



Identification of Periodontal Pathogens in Healthy Periimplant Sites

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The documented high success rates of osseointegrated dental implants have led to their use as a common clinical protocol to reestablish oral health in subjects.¹⁻⁴ Nevertheless, the long-term maintenance of osseointegration depends on a large degree on the preservation of healthy marginal soft and hard periimplant tissues. Recently, biological complications, such as periimplant mucositis and periimplantitis, have been described in several studies.⁵⁻⁸

In 2008, the Sixth European Workshop on Periodontology of the European Academy of Periodontology at Ittigen, Switzerland, discussed issues related to periimplant disease. It was observed that the most common lesions that occur, ie, periimplant mucositis and periimplantitis are caused by bacteria. Although periimplant mucositis lesions reside in the soft tissues, periimplantitis also affects the supporting bone.⁹

The human oral cavity is inhabited by >600 species of bacteria, of which the majority are harmless.^{10,11} It has previously been estimated that at

Purpose: The aim of this study was to evaluate the presence of periodontopathogens in subgingival periimplant sites in partially edentulous patients using polymerase chain reaction procedures, with regard to areas with clinical and radiographic signs of health and areas presenting periimplant disease.

Materials and Methods: Thirty nonsmoking, partially edentulous patients, aged 30 to 76 years, were included in this study and divided in 3 groups according their clinical and radiographic characteristics. Group A (n = 10) presented periimplant health, group B (n = 10) presented periimplant mucositis, and group C (n = 10) were patients with periimplantitis. Periimplant tissues were clinically examined as regards the color of mucosae, presence of bacterial plaque, depth and bleeding on probing, and local suppuration. History of periodontal disease was also considered. Radiographic analysis evaluated the presence of bone loss around the

implant. Samples of periimplant crevicular fluid were collected to analyze the presence of periodontal pathogens, *Actinobacillus actinomycetemcomitans* (Aa), *Porphyromonas gingivalis* (Pg), *Prevotella intermedia* (Pi), *Tannerella forsythensis* (Tf), and *Treponema denticola* (Td).

Results: The results showed that the history of periodontal disease is associated with periimplant disease. The bacteria Aa, Pg, Pi, Td, and Tf were present in periimplant sites clinically and radiographically characterized, as healthy periimplant tissues, mucositis, and periimplantitis.

Conclusions: We concluded that Aa, Pg, Pi, Td, and Tf are present in healthy and diseased conditions. Therefore, these periodontal pathogens are not strictly related to periimplant disease sites. (*Implant Dent* 2011;20:226-235)

Key Words: periimplant disease, periodontal disease, polymerase chain reaction, bacteria

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least 400 species inhabit the subgingival region.¹²

The cause-and-effect relationship between bacterial plaque and the development of mucositis was also convincingly established for oral implants.^{7,13-15} Several investigations have endeavored to characterize the biofilm around dental implants by means of different techniques, including polymerase chain reaction (PCR), bacterial culturing, checkerboard

DNA-DNA hybridization technology, among others.¹⁶⁻¹⁸

Studies have shown that periimplant infection is associated with Gram-negative anaerobic species.¹⁷⁻¹⁹ During periimplant breakdown, a complex microbiota is established, closely resembling that found in adult periodontitis.^{20,21} According to previous studies, the microbiological profile at failing implants differs from that in healthy periimplant tissues. Au-

thors have related high levels of 5 periodontal pathogens in patients with periimplantitis, *Actinobacillus actinomycesetemcomitans* (Aa), *Porphyromonas gingivalis* (Pg), *Prevotella intermedia* (Pi), *Bacteroides forsythus* (Bf), and *Treponema denticola* (Td).^{19,22} In contrast, according to Mombelli *et al*¹⁸ and Ong *et al*,²³ Pg and spirochetes are almost never found in implants in an edentulous mouth even when signs of inflammation were present.

The divergence of results, the different clinical and laboratorial procedures for bacteria identification between authors and the fact that recent research⁹ claimed that periimplant mucositis occurs in ~80% of subjects (50% of sites) restored with implants, and periimplantitis in 28% to 56% of subjects (12%–40% of sites) stimulated our research group to identify the real presence of previously studied bacteria in sites presenting health and disease around implants, because we consider it extremely important to understand the disease process in periimplant tissues, to improve future treatment protocols involving periimplant disease.

The aim of the present study was to evaluate the presence of periodontopathogens in subgingival periimplant sites in partially edentulous patients using PCR procedures, with regard to areas with clinical and radiographic signs of health and areas presenting periimplant disease.

MATERIALS AND METHODS

Clinical study procedures were conducted according to Federal Fluminense University–School of Medicine Research Ethical Board recommendations (Registration Number CMM/HUAP 0061.0.258.000-07).

Clinical Procedure

Thirty nonsmokers partially edentulous patients (12 women and 18 men) with mean age 53 ± 11.8 years (range, 30–76 years), presenting a total of 130 osseointegrated endosseous implant (Titanium Fix Implants A.S.; São José dos Campos, São Paulo, Brazil), 80 in maxilla and 50 in mandible, without any systemic disease, were randomly selected for this study. All

patients signed a consent form after being informed of the nature of the study.

All periimplant regions were clinically and radiographically evaluated. From these, 1 periimplant region from each individual, 17 in maxilla, and 13 in mandible, was selected according to the following criteria: (1) in patients presenting just 1 implant this one was selected for clinical and laboratorial analysis; (2) in patients presenting >1 implant, the periimplant tissue presenting a clinical and/or radiographic signs of disease, compatible with mucositis or periimplantitis was selected to characterize the individual; (3) when all implants presented healthy conditions the implant closest to the midline was selected for analyses. Clinical examination of the periimplant sites consisted of visual inspection and palpation, analysis of gingival color, plaque accumulation, and implant mobility. History of periodontal disease was considered. The periimplant sulcus was carefully probed at 4 aspects of each implant and presence of bleeding and/or suppuration was recorded. Conventional periapical radiography, using a paralleling technique, measured the presence of vertical bone loss adjacent to the implants. The height of periimplant bone around the implant was recorded according to screw exposure. When >2 screw exposures were identified, it was considered as pathologic bone loss and it characterized periimplantitis.

According to the clinical and radiographic characteristics of the periimplant sites, patients were separated into 3 groups, each containing 10 individuals. Patients in group A (healthy sites: control group) showed no clinical signs of inflammation in the periimplant mucosa and no signs of bone loss. In group B, the periimplant sites characterized as periimplant mucositis, the presence of bleeding on probing, mucosa presenting red color and swelling, but no signs of pathologic bone loss were observed. Patients in group C (periimplantitis sites) showed clinical signs of inflammation, including implant mobility, suppuration in some cases, and radiographic signs of pathologic bone loss.

Microbiological Examination

A total of 120 subgingival microbial samples were collected from 30 patients. Supragingival plaque, if present, was removed. The area was dried and isolated with cotton rolls. Samples of periimplant crevicular fluid (PICF) were obtained by placing calibrated, volumetric microcapillary pipettes intracrevicularly. Pipettes in sites which did not express any volume of fluid and pipettes that were contaminated with blood/saliva were discarded. From each site, a standardized volume of 1 μ L was collected at 4 aspects, the pipette was immediately rinsed in 400 μ L of lysis solution (1M Tris/HCL pH 7.5; 0.5M EDTA pH 8.0; 3M NaCl) and then incubated at -20°C .

For DNA extraction, 5 μ L of proteinase K (10 mg/mL) (Sigma Chemical Co., St Louis, MO) and 40 μ L of SDS 10% were added, vortexed vigorously for 5 seconds, and incubated in water at 65°C for 45 minutes. After incubation, 450 μ L of cold phenol (pH 7.5) was added and centrifuged at 13,000 rpm at 4°C , for 2 minutes. The aqueous phase (top), containing DNA, was carefully transferred to a new tube. Cold chloroform:isoamyl alcohol (24:1) solution (1:1) was added and mixed gently for 1 minute. The solution was centrifuged at 13,000 rpm at 4°C for 2 minutes. Aqueous phase was transferred to a new microcentrifuge tube. Briefly, one tenth of the volume of 3M NaCl and twice the volume of cold absolute ethanol were added and centrifuged at 13,000 rpm at 4°C for 30 minutes to remove salts and small organic molecules. The supernatant was carefully removed and pellets were air dried. DNA was resuspended in 40 μ L of sterile distilled water. DNA quantification and purity analysis were achieved by spectrophotometry (Nanodrop Products, Wilmington, Delaware, NJ).

Nested PCR was used to detect periodontal pathogens. In the first amplification reaction, 1 μ L of DNA (100 ng DNA) was mixed with 20 μ L of Universal mix (0.8 μ L MgCl_2 50 mM; 2.5 μ L $10\times$ buffer; 0.2 μ L of 25 mM dNTPs with equimolar amounts of dTTP, dCTP, dGTP, and dATP; 0.1 μ L of primer 27F [25 mM]; 0.1 μ L of

Table 1. Laboratorial Protocol for Bacteria Identification

Nested PCR	Primers	5' → 3' Sequences	PCR Protocols	Size (bp)
First step	27F 1492R	AGA GTT TGA TCC TGG CTC AG TAC GGG TAC CTT GTT ACG ACT T	1 cycle 95°C (15 min); 35 cycles of 94°C (1 min); 60°C (1 min), 72°C (1.5 min); for final extension 72°C (10 min)	1505
Second step (specific primers)	<i>A. actinomycetemcomitans</i> <i>P. gingivalis</i> <i>P. intermedia</i> <i>T. denticola</i> <i>T. forsythensis</i>	CTCAGAGATGGGTTTGTGCC AGATTCACTCCCCATCGCTG GCGTATGCAACTTGCCTTAC GTTTCAACGGCAGGCTGAAC CGTGGACCAAAGATTCATCGGTGGA CCGCTTTACTCCCCAACAAA TAATACCGAATGTGCTCATTTACAT TCAAAGAAGCATTCCCTCTTCTTCTTA AAACAGGCGTTCCGCATGG CACCGCGGACTTAACAGC	1 cycle 95°C (15 min); 35 cycles of 94°C (1 min); 55°C (1 min), 72°C (1.5 min); for final extension 72°C (10 min)	273 518 259 426

Experimental conditions and universal (first step) and bacteria specific (second step) primer sequences for nested-polymerase chain reaction.

primer 1492R [25 mM]; 0.35 μ L of 2 U TaqDNA polymerases [Amersham Pharmacia Biotech AB, Uppsala, Sweden]).

The second amplification identified 5 microorganisms: *Actinobacillus actinomycetemcomitans* (Aa), *Porphyromonas gingivalis* (Pg), *Prevotella intermedia* (Pi), *Tannerella forsythensis* (Tf), and *Treponema denticola* (Td). One microliter of the final volume of the first amplification reaction was mixed with 20 μ L of each species-specific mix (0.4 μ L MgCl₂ 50 mM; 2.5 μ L 10 $\times$ buffer; 0.2 μ L of 25 mM dNTPs with equimolar amounts of dTTP, dCTP, dGTP, and dATP; 0.1 μ L of reverse primer for each bacteria [25 mM]; 0.1 μ L of forward primer for each bacteria [25 mM]; 0.35 μ L of 2 U TaqDNA polymerase [Amersham Pharmacia Biotech AB, Uppsala, Sweden]). Species-specific primers were based on the 16S rRNA gene sequence according to Mayanagi *et al.*²⁴

Six positive DNA controls were used from previous cell cultures for universal PCR and for each bacteria species. Additionally, 2 negative controls were also used: (1) from the result of the first negative control of DNA extraction of the first amplification, and (2) from reaction mixes of the negative control of the first PCR reaction of second amplifications.

All PCR amplifications were carried out with a MyGenie 96 Gradient Thermal Block (Bioneer Corporation, CA) under the conditions listed in Table 1. Reaction products were electro-

phoresed in 1.5% agarose gels, stained with ethidium bromide and photographed under ultraviolet light. A 100 bp DNA Ladder (Invitrogen Corp. Carlsbad, CA) was used as base pair marker.

Statistical Analysis

Individual patient data, including clinical, radiographic, and microbiological characteristics, were transcribed into a statistical software program for PC (SPSS version 12.0, SPSS Inc., Chicago, IL). The chi-square test was used to analyze the presence of each bacterium (Aa, Pg, Pi, Td, and Tf) within each group. The Cochran test was used to compare the presence of all bacteria among groups. The McNemar test was used to identify the difference in bacterial proportions, when present. Differences were considered significant when $P < 0.05$.

RESULTS

Table 2 shows the clinical and radiographic results in each group. Two patients (20%) with healthy periimplant tissues (group A) presented history of periodontal disease. Eight patients in group B (mucositis) and all patients in group C (periimplantitis) presented a history of periodontal disease. Bleeding on probing was observed in 2 patients in group A, showing clinical conditions of health. Plaque accumulation was present only in diseased periimplant tissues (groups B and C). The mean probing depth was $1.1 \pm$

0.6 mm, 2.9 ± 0.7 mm, and 4.2 ± 1.9 mm in groups A, B, and C, respectively. Five implants with periimplantitis presented complete bone loss around the implant and implant mobility.

The detection frequencies of target bacteria in subgingival periimplant sites for each group are shown in Table 3. The product of PCR amplification showed that there were no differences ($P > 0.05$) in the detection frequencies of the Aa, Pg, Pi, and Td within healthy and diseased groups. The chi-square test analysis showed that the proportion of bacteria Tf seemed to be lower in subgingival samples from group B than in groups A and C ($P > 0.05$). The McNemar test, with a level of significance $\alpha = 0.05$, allowed differences to be identified among groups, considering the total proportion of bacteria. As a result, the proportions showed that under healthy conditions, bacteria Pg (90%) are more expressive than bacteria Aa (30%).

The results showed the presence of 5 periodontal pathogens, Aa, Pg, Pi, Td, and Tf (Table 3), in periimplant sites clinically and radiographically characterized as healthy periimplant tissues, mucositis, and periimplantitis.

DISCUSSION

This study evaluated the presence of 5 bacteria (Aa, Pg, Pi, Td, and Tf) implicated in the etiopathogenesis of periodontal disease in subgingival periimplant sites, with regard to areas

Table 2. Clinical and Radiographic Results in Each Group

Groups	Patient	Age	Gender	PDH	BP	PD	Suppuration	Plaque	Mobility	Bone Loss
Group A (periimplant health)	A1	52	M	0	0	2.0	0	0	0	No
	A2	34	F	0	0	2.0	0	0	0	No
	A3	52	F	0	0	0.5	0	0	0	No
	A4	51	F	1	1	0.7	0	0	0	No
	A5	48	M	0	0	1.0	0	0	0	No
	A6	39	F	0	0	0.7	0	0	0	No
	A7	57	F	1	0	0.5	0	0	0	No
	A8	64	M	0	1	1.7	0	0	0	No
	A9	46	F	0	0	1.2	0	0	0	No
	A10	52	F	0	0	0.7	0	0	0	No
Group B (periimplant mucositis)	B1	56	F	1	1	3.5	0	1	0	No
	B2	44	M	1	1	2.8	0	1	0	No
	B3	62	M	0	1	4.5	0	0	0	No
	B4	70	M	1	1	2.5	0	1	0	No
	B5	64	M	1	1	2.7	0	0	0	No
	B6	46	F	1	1	2.2	1	0	0	No
	B7	54	F	1	1	2.3	0	1	0	No
	B8	57	M	1	1	3.0	1	1	0	No
	B9	30	F	1	1	3.0	0	0	0	No
	B10	45	F	0	1	2.0	0	1	0	No
Group C (periimplantitis)	C1	42	F	1	1	5.0	1	0	1	Total
	C2	57	F	1	1	3.5	0	1	1	Total
	C3	76	F	1	1	3.0	0	1	1	Total
	C4	68	F	1	1	2.0	1	1	0	4 screw exposure
	C5	66	F	1	1	3.0	1	1	1	Total
	C6	37	M	1	1	8.5	1	0	0	2 screw exposure
	C7	39	F	1	1	3.0	0	1	1	Total
	C8	58	M	1	1	4.0	1	1	0	6 screw exposure
	C9	55	M	1	1	6.0	1	1	0	6 screw exposure
	C10	76	M	1	1	4.0	0	1	0	2 screw exposure

F, female; M, male; PDH, periodontal disease history; BP, bleeding on probing; PD, probing depth (mean from 4 faces; in mm); score 0, absence; score 1, presence.

Table 3. Frequency of Each Bacterium in Groups A, B, and C

	Frequency of Bacteria				
	<i>A. actinomycetemcomitans</i>	<i>P. gingivalis</i>	<i>P. intermedia</i>	<i>T. denticola</i>	<i>T. forsythensis</i>
Group A (n = 10)	3	9	4	7	8
Group B (n = 10)	4	7	7	9	4
Group C (n = 10)	4	8	7	7	9
Total (n = 30)	11	24	18	23	21

with clinical and/or radiographic signs of health and areas presenting periimplant disease in 30 patients.

In our study, all patients were partially edentulous, in an attempt to understand the presence of cross infection between periodontal sites and periimplant sites. Previous studies detected high levels of periodontopathogens in failing and failed implants.^{19,22} However, there are still controversies in the literature. George *et al*²⁵ showed that the mere presence of *Pi*, *Pg*, and *Aa* was correlated with higher probing depth, more bleeding and a higher

gingival sulcus fluid rate. These 3 pathogens were also found in 60% of periimplant lesions,²⁶ and especially, the high levels of *Pi* and *Aa* were associated with failing implants.^{20,27} Botero *et al*²⁸ evaluated the subgingival microbiota using a culture method, observing significant differences between healthy and diseased tissues. In their study, *Pg* was found in diseased implants, but not in healthy regions. In 2002, Buchmann *et al*²⁹ claimed that the presence of *Aa* and *Pi* is not compatible with a healthy condition around implants. In contrast, our study

showed the presence of 5 periodontal pathogens, *Aa*, *Pg*, *Pi*, *Td*, and *Tf* (Table 3) in periimplant sites clinically and radiographically characterized as healthy periimplant tissues, mucositis, and periimplantitis. However, only in diseased sites were these pathogens detected at the same time. Our results indicate that the presence of these periodontal pathogens in periimplant sulci do not necessarily lead to destruction or even inflammatory symptoms, but a combination of factors, including genetic, inflammatory response, and occlusal overload is involved.

The divergence among authors and the fact that few differences were observed as a result of implant status suggest that pathogens other than those studied here may be involved in the implant disease process. This is consistent with the notion that many species can be found in the oral cavity and have not yet been identified.³⁰ Another important fact³¹ is the notion that the optimal bacterial sampling method has not as yet been established. In our study, we consider the PICF as a secure source for bacterial sampling, which is made possible with laboratory analysis by PCR for different species of bacteria. PICF is an osmotically mediated inflammatory exudate, and changes in flow rate and profile occur according to the condition of the periimplant tissues. Consequently, PICF analysis may help in detecting early metabolic and biochemical lesions that are not readily discernible, and in monitoring the osseointegration process and the bone response to occlusal loading, thereby improving the long-term success of implants.³²

Culture methods have been widely used in studies with the aim of characterizing the subgingival microflora. However, this method can only grow viable bacteria. Therefore, some of the putative pathogens, such as *Td* and *Tf*, are very fastidious and difficult to culture,³³ so that low numbers of a specific pathogen in a subgingival sample could be undetected.³⁴ In contrast, immunological assays for oral bacteria have shown a higher sensitivity and specificity for the detection of microorganisms, however, they require the use of monoclonal antibodies to assure high specificity, which are limited to the number of antibodies tested, in addition to the lack of controlled and clinical studies to validate this procedure.³⁵

Different chemical, enzymatic, or physical methods have been used in molecular biology to obtain DNA for subsequent analysis by means of either DNA probes or the PCR.^{35,36} The technique described in our study has successfully isolated DNA from minute quantities of fluids, such as PICF without requiring sophisticated laboratory equipment and expertise.

However, DNA purification from PICF can be a critical procedure due to the minute amount of fluid. Therefore, we developed a simplified phenol-chloroform-isoamyl protocol to facilitate DNA obtainment from PICF. A diagnosis and epidemiological survey based on DNA analysis as a key factor in planning and establishing disease treatment was considered.

Despite the risk indicators for periimplant disease, such as poor quality and quantity of bone and soft tissue, patient medical condition, unfavorable patient habits, inadequate surgical and prosthetic techniques and suboptimal implants, the causes of implant failure are still far from being understood.³⁷⁻³⁹ In our study, we considered periodontal disease history, probing depth, bleeding on probing, gender, age, and plaque accumulation as possible indicators for periimplant disease development. In addition, based on clinical observations, we suggest that periodontal disease history is highly related to this implant failure. We excluded smoking patients or patients with medical conditions that could affect bone healing, to study local factors only.

Other important point related to periimplant disease is correct diagnosis. In the present study, bleeding on gentle probing was present in 100% of periimplant disease sites; however, 2 healthy sites around implants presented bleeding although there were no clinical signs of inflammation. However, some studies have reported lower rates of periimplant bleeding on probing.^{40,41} A possible explanation for these differences pointed toward the probe force used in the probing procedures around implants. According to Ferreira *et al*,³ it has not been clearly defined whether periimplant BOP could represent a reliable parameter for the identification of the presence of periimplant disease. Our results suggest that the absence of periimplant BOP could indicate a stable periimplant condition, but the presence of BOP is not always related to diseased condition.

CONCLUSIONS

Based on our results, we concluded that a history of periodontal disease may predispose to the establishment of periimplant disease. Be-

sides, the bacteria *Aa*, *Pg*, *Pi*, *Tf*, and *Td*, were not correlated with periimplant disease status. These periodontal pathogens are present in healthy and diseased conditions. In addition, the PCR method and our protocol for DNA extraction from PICF, described in this study, was shown to be effective for identifying bacteria in subgingival sites, including *Td* and *Tf*, not susceptible to being detectable by culture methods. We suggest considering the technique used for microbial evaluation around implant, in addition to clinical and radiographic conditions as a way to standardize future treatment protocols involving periimplant disease.

Disclosure

The authors declare that they do not have any affiliation with any product or company.

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Abstract Translations

GERMAN / DEUTSCH

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Bestimmung parodontaler Pathogene bei gesunden Bereichen im das Implantat umlagernden Raum

ZUSAMMENFASSUNG: Zielsetzung: Die vorliegende Studie zielte darauf ab, das Vorhandensein von parodontalen Pathogenen in subgingivalen Bereichen rund um das Implantat herum bei zahnlosen Patienten zu bewerten. Dies sollte mittels PCR-Abläufen geschehen, die im Hinblick auf Bereiche mit klinischen und röntgenologischen Anzeichen einer Gesunderhaltung bzw. auf Bereiche mit vorliegender Erkrankung der Bereiche um das Implantat herum durchgeführt wurden. **Materialien und Methoden:** 30 nicht rauchende, teilweise zahnlose Patienten im Alter von 30 bis 76 Jahren nahmen an dieser Studie teil. Sie wurden gemäß der klinischen und röntgenologischen Eigenschaften in drei Gruppen eingeteilt. Gruppe A (n = 10) stand für Gesundheit rund um das Implantat herum, Gruppe B (n = 10) litt an Schleimhautentzündung im das Implantat umgebenden Gebiet und Gruppe C (n = 10) war aus Patienten mit Peri-Implantitis zusammengesetzt. Gewebe aus dem das Implantat umlagernden Gewebe wurden klinisch hinsichtlich der Farbe der Schleimhäute, dem Vorhandensein von bakteriellem Plaque, der Tiefe und Blutungsneigung bei Sondierung und lokaler Vereiterung untersucht. Auch die Historie einer parodontalen Erkrankung wurde überlegt. Eventueller Knochengewebsverlust um die Implantate herum wurde mittels Röntgenanalyse beurteilt. Es wurden Proben an Krevikularflüssigkeit aus dem Gebiet um die Implantate herum genommen, um darüber das Vorhandensein von parodontalen Pathogenen sowie ein Vorkommen des *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* und *Treponema denticola* nachzuweisen. **Ergebnisse:** Die Ergebnisse zeigten, dass die Historie einer parodontalen Erkrankung an eine Erkrankung des das Implantat umgebenden Gewebes gebunden ist. Die Bakterien *Aa*, *Pg*, *Pi*, *Td*, und *Tf* konnten klinisch und röntgenologisch in den Bereichen um die Implantate herum festgestellt werden und sie wurden als gesundes Gewebe um die Implantate herum, Mucositis oder Peri-Implantitis charakterisiert. **Schlussfolgerungen:** Wir schlussfolgern, dass sich *Aa*, *Pg*, *Pi*, *Td*, und *Tf* in gesunden sowie kranken Formen finden. Daher sind diese parodontalen Pathogene nicht zwingend mit Krankheitsherden rings um Implantate verknüpft.

SCHLÜSSELWÖRTER: Erkrankung im das Implantat umlagernden Gewebe, parodontale Erkrankung, Polymerase-Kettenreaktion, Bakterien

SPANISH / ESPAÑOL

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Identificación de patógenos periodónticos en sitios periimplante saludables

ABSTRACTO: Propósito: El objetivo de este estudio fue evaluar la presencia de patógenos periodónticos en sitios periimplante subgingivales en pacientes parcialmente sin dientes usando procedimientos PCR con respecto a áreas con indicaciones clínicas y radiográficas de salud y áreas que presentan enfermedades periimplante. **Materiales y métodos:** Treinta pacientes no fumadores parcialmente sin dientes, de 30 a 76 años de edad, participaron en este estudio y formaron tres grupos según sus características clínicas y radiográficas. El grupo A (n = 10) demostró salud periimplante, el grupo B (n = 10) demostró mucositis periimplante y el grupo C (n = 10) fueron pacientes con periimplantitis. Se examinaron clínicamente los tejidos periimplante con respecto al color de la mucosa, presencia de placa bacteriana, profundidad y sangrado ante el contacto y la supuración local. También se consideraron antecedentes en enfermedad periodóntica. El análisis radiográfico evaluó la presencia de la pérdida de hueso alrededor del implante. Se recolectaron muestras de líquido crevicular periimplante para poder analizar la presencia de los patógenos periodónticos *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* y *Treponema denticola*. **Resultados:** Los resultados demostraron que la historia de enfermedad periodóntica está asociada con la enfermedad periimplante. Las bacterias *Aa*, *Pg*, *Pi*, *Td*, y *Tf* estuvieron presentes clínica y radiológicamente en los sitios periimplantes caracterizada como tejido periimplante saludable, mucositis y periimplantitis. **Conclusiones:** Concluimos que *Aa*, *Pg*, *Pi*, *Td*, y *Tf* están presentes en situaciones de salud y enfermedad. Por lo tanto, estos patógenos periodónticos no se relacionan estrictamente con lugares de enfermedad periimplante.

PALABRAS CLAVES: Enfermedad periimplante, enfermedad periodóntica, reacción en cadena de polimerasa, bacteria

PORTUGUESE / PORTUGUÊS

AUTOR(ES): Priscila Ladeira Casado, PhD, Ivone Beatriz Otazu, PhD, Alex Balduino, PhD, Wallace de Mello, PhD, Eliane Porto Barboza, PhD, Maria Eugenia Leite Duarte, PhD

Identificação de Patógenos Periodontais em Locais de Peri-Implante Saudáveis

RESUMO: Objetivo: O objetivo deste estudo era avaliar a presença de periodontopatógenos em locais de peri-implante

subgingivais em pacientes parcialmente desdentados usando procedimentos de PCR, em relação a áreas com sinais clínicos e radiográficos de saúde e áreas que apresentam peri-implantite.

Material e métodos: Trinta pacientes desdentados não-fumantes, com idades entre 30 e 76 anos, foram incluídos neste estudo e divididos em três grupos de acordo com suas características clínicas e radiográficas. O Grupo A (n = 10) apresentou saúde do peri-implante, o grupo B (n = 10) apresentou mucosite do peri-implante e o grupo C (n = 10) era de pacientes com peri-implantite. Os tecidos do peri-implante foram analisados no que concerne à cor das mucosas, presença de placa bacteriana, profundidade e sangramento na sondagem e supuração local. O histórico de doença periodontal também foi considerado. A análise radiográfica avaliou a presença de perda óssea em torno do implante. Amostras de fluido crevicular peri-implante foram coletadas a fim de analisar a presença de patógenos periodontais, *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* e *Treponema denticola*. **Resultados:** Os resultados mostraram que o histórico de doença periodontal está associado a peri-implantite. As bactérias *Aa*, *Pg*, *Pi*, *Td*, e *Tf* estavam presentes em locais de peri-implante clínica e radiograficamente caracterizados, como tecidos de peri-implante saudáveis, mucosite e peri-implantite. **Conclusões:** Concluímos que *Aa*, *Pg*, *Pi*, *Td*, e *Tf* estão presentes em condições saudáveis e doentes. Portanto, esses patógenos periodontais não estão rigorosamente relacionados a locais de peri-implantite.

PALAVRAS-CHAVE: peri-implantite, doença periodontal, reação em cadeia da polimerase, bactérias

RUSSIAN / РУССКИЙ

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Идентификация периодонтальных патогенов в здоровых периимплантатных областях

РЕЗЮМЕ. Цель исследования. Цель данного исследования — оценка присутствия периодонтальных патогенов в поддесневых периимплантатных областях у пациентов с частичной адентией с применением методик ПЦР применительно к областям, которые по клиническим и рентгенографическим показателям можно отнести к здоровым, и областям, где присутствует периимплантатное заболевание. **Материалы и методы.** Тридцать некурящих пациентов с частичной адентией в возрасте от 30 до 76 лет были включены в это исследование и разделены на три группы в соответствии с клиническими и рентгенографическими показателями. Группа А (n=10) имела здоровые периимплантатные области,

группа В (n=10) имела периимплантатный мукозит, и в группу С (n=10) вошли пациенты с периимплантитом. Периимплантатные ткани были клинически обследованы в отношении цвета слизистых оболочек, наличия бактериального налета, глубины и наличия кровотечения при зондировании и наличия местного нагноения. Также учитывалось наличие периодонтального заболевания в анамнезе. При помощи рентгенографического исследования оценивалось наличие потери костной массы вокруг имплантата. Были собраны образцы десневой жидкости, чтобы проанализировать состав присутствующих периодонтальных патогенов: *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* и *Treponema denticola*. **Результаты.** Результаты показали, что периодонтальное заболевание в анамнезе связано с периимплантатным заболеванием. Бактерии *Aa*, *Pg*, *Pi*, *Td* и *Tf* присутствовали в периимплантатных областях, которые клинически и рентгенографически были характеризованы как здоровые периимплантатные ткани, ткани с мукозитом и с периимплантитом. **Выводы.** Был сделан вывод, что микроорганизмы *Aa*, *Pg*, *Pi*, *Td* и *Tf* присутствуют и на здоровых, и на пораженных тканях. Таким образом, эти периодонтальные патогены не строго соотносятся с областями, пораженными периимплантатными заболеваниями.

КЛЮЧЕВЫЕ СЛОВА: периимплантатное заболевание, периодонтальное заболевание, полимеразная цепная реакция, бактерии

TURKISH / TÜRKÇE

YAZARLAR: Priscila Ladeira Casado, PhD, Ivone Beatriz Otazu, PhD, Alex Balduino, PhD, Wallace de Mello, PhD, Eliane Porto Barboza, PhD, Maria Eugenia Leite Duarte, PhD

Sağlıklı Peri-İmplant Yerlerinde Periodontal Patojenlerin Tanımlanması

ÖZET: Amaç: Bu çalışmanın amacı, PCR prosedürlerini kullanarak kısmen dişsiz hastalarda sub-gingival peri-implant yerlerinde klinik ve radyografik bulgulara göre sağlıklı alanlar ile peri-implant hastalığı olan alanlarda periodontal patojenlerin varlığını araştırmaktır. **Gereç ve Yöntem:** Sigara içmeyen, yaşları 30 ile 76 arasında değişen, kısmen dişsiz 30 hasta çalışmaya dâhil edildi ve klinik ve radyografik özelliklerine göre üç gruba ayrıldı. Grup A (n = 10) peri-implant sağlığını temsil ederken, Grup B (n = 10) peri-implant mucozit ve Grup C (n = 10) ise peri-implantit grupları olarak tespit edildi. Peri-implant dokuları mukozanın rengi, bakteriyel plak varlığı, sonda ile yoklama esnasında derinlik ve kanama ve yerel süpürasyon açılarından klinik olarak incelendi. Periodontal hastalık öyküsü de göz önüne alındı.

Radyografik analiz, implantın etrafındaki kemik kaybını değerlendirdi. *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* ve *Treponema denticola* gibi periodontal patojenlerin varlığını araştırmak üzere peri-implant cep sıvısının örnekleri alındı. **Bulgular:** Elde edilen sonuçlar, periodontal hastalık öyküsünün peri-implant hastalığı ile bağlantılı olduğunu gösterdi. *Aa*, *Pg*, *Pi*, *Td*, ve *Tf* bakterileri, klinik ve radyografik olarak sağlıklı peri-implant

dokusu, mukozit ve peri-implantit olarak karakterize edilen peri-implant yerlerinde mevcuttu. **Sonuç:** *Aa*, *Pg*, *Pi*, *Td*, ve *Tf* bakterilerinin sağlıklı ve hasta durumlarda mevcut olduğu sonucuna vardık. Bu nedenle, bu periodontal patojenler sadece peri-implant hastalığının olduğu yerlerle ilişkili değildir.

ANAHTAR KELİMELEER: peri-implant hastalığı, periodontal hastalık, polimeraz zincir reaksiyonu, bakteri

JAPANESE / 日本語

健常インプラント周囲溝における歯周病原菌の検証

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研究概要:

目的: 当研究の狙いは臨床およびレントゲン画像検査で健常を示す部位とインプラント周囲炎を示す部位について、部分無歯症患者の歯肉下インプラント周囲溝における歯周病原菌の存在をPCR法を用いて調査することである。

素材と方法: 非喫煙者で部分無歯症の30歳から76歳までの患者30名を当研究対象とし、臨床ならびにレントゲン診断の指標に従って3つのグループに分類した: グループA (n=10) は健常インプラント周囲溝を呈する患者。グループB (n=10) はインプラント周囲粘膜炎症患者。グループC (n=10) はインプラント周囲炎患者である。インプラント周囲溝組織は粘膜の色と細菌膜の存在、またプロービングの深さと出血さらに局部的化膿に関して臨床検査をおこない歯周病の病歴も考慮した。さらにレントゲン分析調査でインプラント周辺骨吸収を評価した。次に示す歯周病原菌の常在を分析調査する目的でインプラント周囲溝滲出液試料を採取した。アクチノバチルス・アクチノミセテムコミタンス (*Actinobacillus actinomycetemcomitans*), ポルフィロモナス・ジンジバリス (*Porphyromonas gingivalis*), プレボテラ・インテルメディア (*Prevotella intermedia*), タンネレラ・フォーサイセンシス (*Tannerella forsythensis*), トレポネマデンティコラ (*Treponema denticola*) の以上である。

結果: 結果は歯周病の病歴がインプラント周囲炎と関連することを明らかにした。次の細菌 (*Aa*, *Pg*, *Pi*, *Td*, *Tf*) は臨床ならびにレントゲン検査で健常インプラント周囲溝組織、また粘膜炎あるいはインプラント周囲炎と見なされたインプラント周囲溝組織に常在する。

結論: 歯周病原菌 (*Aa*, *Pg*, *Pi*, *Td*, *Tf*) は健常と罹病の双方の状態に常在しているという結論に達した。従って、歯周病原菌の存在はインプラント周囲溝の罹病部位だけに厳重に限られているものではない。

キーワード: インプラント周囲溝疾患、歯周疾患、ポリメラーゼ連鎖反応、細菌

CHINESE / 中国語

辨識健康植體周圍部位的牙周致病菌

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摘要：

目的：本研究旨在使用聚合酶連鎖反應 (PCR) 程序評估局部缺牙患者，瞭解其齒齦下植體周圍部位出現牙周致病菌與臨床和 X 光攝影顯示健康徵兆之區域及出現植體周圍疾病牙周致病菌區域的關係。

資料與方法：本研究包括 30 位不吸菸、年齡 30 至 76 歲的局部缺牙患者，並根據臨床和 X 光攝影特徵將患者分成三組。A 組 (n=10) 的植體周圍健康，B 組 (n=10) 出現植體周圍黏膜炎，C 組 (n=10) 患者則出現植體周圍炎。臨床檢驗植體周圍組織的黏膜顏色、是否出現牙菌斑、探測深度和出血，以及局部化膿。牙周病史也納入考量。X 光攝影分析評估是否出現植體周圍骨質流失。採集植體周圍齦溝液以分析是否出現牙周致病菌 *Actinobacillus actinomycetemcomitans* (Aa)、*Porphyromonas gingivalis* (Pg)、*Prevotella intermedia* (Pi)、*Tannerella forsythensis* (Tf) 和 *Treponema denticola* (Td)。

結果：結果顯示，牙周病史與植體周圍疾病有關。根據臨床和 X 光攝影特徵分類的健康植體周圍組織、黏膜炎和植體周圍炎的植體周圍部位，都出現 Aa、Pg、Pi、Td 和 Tf 細菌。

結論：我們的總結是，無論是健康和患病的情況都會出現 Aa、Pg、Pi、Td 和 Tf。因此，嚴格來說這些牙周致病菌與植體周圍疾病部位並無相關。

關鍵字：植體周圍疾病、牙周病、聚合酶連鎖反應、細菌

KOREAN / 한국어

건강한 임플란트 주변 부위에서 치주 병원체의 식별

저자：Priscila Ladeira Casado, PhD, Ivone Beatriz Otazu, PhD, Alex Balduino, PhD, Wallace de Mello, PhD, Eliane Porto Barboza, PhD, Maria Eugenia Leite Duarte, PhD

요약:

목적：본 시험의 목적은 임플란트 주변 질환 발현 부위와 건강한 부위의 임상적 및 방사선학적 징후가 있는 부위와 관련하여, 부분 무치악 환자의 치은하(subgingival) 임플란트 주변 부위에서 치주병원체의 존재를 PCR 절차를 이용하여 평가하기 위함이었다.

재료 및 방법：30-76세 연령의 비흡연, 부분 무치악 환자 30명이 본 시험에 포함되었으며 이들은 임상적 및 방사선학적 특성에 따라 세 군으로 나뉘었다. A군(n=10)은 임플란트 주변이 건강했으며, B군(n=10)은 임플란트 주변 점막염이, 그리고 C군(n=10)은 임플란트 주위 염이 있었다. 임플란트 주변 조직을 점막의 색상, 세균 플라크의 존재, 탐침(probing)의 깊이 및 출혈 그리고 국소 화농과 관련하여 임상적으로 검사하였다. 방사선분석 결과 임플란트 주변의 골 손실을 평가하였다. 치주 병원체, *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythensis* 및 *Treponema denticola*의 존재 분석을 위해 임플란트 주변 열구액(crevicular fluid) 검체를 채취하였다.

결과：시험 결과 치주질환 병력은 임플란트 주변 질환과 관련된 것으로 나타났다. 임상 및 방사선 검사에서 Aa, Pg, Pi, Td 및 Tf 세균이 건강한 임플란트 주변 조직, 점막염 및 임플란트 주변염증 부위에서 임플란트 주변에 존재하였다.

결론：우리는 건강한 상태 및 질환 상태에서 Aa, Pg, Pi, Td 및 Tf 이 존재하는 것으로 결론지었다. 따라서, 이들 치주 병원체는 임플란트 주변 질환 부위와 엄밀한 관련이 있는 것은 아니다.

키워드：임플란트 주변질환, 치주 질환, 중합효소연쇄반응, 세균