colorvue® probe (Hu-Friedy) for implants. For Dental Implant Carriers, the numbers of implants present were recorded as well as the time of insertion. After clinical examination, dental implants with PD > 5 mm were subjected to radiographic examination for evaluation of alveolar bone loss.

Based on a report by da Silva-Boghossian and others,[14] periodontally healthy individuals should not present e" 10% of sites with BOP and/or attachment loss with BOP; individuals with gingivitis should have > 10% of sites with BOP without attachment loss in those teeth with BOP; and individuals with periodontitis should have PD > 4 mm with attachment loss and BOP. The diagnoses of peri-implant mucositis was defined when BOP was present; when increased PD (> 4 mm) and BOP were present with radiographic evidence of alveolar bone loss, peri-implantitis was identified.[3] All individuals diagnosed with disease were referred for treatment at the School of Dentistry of UNIGRANRIO.

Data analysis

All statistical tests used in the present study were performed with a statistical program (SPSS Statistics 20, IBM Brazil, São Paulo, Brazil). The frequency of sites with BOP and dental biofilm, as well as the median and interquartile ranges (IR) of PD and attachment level, were calculated for each patient, and then in the group. Mean age, distribution of skin colors among individuals, and gender were also calculated. Mean values were also obtained for the number of implants inserted per patient, as well as the average insertion times. Participants were grouped according to their periodontal/peri-implant diagnoses. For categorical data, the Chi-square test was used. Differences in periodontal and peri-implant clinical data in individuals with dental implants were analyzed by the Wilcoxon statistical test. Differences among and between diagnostic groups were verified by Kruskal-Wallis and Mann-Whitney tests, respectively. The significance level was established at 5%.

Table 1: *Demographic data of the studied individuals.*

Variables	Groups			
	Dental Implant Carriers (N=20)	Healthy (N=35)	Periodontitis (N=25)	*p* value
Median for age (years; 95% confidence interval)	50.5 (46.7-58.5)	24.5 (20.5-36.1)	48 (44.3-54.3)	<0.0001*
% Females	45	28.6	20	NS**
% Smokers	0	2.9	28	0.001**
Skin color				
% White	35	51.4	60	NS**
% Black individuals with lighter skin	15	11.4	12	
% Black individuals with dark skin	50	37.1	28	

*Note: * Kruskal-Wallis test; ** Chi-square test; NS, non-significant.*

Table 2: *Periodontal clinical data from the included individuals.*

Variables	Groups				
	Dental Implant Carriers (N=20)		Healthy (N=35)	Periodontitis (N=25)	*p* value
	Teeth	Implants			
Median (mm; IR)					
PD	2 (0.6)	2.8 (1.4)*	2 (0.3) ‡	2.6 (0.7)	<0.0001
CAL	2.2 (1.1)	2.8 (1.5)*	2 (0) ‡	2.9 (1.3)	<0.0001
Median % (IR)					
Biofilm	12 (18)	0 (0)*	13.7 (28.2)	38.7 (44.9) §	<0.0001
Calculus	6 (16)	0 (0)*	5.9 (12.8)	17 (26.8) §	<0.0001
BOP	10 (29.5)	50 (51.5)*	2.9 (5.4) ‡	42.5 (38)	0.001
Mean % (± SD)					
Suppuration	0.4 (1.3)	1.5 (4.4)	0	0.6 (1.9)	NS
Dental implants Mean number of implants inserted (± SD)	-	3.9 (3.)	-	-	N/A
Mean time of insertion (in years; ± SD)	-	5.1 (2.1)	-	-	

*Note: * p d" 0.005, intra-group analysis, Wilcoxon test. † Kruskal-Wallis test, inter-group analysis. ‡ p < 0.0001, Mann-Whitney test, between Implants and Healthy groups. § p<0.0001, Mann-Whitney test, between Implants and Periodontitis groups. IR, Interquartile Range. SD, standard deviation. PD, probing depth. CAL, clinical attachment level. BOP, bleeding on probing.*

RESULTS

The mean age of those in the Dental Implant Carriers group was 57.2 (± 12.6) years, while for those in the Healthy group it was 24.1 (± 7.4), and in the Periodontitis group, 47.5 (± 8.2). Those averages were significantly different among groups (< 0.0001; Kruskal-Wallis test). Overall, most participants were females. However, in the Periodontitis groups only 20% of the individuals were female. There were no smokers in the Dental Implant Carriers group. In the Healthy and Periodontitis groups, 2.9% and 28% were smokers, respectively, with a significant difference between groups (p=0.001). Distribution of skin colors did not differ among groups (Table 1).

Periodontal clinical data are presented in Table 2. Median values for PD and CAL were, respectively, for teeth and implants in the Dental Implant Carriers group, 2 mm (1.6-2.3) and 2.2 mm (1.8-2.7), and 2.8 mm (2.6-3.7) and 2.8 mm (2.6-4.2), with statistically significant differences between them (p=0.001; Wilcoxon test). It was observed that the mean PD for teeth and implants in the Dental Implant Carriers group was 1.9 (± 0.7) and 3.1 (± 1.04) mm, respectively (data not shown). When values of PD in the Implant group were compared with those in the Healthy group (2 mm; IR, 0.3), a statistically significant difference was found (p<0.0001; Mann-Whitney test). CAL also differed significantly between teeth and implants in the Dental Implant Carriers group (p=0.004) and among groups (p<0.0001). CAL was also higher in the group with Implants when compared with the Healthy group (2 mm, 1.9-2.1), p<0.0001. The median percentages of biofilm (12% and 0%, respectively) and dental calculus (6% and 0%, respectively) were significantly greater in teeth compared with implants in the Dental Implant Carriers group (p=0.003). However, the percentages of biofilm (38.7%) and calculus (17%) were higher in the Periodontitis group compared with the other groups (p<0.0001). Conversely, BOP was significantly higher in the Implants group (50%) compared with teeth (10%) in the Dental Implant Carriers (p=0.002) and Healthy (2.9%) groups (p<0.0001).

A mean 3.9 (± 3) dental implants were present in the Dental Implant Carriers group, ranging from 1 to 7 implants (Table 2). Time of insertion ranged from 3 to 7 years, and the mean time of insertion was 5.1 (± 2.1) years.

Figure 2 shows the periodontal/peri-implant diagnoses of the individuals from the Dental Implant Carriers group. It was observed that only 15% of them were healthy in terms of periodontitis and peri-implantitis; 5% had gingivitis, and 5% had periodontitis with no disease in the implants. Remaining individuals (75%) presented peri-implant disease: peri-implantitis and periodontitis (5%), peri-implant mucositis (30%), and peri-implant mucositis and gingivitis (40%).

DISCUSSION

Peri-implant mucositis is an inflammatory response to bacteria present in dental biofilm, and it can be considered a precursor of peri-implantitis.[15] Therefore, the aim of this study was to evaluate peri-implant health status in partially edentulous individuals rehabilitated with dental implants at the Specialization Clinic of Implantology, UNIGRANRIO Caxias.

The current investigation faced an immense operational difficulty in recruiting individuals rehabilitated with dental implants in the past in the post-graduation clinic of UNIGRANRIO, because most of the participants' contact details (cell or telephone numbers) were outdated, and we could not reach past patients. However, it was possible to detect a high prevalence (75%) of peri-implant disease in the studied individuals. That prevalence is comparable with the highest reported by the American Academy of Periodontology, in which the prevalence of individuals with peri-implant mucositis ranged from 31 to 60%.[3] Moreover, a prevalence of peri-implantitis ranged from 6.6% to 36.6% in implants with 10 years of insertion.[3] That broad range in the findings may be the result of different methodological criteria adopted to evaluate the presence of peri-implant disease, or differences in study populations. Other aspects that can influence different results are the presence of risk factors, as well as times of implantation[16-18]; nevertheless, that was not the case for the implant group in our study, since there were neither smokers nor individuals with diabetes.

It should also be noted that some studied individuals had peri-implantitis but no periodontal disease in their teeth. In fact, in general, it was observed that the clinical parameters evaluated (PD, CAL, and BOP) were higher in implants compared with teeth in the same individuals. Similar results were previously reported, showing that mean PD and CAL in teeth (2.27 and 2.03, respectively) and in implants (3.36 and 2.51, respectively) differed significantly.[12] Moreover, current findings showed that the values of PD, CAL, and BOP in individuals in the Dental Implant Carriers group were comparable with those found in individuals in the Periodontitis group. These data are in accordance with those reported by Baelum & Ellegard,[17] who observed that around 25% of the studied dental implants showed PS > 5 mm, and 70% or more of the implants presented BOP. Another study[19] demonstrated that 23.4% of systemically healthy individuals with dental implants presented BOP and PD > 5 mm. Ferreira et al.[20] reported that 19% of implants had BOP and PD > 4 mm. It is important to remember that the force applied at the time of probing can provoke bleeding. However, the absence of BOP characterizes health in the peri-implant tissues.[21] It is also worth mentioning that the values of PD,

CAL, and BOP are the main parameters in periodontal diagnoses, and they were similar between studied dental implants in comparison with the Periodontitis group. However, the current investigation detected only one individual with peri-implantitis (5%). Despite the sample size, current findings may be aligned with those of other reports, such as that by Astrand et al.,[22] who reported 5% of peri-implantitis in individuals with dental implants. Other investigators have reported peri-implantitis in around 10% of the studied individuals.[16,20] The individuals studied in the Dental Implant Carriers group are relatively young, and the possibility of future destructive disease development cannot be excluded. In fact, aging may be a risk factor in the pathogenesis of peri-implantitis, similar to periodontitis pathogenesis.[23]

The current investigation demonstrated that many individuals with dental implants had periodontal disease. As mentioned previously, treatment of periodontitis in partially edentulous individuals is essential to avoid the establishment of peri-implant infection.[10,11] Therefore, individuals rehabilitated with dental implants should be included in a periodic preventive program, including peri-implant probing and radiographic follow-up.[3] It is likely that the lack of a preventive maintenance program was the main factor that influenced the presence of peri-implant disease in this study. It has been demonstrated that a higher risk for peri-implantitis exists when individuals are not included in a maintenance program,[8] which can be translated to poor plaque control and subsequent increased inflammation.

Limitations of the current investigation that may have influenced the presented results include significantly different ages between healthy individuals and the other two groups, and the presence of smokers in the periodontitis group. Moreover, the limited number of participants may also make it difficult for these results to be compared with those from other investigations.

CONCLUSIONS

The population studied has a relatively high prevalence of peri-implant disease. In addition, it is possible to verify that the clinical characteristics of the peri-implant tissues resembled those of individuals with periodontitis.

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