Biomaterial and antibiotic strategies for peri-implantitis: a review.

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Abstract

Dental implants have 89% plus survival rates at 10-15 years, but peri-implantitis or dental implant infections may be as high as 14%. Peri-implantitis can limit clinical success and impose health and financial burdens to patients and health providers. The pathogenic species associated with periodontitis (e.g., Fusobacterium ssp, A. actinomycetemcomitans, P. gingivalis) are also associated with peri-implantitis. Incidence of peri-implantitis is highest within the first 12 months after implantation, and is higher in patients who smoke or have poor oral health as well as with calcium-phosphate-coated or surface-roughened implants. Biomaterial therapies using fibers, gels, and beads to deliver antibiotics have been used in the treatment of Peri-implantitis though clinical efficacy is not well documented. Guided tissue regeneration membranes (e.g., collagen, poly-lactic/glycolic acid, chitosan, ePTFE) loaded with antimicrobials have shown success in reosseointegrating infected implants in animal models but have not been proven in humans. Experimental approaches include the development of anti-bioadhesion coatings, coating surfaces with antimicrobial agents (e.g., vancomycin, Ag, Zn) or antimicrobial releasing coatings (e.g., calcium phosphate, polylactic acid, chitosan). Future strategies include the development of surfaces that become antibacterial in response to infection, and improvements in the permucosal seal. Research is still needed to identify strategies to prevent bacterial attachment and enhance normal cell/tissue attachment to implant surfaces.

Comparative biology of chronic and aggressive periodontitis vs. peri-implantitis.


Heitz-Mayfield LJ, Lang NP.

Abstract

This review was undertaken to address the similarities and dissimilarities between the two disease entities of periodontitis and peri-implantitis. The overall analysis of the literature on the etiology and pathogenesis of periodontitis and peri-implantitis provided an impression that these two diseases have more similarities than differences. First, the initiation of the two diseases is dependent on the presence of a biofilm containing pathogens. While the
microbiota associated with periodontitis is rich in gram-negative bacteria, a similar composition has been identified in peri-implant diseases. However, increasing evidence suggests that S. aureus may be an important pathogen in the initiation of some cases of peri-implantitis. Further research into the role of this gram-positive facultative coccus, and other putative pathogens, in the development of peri-implantitis is indicated. While the initial host response to the bacterial challenge in peri-implant mucositis appears to be identical to that encountered in gingivitis, persistent biofilm accumulation may elicit a more pronounced inflammatory response in peri-implant mucosal tissues than in the dentogingival unit. This may be a result of structural differences (such as vascularity and fibroblast-to-collagen ratios). When periodontitis and peri-implantitis were produced experimentally by applying plaque-retaining ligatures, the progression of mucositis to peri-implantitis followed a very similar sequence of events as the development of gingivitis to periodontitis. However, some of the peri-implantitis lesions appeared to have periods of rapid progression, in which the infective lesion reached the alveolar bone marrow. It is therefore reasonable to assume that peri-implantitis in humans may also display periods of accelerated destruction that are more pronounced than that observed in cases of chronic periodontitis. From a clinical point of view the identified and confirmed risk factors for periodontitis may be considered as identical to those for peri-implantitis. In addition, patients susceptible to periodontitis appear to be more susceptible to peri-implantitis than patients without a history of periodontitis. As both periodontitis and peri-implantitis are opportunistic infections, their therapy must be antiinfective in nature. The same clinical principles apply to debridement of the lesions and the maintenance of an infection-free oral cavity. However, in daily practice, such principles may occasionally be difficult to apply in peri-implantitis treatment. Owing to implant surface characteristics and limited access to the microbial habitats, surgical access may be required more frequently, and at an earlier stage, in periimplantitis treatment than in periodontal therapy. In conclusion, it is evident that periodontitis and peri-implantitis are not fundamentally different from the perspectives of etiology, pathogenesis, risk assessment, diagnosis and therapy. Nevertheless, some difference in the host response to these two infections may explain the occasional rapid progression of peri-implantitis lesions. Consequently, a diagnosed peri-implantitis should be treated without delay.

Microbiota around root-form endosseous implants: a review of the literature.

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Abstract

Although high success rates for root-form endosseous implants have been reported, failures occasionally occur, and these implants must be removed. At least 10% of the failures have been suggested to be the result of peri-implantitis. There is some evidence that periodontal pathogens, mainly those belonging to the group of gram-negative anaerobic rods, play a role in the etiology of peri-implantitis. This article provides an overview of the literature associated with common peri-implant microbiology and an assessment as to whether bacteria associated with periodontitis exert a possible risk for peri-implant tissue breakdown. The peri-
Implant area is colonized by a large variety of oral microbial complexes. The microflora of the oral cavity prior to implant placement determines the composition of the microflora in the peri-implant area. Implants involved in peri-implantitis are colonized with large amounts of gram-negative anaerobic bacteria, including Fusobacteria, spirochetes, Bacteroides forsythus, and "black-pigmented bacteria" such as Prevotella intermedia, Prevotella nigrescens, and Porphyromonas gingivalis. Also, Actinobacillus actinomycetemcomitans can be isolated from these lesions. Thus, the microflora of peri-implantitis lesions resembles that of adult or refractory periodontitis. However, the presence of periodontal pathogens does not always lead to a destructive process. Therefore, the etiologic role of specific microorganisms in implant failure related to infection is still not resolved. Controversy remains as to whether organisms recovered from the original microflora cause the failure (and if so to what extent) or merely result from the infection. Nevertheless, there is accumulating evidence that bacteria cause the disease, while the individual's genetic makeup and environmental influences determine the severity of the disease.

**Actinobacillus actinomycetemcomitans-associated peri-implantitis in an edentulous patient. A case report.**

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**Abstract**

**BACKGROUND:** Peri-implantitis is a risk factor for implant loss. Late bacterial infection of the peri-implant tissues and loss of alveolar bone in edentulous patients is caused by commensal oral anaerobic bacteria. In partially edentulous patients, Porphyromonas gingivalis and occasionally *Actinobacillus actinomycetemcomitans* are associated with peri-implantitis lesions.

**AIMS:** To investigate the microbiology of a peri-implantitis case in an edentulous patient.

**METHODS:** Anaerobic culture techniques and selective culture techniques for *A. actinomycetemcomitans* were used to study the peri-implant microflora at sites with and without bone loss.

**RESULTS:** An anaerobic peri-implant microflora with several putative periodontal pathogens was found at sites with bone loss. Furthermore, a metronidazole-resistant *A. actinomycetemcomitans* was isolated. The *A. actinomycetemcomitans* infection did not respond to systemic doxycycline therapy, despite good susceptibility in vitro.

**CONCLUSIONS:** The present case of severe *A. actinomycetemcomitans*-associated peri-implantitis shows the importance of pre-operative infection control. The findings...
in this case show that remaining teeth affected by periodontitis can be a serious risk factor for peri-implantitis.

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### Early colonization of dental implants by putative periodontal pathogens in partially edentulous patients.

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#### Abstract

There is limited scientific information available on the early colonization of the peri-implant pockets in partially edentulous individuals. Knowledge about this process is one step in better understanding the etiology and pathogenesis of peri-implantitis. In this study, the early colonization of the peri-implant pockets by putative periodontal pathogens was studied in 20 partially edentulous individuals using anaerobic culture techniques. At baseline, the presence and levels of putative periodontal pathogens in the microflora of periodontal pockets and saliva were established. Immediately after loading of the titanium implants and after 6 and 12 months the presence and levels of selected putative periodontal pathogens were determined in periodontal and peri-implant pockets. A second aim was to detect bacterial contamination of the implant site and the inside of the implant. At baseline, the most frequently isolated species from the periodontal pockets were Fusobacterium nucleatum, Prevotella intermedia and Peptostreptococcus micros. Bacteroides forsythus, Actinobacillus actinomycetemcomitans and Porphyromonas gingivalis were isolated from 9, 2 and 3 patients respectively. Six months after placing of the bridges, the majority of the implant sites had detectable levels of most periodontal bacterial species with the exception of A. actinomycetemcomitans which could not be isolated from any of the peri-implant samples during the experimental period, although 2 patients had this organism at baseline. In 2 patients with detectable subgingival P. gingivalis at baseline this species was found after 12 months in the peri-implant sites. One of these patients lost 2 implants which was associated with a high proportion of P. gingivalis in the peri-implant pockets. A second patient developed 2 fistulas around 2 implants at 8 months and this event was also associated with the presence of P. gingivalis. It is concluded that proper periodontal infection control before installment of dental implants in partially edentulous patients may prevent early bacterial complications.
Transmission of periodontal disease-associated bacteria from teeth to osseointegrated implant regions.

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Abstract

PURPOSE: The presence of periodontopathic bacteria is a risk factor for peri-implantitis. The present study examined colonization by periodontopathic bacteria and their transmission from periodontal pockets to osseointegrated implant sulcus.

MATERIALS AND METHODS: Plaque samples were collected from 105 sites in the 15 patients who participated in the study. Colonization by these bacteria was examined by polymerase chain reaction (PCR) and culture. The transmission of periodontopathic bacteria from periodontal sites of natural teeth to the implant sulcus was analyzed by pulsed field gel electrophoresis (PFGE).

RESULTS: The PCR detection rates of Porphyromonas gingivalis, Prevotella intermedia, Actinobacillus actinomycetemcomitans, Bacteroides forsythus, and Treponema denticola were 80.0%, 53.3%, 46.7%, 60.0% and 40.0%, respectively. Colonizations by P gingivalis and A actinomycetemcomitans were statistically correlated with periodontal pockets and implant sulcus regions (P < .01). The PFGE patterns of the P gingivalis strains isolated from each patient were identical, but differed from those from other patients. The PFGE patterns of P intermedia strains were identical in 2 out of 3 patients.

DISCUSSION: These analyses indicated that there appeared to be transmission of P gingivalis and P intermedia from the periodontal pocket to the peri-implant region.

CONCLUSION: Elimination of these periodontal pathogens from the patient's oral cavity before administering dental implant treatment may inhibit colonization by these pathogens and reduce the risk of peri-implantitis.

Osseointegrated implants in patients treated for generalized chronic periodontitis and generalized aggressive periodontitis: 3- and 5-year results of a prospective long-term study.

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Abstract

BACKGROUND: The successful use of osseointegrated implants in periodontally healthy patients has been documented in numerous longitudinal studies in recent years. However,
the extent to which these positive results apply to periodontally diseased patients remains unclear. The aim of the present prospective longitudinal study of partially edentulous patients treated for generalized chronic periodontitis and generalized aggressive periodontitis was a clinical, microbiological, and radiographic comparison of teeth and implants and assessment of the implant success rate.

METHODS: Five partially edentulous patients treated for generalized aggressive periodontitis (GAgP) and 5 treated for generalized chronic periodontitis (GCP) were enrolled in this study. The GAgP patients received 36 implants, and the GCP patients 12 implants. The teeth were examined 2 to 4 weeks before extraction of the non-retainable teeth (baseline), and 3 weeks after insertion of the final abutments (second examination). All further examinations were performed during a 3-month recall schedule over a 5-year period for the GAgP patients and over a 3-year period for the GCP patients. At each session clinical parameters were recorded at teeth and implants and the composition of the subgingival microflora was determined by dark-field microscopy and DNA analysis. Intraoral radiographs of the teeth and implants were taken for control purposes at baseline; after insertion of the superstructure; and 1, 3, and 5 years later.

RESULTS: The clinical findings indicated healthy periodontal and peri-implant conditions in both patient groups throughout the study. However, an increased probing depth and an attachment loss were recorded in the GAgP patients after the third year (P<0.001). The distribution of the microorganisms revealed no significant differences between the patient groups or between implants and teeth. Moderate bone loss at teeth and implants was registered in both groups. The success rates recorded were 100% in the GCP patients and 88.8% (maxilla: 85.7%; mandible: 93.3%) in the GAgP patients.

CONCLUSIONS: The 3-year and 5-year follow-ups show that osseointegrated implants may be successful in oral rehabilitation of partially edentulous patients treated for generalized aggressive periodontitis and generalized chronic periodontitis. However, as no significant differences were recorded between conditions at teeth and at implants, progression of the disease cannot be ruled out.

Do periodontopathogens disappear after full-mouth tooth extraction?

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Abstract

AIM: To monitor the intra-oral microbiological changes after full-mouth extraction using quantitative polymerase chain reaction (qPCR).

MATERIAL AND METHODS: Nine patients with severe, aggressive periodontitis, for whom a full-mouth tooth extraction was the only remaining treatment option were recruited. Before and 6 months after extraction, microbial samples were obtained (tongue, saliva and subgingival plaque) and analysed by qPCR.
RESULTS: The elimination of subgingival niches, by extraction of all natural teeth, resulted in a 3-log reduction of Porphyromonas gingivalis and Tannerella forsythia, and more modest reductions of Aggregatibacter actinomycetemcomitans and Prevotella intermedia. However, the detection frequencies of these periodontopathogens in saliva and on the tongue remained unchanged after full-mouth tooth extraction.

CONCLUSION: In contrast to what has been believed so far, full-mouth tooth extraction does not result in eradication of all periodontopathogens but only in a significant reduction. The clinical consequences of this observation remain speculative.

Infectious risks for oral implants: a review of the literature.
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Abstract

The use of oral implants in the rehabilitation of partially and fully edentulous patients is widely accepted even though failures do occur. The chance for implants to integrate can for example be jeopardised by the intra-oral presence of bacteria and concomitant inflammatory reactions. The longevity of osseointegrated implants can be compromised by occlusal overload and/or plaque-induced peri-implantitis, depending on the implant geometry and surface characteristics. Animal studies, cross-sectional and longitudinal observations in man, as well as association studies indicate that peri-implantitis is characterised by a microbiota comparable to that of periodontitis (high proportion of anaerobic Gram-negative rods, motile organisms and spirochetes), but this does not necessarily prove a causal relationship. However, in order to prevent such a bacterial shift, the following measures can be considered: periodontal health in the remaining dentition (to prevent bacterial translocation), the avoidance of deepened peri-implant pockets, and the use of a relatively smooth abutment and implant surface. Finally, periodontitis enhancing factors such as smoking and poor oral hygiene also increase the risk for peri-implantitis. Whether the susceptibility for periodontitis is related to that for peri-implantitis may vary according to the implant type and especially its surface topography.

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Collaborators (13)
Abstract

Issues related to peri-implant disease were discussed. It was observed that the most common lesions that occur, i.e., peri-implant mucositis and peri-implantitis are caused by bacteria. While the lesion of peri-implant mucositis resides in the soft tissues, peri-implantitis also affects the supporting bone. Peri-implant mucositis occurs in about 80% of subjects (50% of sites) restored with implants, and peri-implantitis in between 28% and 56% of subjects (12-40% of sites). A number of risk indicators were identified including (i) poor oral hygiene, (ii) a history of periodontitis, (iii) diabetes and (iv) smoking. It was concluded that the treatment of peri-implant disease must include anti-infective measures. With respect to peri-implant mucositis, it appeared that non-surgical mechanical therapy caused the reduction in inflammation (bleeding on probing) but also that the adjunctive use of antimicrobial mouthrinses had a positive effect. It was agreed that the outcome of non-surgical treatment of peri-implantitis was unpredictable. The primary objective of surgical treatment in peri-implantitis is to get access to the implant surface for debridement and decontamination in order to achieve resolution of the inflammatory lesion. There was limited evidence that such treatment with the adjunctive use of systemic antibiotics could resolve a number of peri-implantitis lesions. There was no evidence that so-called regenerative procedures had additional beneficial effects on treatment outcome.

Comparison of bacterial plaque samples from titanium implant and tooth surfaces by different methods.

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Abstract

Studies have shown similarities in the microflora between titanium implants or tooth sites when samples are taken by gingival crevicular fluid (GCF) sampling methods. The purpose of the present study was to study the microflora from curette and GCF samples using the checkerboard DNA-DNA hybridization method to assess the microflora of patients who had at least one oral osseo-integrated implant and who were otherwise dentate. Plaque samples were taken from tooth/implant surfaces and from sulcular gingival surfaces with curettes, and from gingival fluid using filter papers. A total of 28 subjects (11 females) were enrolled in the study. The mean age of the subjects was 64.1 years (SD+/-4.7). On average, the implants studied had been in function for 3.7 years (SD+/-2.9). The proportion of Streptococcus oralis (P<0.02) and Fusobacterium periodonticum (P<0.02) was significantly higher at tooth sites (curette samples). The GCF samples yielded higher proportions for 28/40 species studies (P-values varying between 0.05 and 0.001). The proportions of
Tannerella forsythia (T. forsythensis), and Treponema denticola were both higher in GCF samples (P<0.02 and P<0.05, respectively) than in curette samples (implant sites). The microbial composition in gingival fluid from samples taken at implant sites differed partly from that of curette samples taken from implant surfaces or from sulcular soft tissues, providing higher counts for most bacteria studied at implant surfaces, but with the exception of Porphyromonas gingivalis. A combination of GCF and curette sampling methods might be the most representative sample method.

The characteristics of biofilms in peri-implant disease.

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Abstract

AIM: To describe the microbiota associated with peri-implant disease, with a specific emphasis on the differential diagnosis of the condition.

MATERIAL AND METHODS: The potentially relevant literature was preliminarily assessed via scoping searches to find the most appropriate search terms and the most efficient Boolean search algorithm. We identified 29 reports on subjects with osseointegrated implants, with a pathological condition compatible with the definition of "peri-implant disease", and reporting microbiological data from samples taken in affected sites.

RESULTS AND CONCLUSIONS: In most studies bacterial samples were obtained by methods that destroy the three-dimensional structure of the biofilm. The samples therefore describe mixtures of bacteria from unspecified districts of biofilm associated with peri-implant diseases. Analyses of such samples with various methods indicate that peri-implant disease maybe viewed as a mixed anaerobic infection. In most cases the composition of the flora is similar to the subgingival flora of chronic periodontitis that is dominated by Gram-negative bacteria. Peri-implant infections may occasionally be linked to a different microbiota, including high numbers of peptostreptococci or staphylococci. Beneficial effects of mechanical and chemical interventions to disrupt the peri-implant biofilm demonstrate that microorganisms are involved in the disease process, even if they may not always be the origin of the condition.

Antimicrobial therapy using a local drug delivery system (Arestin) in the treatment of peri-implantitis. I: Microbiological outcomes.

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Abstract

OBJECTIVES: To assess the microbiological outcome of local administration of minocycline hydrochloride microspheres 1 mg (Arestin) in cases with peri-implantitis and with a follow-up period of 12 months.

MATERIAL AND METHODS: After debridement, and local administration of chlorhexidine gel, peri-implantitis cases were treated with local administration of minocycline microspheres (Arestin). The DNA-DNA checkerboard hybridization method was used to detect bacterial presence during the first 360 days of therapy.

RESULTS: At Day 10, lower bacterial loads for 6/40 individual bacteria including Actinomyces gerensceriae (P<0.1), Actinomyces israelii (P<0.01), Actinomyces naeslundi type 1 (P<0.01) and type 2 (P<0.03), Actinomyces odontolyticus (P<0.01), Porphyromonas gingivalis (P<0.01) and Treponema socranskii (P<0.01) were found. At Day 360 only the levels of Actinobacillus actinomycetemcomitans were lower than at baseline (mean difference: 1x10⁵; SE difference: 0.34x10⁵, 95% CI: 0.2x10⁵ to 1.2x10⁵; P<0.03). Six implants were lost between Days 90 and 270. The microbiota was successfully controlled in 48%, and with definitive failures (implant loss and major increase in bacterial levels) in 32% of subjects.

CONCLUSIONS: At study endpoint, the impact of Arestin on A. actinomycetemcomitans was greater than the impact on other pathogens. Up to Day 180 reductions in levels of Tannerella forsythia, P. gingivalis, and Treponema denticola were also found. Failures in treatment could not be associated with the presence of specific pathogens or by the total bacterial load at baseline. Statistical power analysis suggested that a case control study would require approximately 200 subjects.

Short-term clinical and microbiological evaluations of peri-implant diseases before and after mechanical anti-infective therapies.


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Abstract

OBJECTIVES: The aim of this study was to evaluate the clinical and microbiological effects of mechanical anti-infective therapies for mucositis and peri-implantitis.

MATERIAL AND METHODS: Subjects with at least one dental implant were assigned to healthy (n=10), mucositis (n=12) or peri-implantitis (n=13) groups. Implants with mucositis or peri-implantitis were decontaminated by means of teflon curettes and abrasive sodium carbonate air-powder, performed by an open flap for peri-implantitis and without surgery for mucositis. Visible plaque (PI), marginal bleeding (MB), bleeding on probing (BOP), suppuration (SUP), probing depth (PD) and relative clinical attachment level (rCAL) were assessed at baseline and at 3 months after therapies. At the same time points, submucosal
plaque samples were collected from each implant and analyzed by Checkerboard DNA-DNA hybridization for 40 bacterial species.

RESULTS: All clinical parameters improved at 3 months post-therapy in mucositis and peri-implantitis groups (P<0.05). The mean reduction in rCAL (+/-SD) was 1.4+/-1.2 mm and 2.3+/-1.6 mm, and it was 1.3+/-1.2 mm and 3.1+/-1.7 mm in PD (+/-SD) for mucositis and peri-implantitis, respectively. Levels of Treponema denticola, Tannerella forsythia and Parvimonas micra, and of Fusobacterium nucleatum ss nucleatum, were significantly reduced after peri-implantitis therapy and after mucositis therapy, respectively (P<0.05). In addition, counts of Porphyromonas gingivalis, Treponema socranskii and the proportions of red complex were reduced in both groups at 3 months after treatments (P<0.05).

CONCLUSION: Mechanical therapies alone were effective in treating mucositis and peri-implantitis over a period of 3 months. The open debridement procedure showed clinical and microbiological benefits on the treatment of peri-implantitis and could be safely used as a standard control group for future studies.

Microbiology and antimicrobial therapy of peri-implantitis.
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Microbiological findings and host response in patients with peri-implantitis.
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Abstract
The aim of the present study was to characterise microbiota and inflammatory host response around implants and teeth in patients with peri-implantitis. We included 17 partly edentulous patients with a total of 98 implants, of which 45 showed marginal bone loss of more than three fixture threads after the first year of loading. Nineteen subjects with stable marginal tissue conditions served as controls. Oral hygiene, gingival inflammation, and probing pocket depth were evaluated clinically at teeth and implants. Microbiological and crevicular fluid samples were collected from five categories of sites: 1) implants with peri-implantitis (PI), 2) stable implants (SI) in patients with both stable and peri-implantitis implants, 3) control implants (CI) in patients with stable implants alone, 4) teeth in patients (TP) and 5) controls (TC). Crevicular fluid from teeth and implants was analysed for elastase activity, lactoferrin and IL-1 beta concentrations. Elastase activity was higher at PI than at CI in controls. Lactoferrin concentration was higher at PI than at SI in patients with peri-implantitis. Higher
levels of both lactoferrin and elastase activity were found at PI than at teeth in patients. The concentrations of IL-1 beta were about the same in the various sites. Microbiological DNA-probe analysis revealed a putative periodontal microflora at teeth and implants in patients and controls. Patients with peri-implantitis harboured high levels of periodontal pathogens, Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Bacteroides forsythus and Treponema denticola. These findings indicate a site-specific inflammation rather than a patient-associated specific host response.

Infection at titanium implants with or without a clinical diagnosis of inflammation.

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Abstract

OBJECTIVES: To assess the microbiota at implants diagnosed with peri-implantitis, implant mucositis, or being clinically healthy.

MATERIAL AND METHODS: Clinical and microbiological data were collected from 213 subjects (mean age: 65.7 +/- 14) with 976 implants in function (mean: 10.8 years, SD +/- 1.5). Forty species were identified by the checkerboard DNA-DNA hybridization method.

RESULTS: Implant mean % plaque score was 41.8 +/- 32.4%. Periodontitis defined by bone loss was found in 44.9% of subjects. Implant mucositis was diagnosed in 59% and peri-implantitis in 14.9% of all cases. Neisseria mucosa, Fusobacterium nucleatum sp. nucleatum, F. nucleatum sp. polymorphum, and Capnoctyophaga sputigena dominated the implant sub-mucosal microbiota and the sub-gingival microbiota at tooth sites. Implant probing pocket depth at the implant site with the deepest probing depth was correlated with levels of Eikenella corrodens (r=0.16, P<0.05), the levels of F. nucleatum sp. vincentii (r=0.15, P<0.05), Porphyromonas gingivalis (r=0.14, P<0.05), and Micromonas micra (r=0.17, P=0.01). E. corrodens was found in higher levels at implants with mucositis compared with implant health (P<0.05). Subjects who lost teeth due to periodontitis had higher yields of F. nucleatum sp. vincentii (P<0.02) and N. mucosa (P<0.05). Independent of implant status subjects with teeth had higher levels of P. gingivalis (P<0.05), and Leptotrichia buccalis (P<0.05).

CONCLUSIONS: At implant sites studied, few bacteria differed by whether subjects were dentate or not or by implant status.
Clinical and microbiological analysis of subjects treated with Brånemark or AstraTech implants: a 7-year follow-up study.

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Abstract

AIMS: To assess the impact of different implant systems on the clinical conditions and the microbiota at implants, and whether the presence of bacteria at tooth sites was predictive of the presence at implant sites.

MATERIALS AND METHODS: Subjects with either AstraTech or Brånemark in function for 7 years were enrolled. Sub-gingival bacterial samples at tooth and implant sites were collected with sterile endodontic paper points, and analyzed by the checkerboard DNA-DNA hybridization method (40 species).

RESULTS: Fifty-four subjects, 27 supplied with AstraTech (n=132 implants) and 27 with Brånemark (n=102) implants, were studied. Test tooth sites had significantly less evidence of bleeding on probing (P<0.001) and presence of plaque (P<0.001) than implant test sites. Implant sites presented with deeper probing pocket depth than tooth sites (mean difference: 1.1 mm, standard error of differences: 0.08, 95% confidence intervals (CI): 0.9-1.3, P<0.001). Tannerella forsythia (P<0.05), Capnocytophaga sputilena (P<0.05), Actinomyces israelii (P<0.05) and Lactobacillus acidophilus (P<0.05) were found at higher levels at tooth surfaces. No differences in bacterial load for any species were found between the two implant systems. The odds of being present/absent at tooth and implants sites were only significant for Staphylococcus aureus [odds ratio (OR): 5.2 : 1, 95% CI: 1.4-18.9, P<0.01].

CONCLUSIONS: After 7 years in function, implants presented with deeper probing depths than teeth. S. aureus was commonly present at both teeth and implants sites. S. aureus at tooth sites was predictive of also being present at implant sites.

Composition of supra- and subgingival biofilm of subjects with healthy and diseased implants.

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Abstract

OBJECTIVES: The purpose of this study was to compare the microbial composition of supra- and subgingival biofilm in subjects with and without peri-implantitis.
MATERIAL AND METHODS: Forty-four subjects (mean age 48.9 +/- 13.51 years) with at least one implant restored and functional for at least 2 years were assigned to two groups: a peri-implantitis group (n=22), consisting of subjects presenting peri-implant sites with radiographic defects >3 mm, bleeding on probing and/or suppuration; and a control group (n=22), consisting of subjects with healthy implants. The clinical parameters evaluated were plaque index, gingival bleeding, bleeding on probing, suppuration, probing depth and clinical attachment level. Supra- and subgingival biofilm samples were taken from the deepest sites of each implant and analyzed for the presence of 36 microorganisms by checkerboard DNA-DNA hybridization.

RESULTS: Higher mean counts of Porphyromonas gingivalis, Treponema denticola and Tannerella forsythia were observed in the peri-implantitis group, both supra- and subgingivally (P<0.05). The proportions of the pathogens from the red complex were elevated, while host-compatible beneficial microbial complexes were reduced in diseased compared with healthy implants. The microbiological profiles of supra- and subgingival environments did not differ substantially within each group.

CONCLUSION: Marked differences were observed in the composition of supra- and subgingival biofilm between healthy and diseased implants. The microbiota associated with peri-implantitis was comprised of more periodontal pathogenic bacterial species, including the supragingival biofilm.

**Dynamics of initial subgingival colonization of ‘pristine’ peri-implant pockets.**


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**Abstract**

BACKGROUND: Periodontitis and peri-implantitis are linked to the presence of several key pathogens. The treatment of these infectious processes therefore involves the reduction/eradication of bacteria associated with periodontitis.

METHODS: This prospective, split-mouth, single-blind study followed the colonization of ‘pristine’ sulci created in 42 partially edentulous patients during implant surgery (e.g. abutment connection). The hypothesis was that the composition of the maturing subgingival plaque in these ‘fresh’ peri-implant pockets would soon (within 2 weeks) be comparable to the subgingival microbiota of teeth with similar clinical parameters (reference sites), including the presence of bacteria associated with periodontitis. Per patient, four subgingival plaque samples were taken from shallow and medium pockets around implants (test sites), and teeth within the same quadrant (undisturbed microbiota as control sites), 1, 2, 4, 13, 26 and 78 weeks after abutment connection, respectively. The samples were analysed by either checkerboard DNA-DNA hybridization, or cultural techniques, or real-time polymerase chain reaction (PCR) for intra-subject comparisons (teeth vs. implant, for comparable probing depths).
RESULTS: Checkerboard DNA-DNA hybridization and real-time PCR revealed a complex microbiota (including several pathogenic species) in the peri-implant pockets within 2 weeks after abutment connection. After 7 days, the detection frequency for most species (including the bacteria associated with periodontitis) was already nearly identical in samples from the fresh peri-implant pockets (5% and 20% of the microbiota belonging to red and orange complex, respectively) when compared with samples from the reference teeth. Afterwards (e.g. between weeks 2 and 13), the number of bacteria in peri-implant pockets only slightly increased (+/-0.1 log value), with minor changes in the relative proportions of bacteria associated with periodontitis (8% and 33% of the microbiota belonging to red and orange complex, respectively). Although small differences were seen between teeth and implants at week 2 with cultural techniques, a striking similarity in subgingival microbiota was found with this technique from month 3 on, with nearly identical detection frequencies for bacteria associated with periodontitis for both abutment types.

CONCLUSIONS: This study indicates that the initial colonization of peri-implant pockets with bacteria associated with periodontitis occurs within 2 weeks.

Prevalence and microbiological diversity of Archaea in peri-implantitis subjects by 16S ribosomal RNA clonal analysis.

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Abstract

Background and Objective: evaluated the prevalence and the molecular diversity of Archaea in the subgingival biofilm samples of subjects with peri-implantitis. Material: Fifty subjects were assigned into two groups: Control and Methods: 25), consisting of subjects with healthy implants; and Test = (n 25), consisting of subjects with peri-implantitis sites, as well as = (n a healthy implant. In the Test group, subgingival biofilm samples were taken from the deepest sites of the diseased implant. In both groups, subgingival biofilm was collected from one site with a healthy implant and from one site with a periodontally healthy tooth. DNA was extracted and the 16S ribosomal RNA gene was amplified with universal primer pairs for Archaea. Amplified genes were cloned and sequenced, and the phylotypes were identified by comparison with known 16S ribosomal RNA. In the Control group, Archaea were detected in two sequences. Results: and three sites of the implant and the tooth, respectively. In the Test group, Archaea were detected in 12, 4 and 2 sites of diseased implants, healthy implants and teeth, respectively. Diseased implants presented a significantly higher prevalence of Archaea in comparison with healthy implants and natural teeth, irrespective of group. Over 90% of the clone libraries were formed by Methanobrevibacter oralis, which was detected in both groups. Methanobacterium congelense/curvum was detected in four subjects from the Test group and in two subjects from the Control group. Although M. oralis was the main species of Archaea Conclusion:
associated with both healthy and diseased implant sites, the data indicated an increased prevalence of Archaea in peri-implantitis sites, and their role in pathogenesis should be further investigated.

**Microbiologically compromised patients and impact on oral implants.**

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**Early colonization of non-submerged dental implants in patients with a history of advanced aggressive periodontitis.**

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**Abstract**

The aim of the study was to evaluate the early colonization of non-submerged implants over a 6-month period in partially edentulous patients treated for advanced aggressive periodontal disease. In 22 patients treated for advanced aggressive periodontitis and in a supportive maintenance program for a period between 12 and 240 months at implant surgery, a total of 68 non-submerged dental implants were installed. Patients had a plaque score below 20%, and less than 20% of the pockets around the teeth were bleeding on probing (BOP). Using DNA-probes (micro-IDent), the presence and concentration of five periodontal pathogens (Actinobacillus actinomycetemcomitans (Aa), Porphyromonas gingivalis (Pg), Prevotella intermedia (Pi), Tannerella forsythensis (Tf) and Treponema denticola (Td)) were determined in the five deepest pockets of the rest dentition pre-operatively and after 6 months as well as five places around each implant 10 days, 1 month, 3 months and 6 months after surgery. In each patient, a test to determine the genotype interleukin-1 (IL-1) was performed (PST-micro-IDent). After 6 months, no difference in microbial composition as compared with baseline was found around the teeth in five patients, in 12 minute differences and in five patients important differences were observed. Ten days after surgery, three patients had a complete similar bacterial composition between teeth and implants. In 14 patients, the composition was fairly similar, while large differences in composition and concentration occurred in five patients. This microbiota around the implants remained almost unchanged over a 6-month period and did not hamper the clinical and radiographic osseointegration and did not lead to peri-implantitis, mucositis or initiation of bone destruction.
Periodontitis as a potential risk factor for peri-implantitis.

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Abstract

OBJECTIVES: To review the literature regarding the possible association between a previous history of periodontitis and peri-implantitis.

MATERIAL AND METHODS: A search of MEDLINE as well as a manual search of articles were conducted. Publications and articles accepted for publication up to January 2008 were included.

RESULTS: Out of 951 papers retrieved, a total of three papers were selected for the review. Thus, the available evidence for an association between periodontitis and peri-implantitis is scarce.

CONCLUSIONS: Based on three studies with a limited number of patients and considerable variations in study design, different definitions of periodontitis, and confounding variables like smoking that not been accounted for, this systematic review indicates that subjects with a history of periodontitis may be at greater risk for peri-implant infections. It should, however, be stressed that the data to support this conclusion are not very robust.

A review of dental implants and infection.

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Abstract

Dental implants have become increasingly common for the management of tooth loss. Despite their placement in a contaminated surgical field, success rates are relatively high. This article reviews dental implants and highlights factors leading to infection and potential implant failure. A literature search identified studies analysing the microbial composition of peri-implant infections. The microflora of dental peri-implantitis resembles that found in chronic periodontitis, featuring predominantly anaerobic Gram-negative bacilli, in particular Porphyromonas gingivalis and Prevotella intermedia, anaerobic Gram-negative cocci such as Veillonella spp. and spirochaetes including Treponema denticola. The role of Staphylococcus aureus and coagulase-negative staphylococci that are typically encountered in orthopaedic infections is debatable, although they undoubtedly play a role when isolated from clinically infected sites. Likewise, the aetiological involvement of coliforms and Candida spp. requires further longitudinal studies. Currently, there are neither standardised antibiotic prophylactic regimens for dental implant placement nor universally accepted treatment for peri-implantitis.
The treatment of infected implants is difficult and usually requires removal. In the UK there is no systematic post-surgical implant surveillance programme. Therefore, the development of such a project would be advisable and provide valuable epidemiological data.

Befundorientiertes Behandlungskonzept bei periimplantären Infektionen
Kombinierter Einsatz mechanischer und desinfizierender Methoden – Übersicht und Falldarstellungen

Schmage, P
Parodontologie 21; 2010, (4), 339-358


Periodontitis vs. peri-implantitis: the same disease? The same treatment?

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Abstract

The microbial flora in the natural dentition sulcus/pocket and the implant crevice/pocket is very similar in both health and disease. In health, coccal forms predominate, and in disease, large numbers of Gram-negative pathogens are associated with both tooth and implant. It has also been demonstrated that the bacteria in the partially edentulous implant case may be more pathogenic (especially Gram-negative rods and spirochetes) than in the fully edentulous case, indicating a possible seeding mechanism from tooth pocket to implant crevice. Detoxification procedures involving the use of tetracycline and citric acid prior to regenerative procedures with the use of barrier membranes and grafting materials are necessary, and the same problems attendant to premature exposure of the barrier
membrane(s) in the natural dentition situation apply to the implant case. It is apparent that periodontitis = peri-implantitis in etiology and therapy.

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