CLINICAL ORAL IMPLANTS RESEARCH

Indicadores de Risco para a Peri-implantite: Estudo Retrospectivo com 916 implantes

Resumo

Objetivos: O objetivo do estudo foi identificar indicadores de risco locais e sistêmicos associados com a peri-implantite.

Materiais e métodos: 183 pacientes tratados com 916 implantes osseointegrados, em função por no mínimo 1 ano, foram incluídos no presente estudo. Os implantes foram instalados na FUNDECTO – Universidade de São Paulo (USP) – durante o período de 1998 a 2012. Fatores relacionados às condições sistêmicas do paciente (problemas cardíacos, hipertensão, tabagismo, alcoolismo, problemas renais, hepatite, doença gastrointestinal, diabetes tipo I e II, hipertireoidismo ou hipotireoidismo, radioterapia, quimioterapia, menopausa, osteoporose, doença periodontal ativa, histórico de doença periodontal e bruxismo), características dos implantes (localização, diâmetro, comprimento, conexão, formato e antagonista) e parâmetros clínicos (facetas de desgaste, condição periodontal do dente adjacente, acúmulo de placa no dente adjacente, índice de placa modificado, índice de sangramento do sulco, profundidade à sondagem, sangramento à sondagem, faixa de mucosa ceratinizada e recessão marginal) foram avaliados.

Resultados: Para pacientes com histórico de doença periodontal, houve um risco aumentado em 2.2 vezes, para próteses cimentadas o risco aumentou para 3.6 vezes quando comparado às prótese parafusadas, 2.4 vezes quando facetas de desgaste estavam presentes na coroa unitária e 16.1 vezes para as reabilitações totais quando em comparação com as reabilitações unitárias. A regressão logística não apresentou qualquer associação entre peri-implantite e as características dos implantes avaliados.

Conclusões: Histórico de doença periodontal, próteses cimentadas, presença de facetas de desgaste na coroa protética e reabilitações totais sobre implantes foram identificados como indicadores de risco para o surgimento da peri-implantite. As características dos implantes avaliados não estiveram relacionadas com a presença de peri-implantite.

Palavras-chave: exame clínico, pesquisa clínica, ensaios clínicos, diagnóstico, epidemiologia.

O presente artigo foi publicado no periódico de implantodontia de maior fator de impacto mundial, o que da uma grande credibilidade aos resultados obtidos. Além disso, um dos co-autores do trabalho é o professor Stefan Renvert, da Suécia, autoridade mundial em periodontia e implantodontia e um dos autores do consenso de peri-implntite publicado no EAO de 2015.

A taxa de peri-implantite obtida para pacientes (16,4%) e implantes (7,3%) está abaixo dos números encontrados em muitas outras marcas de renome mundial o que comprova a a qualidade dos implantes Implacil DeBortoli. Os indicadores de risco para peri-implantite encontrados nessa pesquisa coincidem com aqueles descritos na literatura e também no consenso do EAO 2015, mostrando que os implantes realizados nessa pesquisa seguem os mesmos padrões dos demais implantes internacionais analisados em diversos outros estudos.

A taxa de sobrevivência dos implantes avaliados nessa pesquisa atingiu a impressionante marca de 98,3%, número também superior a muitas marcas de renome internacional. Vale lembrar aqui que o tempo médio de vida dos implantes analisados foi de aproximadamente 6 anos. Dos 916 implantes avaliados, aproximadamente 500 tinham mais de 6 anos em boca e 300 tinham mais de 7 anos. 95 deles tinham mais de 10 anos de uso (ver figura 3). Isso demonstra que a amostra avaliada prezou pelos resultados de longo prazo.

Por fim nenhuma característica relacionada diretamente com os implantes (superfície, tamanho, forma, intermediário, etc) teve relação direta com o aparecimento da peri-implantite. Isto comprova a qualidade dos implantes avaliados, dando segurança a quem utiliza a marca.

A Implacil De Bortoli mais uma vez torna-se a pioneira das brasileiras em apresentar resultados de longo prazo, trazendo muito orgulho a implantodontia nacional.

CLINICAL ORAL IMPLANTS RESEARCH

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Risk indicators for Peri-implantitis. A cross-sectional study with 916 implants

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Key words: clinical assessment, clinical research, clinical trials, diagnosis, epidemiology

Abstract

Objectives: The aim of this study was to identify systemic and local risk indicators associated with peri-implantitis.

Material and methods: One hundred eighty-three patients treated with 916 osseointegrated titanium implants, in function for at least 1 year, were included in the present study. The implants were installed at the Foundation for Scientific and Technological Development of Dentistry (FUNDECTO) - University of Sao Paulo (USP) - from 1998 to 2012. Factors related to patient's systemic conditions (heart disorders, hypertension, smoking habits, alcoholism, liver disorders, hepatitis, gastrointestinal disease, diabetes mellitus I and II, hyperthyroidism or hypothyroidism, radiation therapy, chemotherapy, menopause, osteoporosis, active periodontal disease, history of periodontal disease and bruxism), implant's characteristics (location, diameter, length, connection, shape, and antagonist), and clinical parameters (wear facets, periodontal status on the adjacent tooth, plaque accumulation on the adjacent tooth, modified plaque index, sulcus bleeding index, probing depth, bleeding on probing, width of keratinized tissue and marginal recession).

Results: An increased risk of 2.2 times for history of periodontal disease (PD), 3.6 times for cemented restorations compared to screw-retained prostheses, 2.4 times when wear facets were displayed on the prosthetic crown and 16.1 times for total rehabilitations when compared to single rehabilitations were found. Logistic regression analysis did not show any association between the implant's characteristics and peri-implantitis.

Conclusions: A history of periodontal disease, cemented prostheses, presences of wear facets on the prosthetic crown and full mouth rehabilitations were identified as risk indicators for peri-implantitis. Implants' characteristics were not related to the presence of peri-implantitis.

The word peri-implantitis is used to describe destructive infectious pathologies in the soft tissues around dental implants resulting in bone loss (Lindhe & Meyle 2008). Bone remodeling after implant placement should be distinguished from bone loss due to subsequent infection. The presence of bacteria at the implant-abutment interface and its proximity to the bone may result in bone loss (Berglundh et al. 1991; Quirynen & van Steenberghe 1993; Jansen et al. 1997). The microbiota adhering to the implant surface results in an inflammatory response. The marginal bone is affected, which may be due to the absence of a periodontal ligament and a reduced number of fibroblasts and blood vessels (Zeza & Pilloni 2012; Wilson 2013).

Current guidelines for the diagnosis of peri-implantitis were determined in the seventh (Lang & Berglundh 2011) and eighth (Sanz & Chapple 2012) European Workshop on Periodontology. Peri-implantitis is characterized by increased depth of the peri-implant sulcus >4 mm; bleeding and/or suppuration on probing and marginal bone loss ≥2 mm, very often detected accidentally in radiographs during professional maintenance care, since pain does not seem to be a common phenomenon (Mombelli 1999; Lindhe et al. 2008; Lang & Berglundh 2011). If the apical osseointegration is maintained, the disease can progress without any notable signs of implant mobility (Mombelli & Lang 1998).

It is assumed that risk indicators associated with periodontal disease actively contribute to peri-implantitis, thus patients with increased susceptibility to periodontal disease, poor oral hygiene and smoking habits

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have been reported to display higher risk for peri-implantitis (Heitz-Mayfield 2008). Diabetes status at the time of implant placement also seems to be associated with peri-implantitis (Daubert et al. 2015) and should be considered a risk factor as well.

In order to optimize the long-term prognostic of the treatment with dental implants, there is a need for further analysis of the possible impacts of local and systemic factors on the prevalence of peri-implant diseases. Therefore, the aim of the present study was to identify the systemic and local risk indicators associated with the prevalence of peri-implantitis from a specific implant company.

Material and methods

Sample selection

The present study was approved by the ethics committee in human research – University of Sao Paulo - School of Dentistry - Brazil (n° 367.077). All patients signed a consent form authorizing clinical data collection and necessary interventions for the research. Patients treated with titanium implants (Implacil De Bortoli, Sao Paulo, Brazil) and implant-supported fixed prostheses installed from 1998 to 2012, at the Foundation for Scientific and Technological Development of Dentistry (FUNDECTO), at the University of Sao Paulo were asked to participate in the study. Implants were installed under strict aseptic conditions according to the manufacturer's protocol. All implants included in the study had to be at least 1 year in function and with its respective final restoration. Moreover, they had to present no mobility (Smith & Zarb 1989; Lekholm et al. 1999). The study was in accordance with the Helsinki Declaration of 1975, as revised in 2004.

Description of implants

Implants were made from commercially pure titanium bars. The implant body was blasted with titanium particles. A low roughness finishing of the surface was maintained at the implant neck. The following implant models from the same supplier (Implacil De Bortoli) were evaluated:

1. Cylindrical implant with internal hexagon connection: cylindrical body and self-screwed tapered apex;
2. Cylindrical implant with external hexagon connection: cylindrical body and self-screwed tapered apex;
3. Tapered implant with internal hexagon connection: conical body with internal hex connection. It displays micro-threads on its cervical region.
4. Tapered implant with external hexagon connection: conical body with external hex connection. It displays micro-threads on its cervical region.

Data collection and analyses

Systemic factors

Information about medical and behavioral patient history was obtained preoperatively and the patient's health status was assessed at the time of implant therapy. The information collected included: heart disorders, hypertension, smoking habits, alcoholism, liver disorders, hepatitis, gastrointestinal disease, diabetes mellitus I and II, hyperthyroidism or hypothyroidism, radiation therapy, chemotherapy, menopause, osteoporosis, active periodontal disease (PD), history of PD, and bruxism. Smoking habits were defined as current daily cigarette consumption (non-smoker, ≤10 or >10 cigarettes). Alcoholism has been defined as reporting of medical treatment for the condition. Patients considered as having active periodontal disease had to present PD >4 mm, loss of clinical attachment ≥2 mm and radiographic evidence of bone loss (Cionca et al. 2009). The history of periodontal disease was defined based on the clinical and radiographic records. Lost teeth, teeth with bone loss over five millimeters, mobility grade III and periodontal pocket >4 mm were used to define a history of periodontal disease. Patients who presented wear facets, complained about muscle pains or reported grinding during sleep were considered as bruxers (Canto et al. 2013).

Implant related factors

Implants' related factors included: implant location (anterior/posterior, maxilla, or mandible), implant diameter (<3.75, =3.75, >3.75); implant length (>8.5 and ≤8.5 mm); implant connection (external/internal hexagon); implant shape (cylindrical and tapered); type of antagonist (natural teeth, implant-supported prosthesis, dentures, missing teeth); use of a block graft at time of surgery (yes, no).

Prosthesis related factors and maintenance

Prostheses' related factors included: antagonist crown material (natural tooth, resin crown, ceramic crown, missing tooth); type of retention (cemented, screwed); artificial gingiva (absent, present); type of prosthesis (single, partial, total); coating material (acrylic, ceramic); coronal fracture (absent, present); screw failure (absent, present); time in function (≤5 years; >5 years); use of protection device (no, yes); hygiene difficulty as rated by the patient at the moment of data collection (low, medium, high); abutment (straight, angled) periodic maintenance care (yes - at least one prophylaxis per year, no – less than one per year or none).

Clinical parameters

The following clinical parameters were assessed during the follow-up visit:

1. The modified plaque index (MPi) according to Mombelli et al. (1987);
2. Sulcus bleeding index (SBi);
3. Probing depth (PD) in millimeters;
4. The bleeding on probing (BOP) (absent or present);
5. Keratinized tissue (KT) was measured in millimeters at the midpoint of the buccal site that had the mucogingival line as the apical limit. Differences in color, texture, and mobility served as markers for mucogingival junction detection. KM was categorized as absent; >0 and ≤2; and >2;
6. Marginal recession (MR) measured in mm on the mid-buccal area of the implant. The implant platform was considered as the cervical limit for marginal recession. Marginal recession was categorized as absent; >0 and ≤1; >1 and ≤2; and >2 mm.

Measurements for MPi, PD, BOP, and MR were obtained at six sites (disto-buccal, mid-buccal and mesio-buccal and disto-lingual, mid-lingual and mesio-lingual). All the clinical parameters were obtained using a periodontal probe (PCV12PT Hu-Friedy Inc., Chicago, IL, USA). A single and experienced examiner performed the measurements in order to reduce errors and establish reliability and consistency. Moreover, the greatest value was used for analysis. All prostheses containing artificial gingiva were removed prior to the clinical examination to permit data collection during the follow-up visit.

Radiographic analysis

Bone level changes were determined by means of digital periapical x-rays (EVO; Micro Imagem, Indaiatuba, Sao Paulo, Brazil) taken at the time of data collection. For each radiographic image, mesial and distal measurements were obtained from the implant/abutment interface to the first bone-to-implant contact. The greatest value was used

for each implant. Computer-assisted measurement was automatically provided by the Dental Master DICOM ® version 1.0 (Micro Imagem). Obtained images were compared with panoramic radiographs taken at the time of the abutment installation for bone level confirmation.

Diagnosis of peri-implantitis

Implants with the diagnosis of peri-implantitis had to present PD >5 mm, at least one point with bleeding/suppuration on probing and BL >2 mm (Figs 1 and 2). For PD, the highest value was considered.

Statistical analysis

A descriptive analysis on the number of implants and the frequency of peri-implantitis was performed for each factor. A generalized estimating equation (GEE) was used to evaluate the effect of independent variables for peri-implantitis. GEE was applied to explain the fact that repeated observations were available for a single patient. This technique considers the correlation among individuals within the same group (Zeger & Liang 1986). Odds ratio and confidence intervals (95%) were computed based on robust standard logistic regression GEE. The Wald test was also used to assess the significance of each factor. For categorical factors with more than two levels, *P* values were adjusted by the Holm method (1979).

Subsequently, a logistic regression was performed to assess the multi-factor effects that presented $P < 0.2$ in the univariate analysis. The dependent variable peri-implantitis was classified as present or absent for the multi-factor analysis. The IBM SPSS Statistics version 20 Software (Armonk, New York, USA) was used for this purpose.

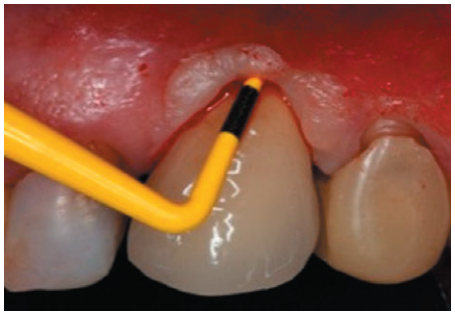

Fig. 1. Clinical probing depth. Observe its 8 mm of probing depth and bleeding on probing.

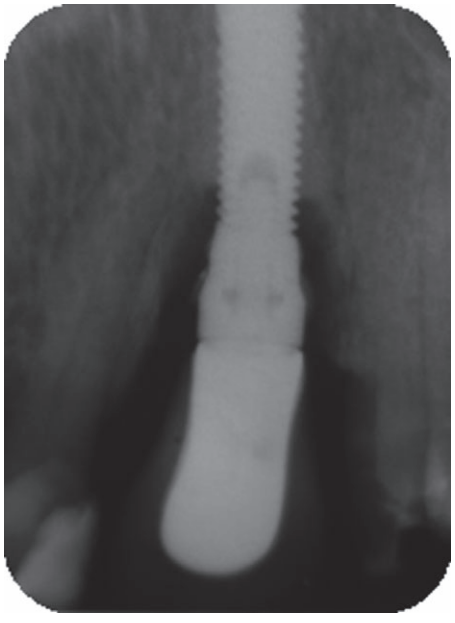

Fig. 2. Periapical x-ray. Observe peri-implant BL >2 mm onto the 3 first threads.

Results

A total of 183 patients (69 men and 114 women) rehabilitated with 938 implants were included in the study. Sixteen implants were lost during the follow-up and six were inactivated due to its bad positioning. The survival rate was defined as 98.3%. The age of the patients ranged from 27 to 89 years (mean of 59.3 years). This study evaluated implants with prosthetic restorations in function for a minimum of one and a maximum of 14 years (mean of 5.64). The distribution of implants according to time in function is depicted in Fig. 3.

The prevalence of peri-implantitis was 16.4% and 7.3% for patients and implants respectively. Systemic factors (Table 1) that according to the univariate analysis were selected for inclusion in the multi-factor analysis were heart disorders, smoking habits, hepatitis, gastrointestinal disease, diabetes, thyroid diseases, and a history of periodontal disease. Factors related to implant characteristics (Table 2) and surgical site that were found significantly related to peri-implantitis in the univariate analysis included posterior mandible, cylindrical implants, platform connection, and implant length.

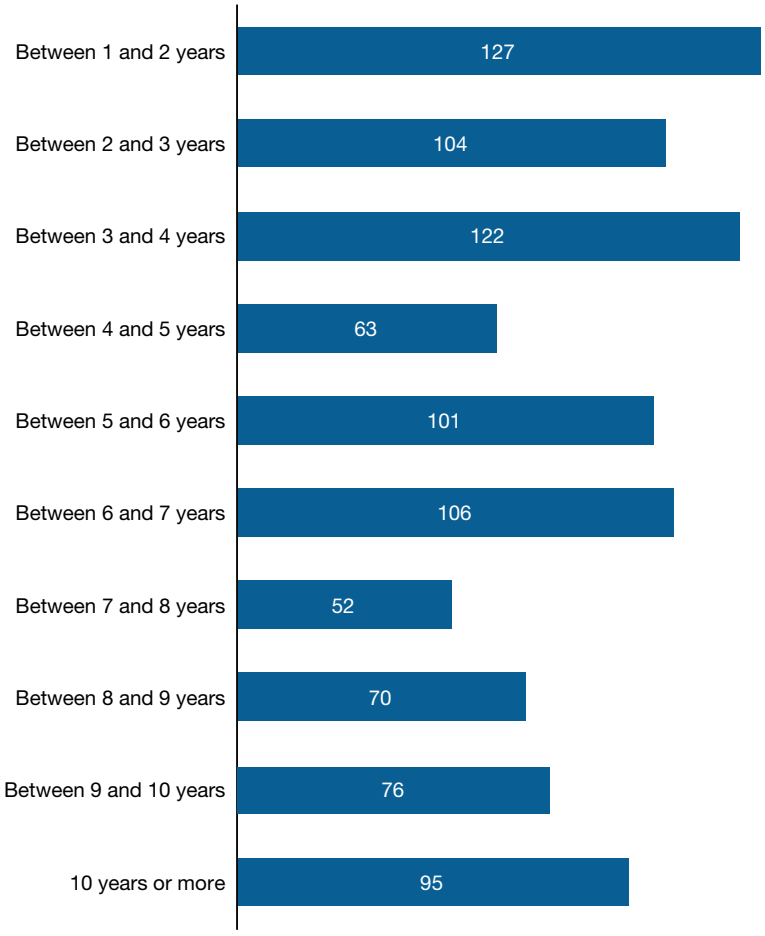

Fig. 3. Distribution of implants according to time in function.

Table 1. **Peri-implantitis distribution for patients and implants according to systemic factors**

	No				Yes				
	Patients		Implants		Patients		Implants		
	H (%)	PI (%)	H (%)	PI (%)	H (%)	PI (%)	H (%)	PI (%)	*P*
Heart disorders	143 (83.1)	29 (16.9)	796 (93.1)	59 (6.9)	10 (90.9)	1 (9.1)	53 (86.9)	8 (13.1)	0.012
Smoking habits	136 (84.0)	26 (16.0)	768 (93.0)	58 (7.0)	17 (81.0)	4 (19.0)	81 (90.0)	09 (10.0)	0.659
Hepatitis	145 (83.3)	29 (16.7)	803 (92.5)	65 (7.5)	07 (77.8)	2 (22.2)	46 (95.8)	2 (4.2)	0.052
Gastro disease	121 (82.9)	25 (17.1)	703 (92.0)	61 (8.0)	32 (86.5)	5 (13.5)	146 (96.0)	6 (3.9)	0.040
Diabetes	138 (82.6)	29 (17.4)	770 (92.8)	60 (7.2)	15 (93.8)	1 (6.2)	79 (91.9)	7 (8.1)	0.263
Thyroid	120 (80.5)	29 (19.5)	706 (91.8)	63 (8.2)	32 (94.1)	2 (5.9)	143 (97.3)	4 (2.7)	0.011
PD history	126 (84.0)	24 (16.0)	700 (93.7)	47 (6.3)	27 (81.8)	6 (18.2)	149 (88.2)	20 (11.8)	0.084

Table 2. **Peri-implantitis distribution regarding implants' characteristics and surgical site**

	Healthy (%)	PI (%)	*P* value
Location			
Anterior mandible	154 (95.65)	07 (04.35)	0.235
Posterior mandible	412 (93.21)	30 (06.79)	0.050
Anterior maxilla	114 (87.02)	17 (12.98)	0.324
Posterior maxilla	169 (92.86)	13 (07.14)	–
Diameter			
<3.75 mm	139 (93.92)	09 (06.08)	0.959
3.75 mm	530 (92.17)	45 (07.83)	0.419
>3.75 mm	180 (93.26)	13 (06.74)	–
Length			
<9 mm	732 (91.96)	64 (08.04)	0.087
≥9 mm	117 (97.50)	03 (02.50)	–
Connection			
HE	367 (91.75)	33 (08.25)	0.079
HI	482 (93.41)	34 (06.59)	–
Shape			
Cylindric	537 (93.88)	35 (06.12)	0.035
Tapered	312 (90.70)	32 (09.30)	–
Antagonist			
Natural tooth	466 (90.14)	51 (09.86)	0.085
Implant-supported	159 (92.44)	13 (07.56)	0.162
Full-denture	171 (98.84)	02 (01.16)	0.699
Absent	53 (98.15)	01 (01.85)	–

Table 3. **Peri-implantitis distribution regarding prosthetic characteristics**

	Healthy (%)	PI (%)	*P* value
Wear facets on the prosthetic crown			
No	741 (93.56)	51 (06.44)	0.024
Yes	108 (87.10)	16 (12.90)	–
Active periodontitis on the adjacent tooth			
No	777 (92.94)	59 (07.06)	0.139
Yes	72 (90.00)	08 (10.00)	–
Plaque accumulation on the adjacent tooth			
No	787 (92.48)	64 (07.52)	0.607
Yes	62 (95.38)	03 (04.62)	–
Modified plaque index			
0	281 (93.67)	19 (06.33)	0.865
1	348 (92.06)	30 (07.94)	0.524
2	140 (93.33)	10 (06.67)	0.517
3	80 (90.91)	08 (09.09)	–
Sulcus bleeding index			
0	614 (93.31)	44 (06.69)	0.350
1	134 (93.06)	10 (06.94)	0.173
2	94 (90.38)	10 (09.62)	0.017
3	07 (70.00)	03 (30.00)	–
Keratinized mucosa			
Ausente	279 (91.18)	27 (08.82)	0.181
>2 mm	176 (95.14)	09 (04.86)	0.936
≤2 mm	394 (92.71)	31 (07.29)	–
Recession			
Absent	524 (92.58)	42 (07.42)	0.593
≤1 mm	172 (93.99)	11 (06.01)	0.923
≤2 mm	74 (93.67)	05 (06.33)	0.982
>2 mm	79 (89.77)	09 (10.23)	–

Factors related to the maintenance and prosthetic restorations taken forward to the multi-level analysis were antagonist, system of retention, artificial gingiva, type of prosthesis, and periodic maintenance care. Wear facets on the prosthetic crown and sulcus-bleeding index was positively associated with peri-implantitis in the univariate analysis (Table 3).

In the multi-factor analysis, a positive relationship was found between peri-implantitis and a history of periodontal disease (OR: 2.2, 95% CI 1.2–4.1 $P = 0.043$), cemented prostheses (OR: 3.6, 95% CI 1.4–9.3 $P = 0.011$), prosthetic wear facets onto crown and dentures (OR: 2.4, 95% CI 1.2–4.8 $P = 0.032$). A positive relationship was also found between full-rehabilitations and peri-implantitis (OR: 16.1, 95% CI 5.3–48.7 $P > 0.001$) (Table 4).

Discussion

In this study, the prevalence of peri-implantitis was 16.4% and 7.3% for patients and implants respectively. This is consistent with the results presented in two recent systematic reviews. In one of these including a total of 1497 patients and 6283 implants, the prevalence of peri-implantitis was reported to be 18.8% for patients and 9.6% for implants (Atieh et al. 2012). Mombelli et al. (2012), in another systematic review, reported the prevalence of peri-implantis to be 20% for patients and 10% for implants. Smoking habits and history of periodontal disease were associated with a higher prevalence of peri-implantitis. The present study confirmed that peri-implantitis was associated with a history of periodontal disease. However, in the present study an association between smoking habits and peri-implantitis was not found.

In our study, in the univariate analysis, an association between irregular maintenance visits and the presence of peri-implantitis

Table 4. **Analyses of explanatory variables for the outcome event peri-implantitis**

Explanatory variable (implant level)	Outcome	Univariate analyses	Multivariate analyses	
	Yes/Total	*P*	OR (95% CI)	*P*
History of periodontal disease				
No	47/747	0.084	2.2 (1.2–4.1)	0.043
Yes	20/169			
System of retention				
Screwed	25/436	0.002	1.0*	0.011
Cemented	42/480		3.6 (1.4–9.3)	
Wear facets				
No	51/792	0.024	1.0*	0.032
Yes	16/124		2.4 (1.2–4.8)	
Type of prostheses				
Single	9/167	0.122	1.0*	>0.001
Partial	36/522	0.190	1.9 (0.9–4.2)	
Total	22/227		16.1 (5.3–48.7)	

was found. However, this association disappeared in the multi-factor analysis. This finding is in contrast with the findings by De Souza et al. 2013 that reported that frequent follow-up visits are useful for the prevention of peri-implantitis. One reason may be that the present study also included individuals who had short follow-up time after their implant treatment. The effects of an irregular maintenance most likely need a longer follow-up to have an impact on the development of peri-implantitis. Accordingly based on previous reports demonstrating that supportive periodontal therapy decrease the occurrence of peri-implantitis disease, it is of importance to inform the patients of the need of the supportive periodontal therapy in order to maintain long-term successful outcomes following implant therapy.

In the present study a history of periodontitis was found to increase the risk of peri-implantitis. This finding is in accordance with what has been reported previously by several authors (Roos-Jansåker et al. 2006; Karoussis et al. 2007; Quirynen et al. 2007; Ong et al. 2008; Renvert & Persson 2009; Roccuzzo et al. 2014).

This may be attributed to the presence of periodontal pathogens in the oral cavity (Leonhardt et al. 1999; Quirynen & Teughels 2003; Shibli et al. 2008; Heitz-Mayfield & Lang 2010; Meijndert et al. 2010). After installation and activation of implants, the bacteria rapidly colonize the implant surface (Fürst et al. 2007). The biofilm formation may be influenced by the bacteria present in the oral environment (Leonhardt et al. 1999) and teeth with adjacent bone loss at the time of implant installation have been reported to be a risk factor for peri-implantitis (Roos-Jansåker et al. 2006). Thus, the increased risk of peri-implantitis in periodontal patients may be related to sites that hold periodontal pathogens (Van Winkelhoff et al. 2002).

A genetic susceptibility for periodontal disease may also be an important factor for the development of peri-implantitis. Patients with an increased genetic susceptibility to develop periodontitis may accordingly also be more susceptible to develop peri-implantitis (Laine et al. 2006; Hamdy & Ebrahem 2011).

In our study, an association between peri-implantitis and diabetes mellitus was found in the univariate analysis. However, in the multi-factor analysis this association was no longer present. Diabetes status at the time of implant placement has, however, been associated with peri-implantitis in other papers (Ferreira et al. 2006; Daubert et al. 2015).

The reason for the discrepancy in results is unclear. One possible explanation would be related to follow-up time as in the paper of Daubert et al. (2015) where the mean follow-up time was 10.9 years as compared to 5.6 years in our study. On the other hand the follow-up time in the paper written by Ferreira et al. (2006) was shorter than in the present paper.

It also should be emphasized and stated that this topic is a limitation of our study, since glucose levels were not obtained at the moment of data collection. Information about diabetes were collected at the time of follow-up visit and obtained through the patient's chart.

In the present study, cemented prosthesis presented an increased risk (OR 3.6) of presenting peri-implantitis compared to screwed restorations. This finding is in agreement with other recent reports demonstrating that cementing the prostheses result in an increased risk of bone loss around implants. This is more likely due to the presence of residual cement in the peri-implant sulcus (Shapoff & Lahey 2012; Linkevicius et al. 2013). A systematic review and meta-analysis evaluated and compared peri-implant bone loss in cemented and screwed prostheses. It was reported that the mean marginal bone loss was 0.53 mm (0.31–0.76 mm) for cemented and 0.89 mm (0.45–1.33 mm) for screwed restorations.

The presence of wear facets onto the prosthetic crown was in the present study associated with an increased prevalence of peri-implantitis (OR 2.4). Wear facets are related to occlusal disfunction and may be associated with time in function, overload and/or parafunction. Although the issue of overload is controversial, a recent literature review reported overload to be associated with peri-implant bone loss (Fu et al. 2012).

In the present study, total rehabilitations with implants were found to increase the risk for peri-implantitis compared to single crown rehabilitations. This may be due to the difficulty (Schuldt Filho et al. 2014) to perform adequate oral hygiene around full-mouth implant supported constructions. The inability to perform oral hygiene has been reported as a factor related to peri-implantitis (Serino & Ström 2009). More than this, recent findings suggest that attention should be given to the use of dental floss in cases where the implant rough surface is exposed (Van Velzen et al. 2015).

Another possible reason may be that single crowns are placed in individuals with tooth loss due to trauma, failure of endodontic therapy, congenitally missing tooth and root fractures, whereas full mouth reconstructions may be placed in individuals with a history of periodontal disease and thus having a predisposition for an increased inflammatory response to the oral microflora. Regarding the oral microflora, systematic reviews and meta-analysis should be performed in order to elucidate whether specific micro-organisms play or not a key role for the progression of peri-implantitis.

This study evaluated implants from a single manufacturer and therefore factors like surface roughness or other implant characteristics could not be evaluated as risk indicators. A limitation of this study is the utilization of panoramic radiographies as baseline to evaluate bone loss, short observation time in some of the patients and the irregular distribution of the number of women and men recruited for the study.

The identification of risk factors is of importance for the prevention of peri-implantitis disease. Individuals presented with several risk indicators should be monitored more frequently to avoid the development of

peri-implantitis disease. Future prospective studies are required to confirm these factors as true risk factors. At last but not least, there is a need to improve the study of peri-implant disease in order to discover how local factors contribute to the development of peri-implant bone loss.

Conclusion

A history of periodontal disease, cemented prostheses, presence of wears facets on single crowns and full-mouth rehabilitations should be considered as risk indicators for peri-implantitis.

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