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**Introduction**

With this scientific dossier we would like to offer some very strong studies performed globally that support the scientific understanding of our claims of "protecting the dental bone".

It’s divided in 4 main parts, the first being the overall understanding of the current situation on periodontal diseases prevalence across the world, the importance of dentistry using (systemic) antibiotics that help existing treatments but fail to provide an income to the industry while, due to poor patient compliance, it generates a less predictable treatment outcome.

On the second part periodontitis is analyzed, with a strong focus on treatment options as well as outcomes.

Part 3 is dedicated to peri-implantitis and peri-implant mucositis, citing several studies on these diseases.

Lastly, in part 4 several full studies are placed to go in depth on the key issues discussed.

This is a living document and we always appreciate contributions and support to it. Thanks in advance for taking the time to go through it.

In all parts of the documents we have underlined key elements that help you understand key findings from the studies that allow us to support our scientific belief that we are innovating in the dental field with the best possible knowledge from dental and other fields.

Sincerely

**The MTD team**
I) Bacteria, biofilm and antibiotic usage, topical and systemic in dentistry and other fields – what do we know.

Bacteria & Biofilm and the relationship with antibiotics

1. **Bacterial mediators in periodontal disease.**

Loesche WJ.


**ABSTRACT**

Periodontal disease is the general description given to the inflammatory response of the gingiva and underlying connective tissue to bacterial accumulations (dental plaque) on the teeth. A limited number of cultivable species are usually associated with periodontal disease. The majority of putative periodontal pathogens are gram-negative anaerobic rods. Some of the characteristics of Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, and Treponema denticola will be discussed, given their prominence in the literature. These organisms share the ability to penetrate the gingival epithelium, such that their endotoxins, immunologically active compounds, and cytotoxic enzymes and molecules are presented directly to the host's inflammatory cells. This ability may be what distinguishes these gram-negative species from the plethora of other gram-negative species that inhabit the subgingival plaque. In addition, these organisms tend to be selected for in disease-associated plaques, suggesting that their nutritional needs are met when the gingival crevicular fluid contains a variety of inflammatory mediators and products of tissue breakdown. *A. actinomycetemcomitans* produces a leukotoxin, and the immunologic response of the host to this antigen may explain the unique pattern of tooth involvement in localized juvenile periodontitis. Both *P. gingivalis* and *T. denticola* have a trypsin-like enzyme that could be a virulence factor, primarily because this enzyme(s) may allow these organisms to grow in the presence of the inflammatory response of the host.
2. The clinical impact of bacterial biofilms.

Høiby N1, Ciofu O, Johansen HK, Song ZJ, Moser C, Jensen PØ, Molin S, Givskov M, Tolker-Nielsen T, Bjarnsholt T.


ABSTRACT

Bacteria survive in nature by forming biofilms on surfaces and probably most, if not all, bacteria (and fungi) are capable of forming biofilms. A biofilm is a structured consortium of bacteria embedded in a self-produced polymer matrix consisting of polysaccharide, protein and extracellular DNA. Bacterial biofilms are resistant to antibiotics, disinfectant chemicals and to phagocytosis and other components of the innate and adaptive inflammatory defense system of the body. It is known, for example, that persistence of staphylococcal infections related to foreign bodies is due to biofilm formation. Likewise, chronic Pseudomonas aeruginosa lung infections in cystic fibrosis patients are caused by biofilm growing mucoid strains. Gradients of nutrients and oxygen exist from the top to the bottom of biofilms and the bacterial cells located in nutrient poor areas have decreased metabolic activity and increased doubling times. These more or less dormant cells are therefore responsible for some of the tolerance to antibiotics. Biofilm growth is associated with an increased level of mutations. Bacteria in biofilms communicate by means of molecules, which activate certain genes responsible for production of virulence factors and, to some extent, biofilm structure. This phenomenon is called quorum sensing and depends upon the concentration of the quorum sensing molecules in a certain niche, which depends on the number of the bacteria. Biofilms can be prevented by antibiotic prophylaxis or early aggressive antibiotic therapy and they can be treated by chronic suppressive antibiotic therapy. Promising strategies may include the use of compounds, which can dissolve the biofilm matrix and quorum sensing inhibitors, which increases biofilm susceptibility to antibiotics and phagocytosis.
3. **Strategies for combating bacterial biofilm infections**

*Hong Wu, Claus Moser, Hengzhuang Wang, Niels Høiby, Zhijun Song*


**ABSTRACT**

Formation of biofilm is a survival strategy for bacteria and fungi to adapt to their living environment, especially in the hostile environment. Under the protection of biofilm, microbial cells in biofilm become tolerant and resistant to antibiotics and the immune responses, which increases the difficulties for the clinical treatment of biofilm infections. Clinical and laboratory investigations demonstrated a perspicuous correlation between biofilm infection and medical foreign bodies or indwelling devices. Clinical observations and experimental studies indicated clearly that antibiotic treatment alone is in most cases insufficient to eradicate biofilm infections. Therefore, to effectively treat biofilm infections with currently available antibiotics and evaluate the outcomes become important and urgent for clinicians. The review summarizes the latest progress in treatment of clinical biofilm infections and scientific investigations, discusses the diagnosis and treatment of different biofilm infections and introduces the promising laboratory progress, which may contribute to prevention or cure of biofilm infections. We conclude that an efficient treatment of biofilm infections needs a well-established multidisciplinary collaboration, which includes removal of the infected foreign bodies, selection of biofilm-active, sensitive and well-penetrating antibiotics, systemic or topical antibiotic administration in high dosage and combinations, and administration of anti-quorum sensing or biofilm dispersal agents.

4. **Antibiotics in the management of aggressive periodontitis**

Abinaya Prakasam, S. Sugumari Elavarasu, and Ravi Kumar Natarajan


**ABSTRACT**

Aggressive periodontitis, although not rare, is a fairly unknown condition. Little is known about its optimal management. While majority of patients with common forms of periodontal disease respond predictably well to conventional therapy (oral hygiene instructions (OHI), non-surgical debridement, surgery, and Supportive Periodontal therapy (SPT)), patients diagnosed with aggressive form of periodontal disease often do not respond predictably/favorably to conventional therapy owing to its complex multi-factorial etiology. Protocols for treating aggressive periodontitis are largely empirical. There is compelling evidence that adjunctive antibiotic treatment frequently results in more favorable clinical response than conventional therapy alone. This article mainly focuses on the role of adjunct use of pharmacological agents in improving the prognosis and treatment outcome of aggressive periodontitis patients.
5. **Effects of combined topical metronidazole and mechanical treatment on the subgingival flora in deep periodontal pockets in cuspids and bicuspids.**

Hitzig C, Fosse T, Charbit Y, Bitton C, Hannoun L.


**ABSTRACT**

The Effect on the subgingival microflora of a single topical administration of a 95% collagen and 5% metronidazole device in combination with debridement was investigated in 30 adult periodontitis patients in comparison with mechanical treatment alone. For each patient, plaque samples from test and control sites in cuspids and bicuspids were collected for culture and enumeration of total anaerobically cultivable bacteria (TA), black-pigmented anaerobes (BPA), and Actinobacillus actinomycetemcomitans (Aa). Spirochetes and fusiforms were quantified by direct microscopic examination after Giemsa staining. A decrease was observed for all parameters, and a significant difference in comparison with the control group was found for fusiforms. After treatment, a lower number of Aa positive sites were observed in the test group (13/25). These results show that a single application of topical metronidazole seems to be effective as adjunctive antimicrobial treatment in adult periodontitis.
6. **Evaluation of treatment outcomes and clinical indications for antibiotic prophylaxis in patients undergoing implantation procedures.**

Krasny M¹, Krasny K², Zadurska M³, Fiedor P⁴.


**ABSTRACT**

**PURPOSE:**

The use of antibiotic therapy during implantation to reduce the risk of an early implant failure is widely discussed among clinicians. However, half an hour after the procedure a quarter of patients show bacteremia which could decrease the efficacy of the surgery. Implant failure is associated with destruction of bone tissue within the alveolar process and may lead to an alternative but compromised treatment plan. The aim of the study was to evaluate the influence of perioperative antibiotic protection on success of implantation.

**MATERIAL AND METHODS:**

The retrospective study involved 1915 patients (females: 57.3%, males: 42.7%) with no systemic or local diseases, who required antibiotic therapy during surgical procedures. Group 1 comprised 203 patients with diagnosed vertical or horizontal bone atrophy within the alveolar ridge requiring reconstruction procedure before implantation. Group 2 included 1712 patients who did not need any surgical procedures before implantation. All the subjects took three types of antibiotics twice a day for 7 days. The data were statistically analyzed.

**RESULTS:**

A total number of 3309 implants were placed. Implantation efficacy in group 1 amounted to 98.53% and in group 2 it was 99.24%. Complications occurred most commonly after administration of cephalosporin which proved to be statistically significant for the patients who underwent augmentation with a bone block before the implant procedure (p 0.0209).

**CONCLUSIONS:**

Perioperative use of antibiotic therapy beneficially influences tissue healing, provides safety and success of the surgical procedure, as well as translates into high efficacy of implantation (99.52%).
Antibiotic usage and bacterial resistance in dentistry

7. Antibiotic prescribing practices by dentists: A review

Najla Saeed Dar-Odeh,1 Osama Abdalla Abu-Hammad,1 Mahmoud Khaled Al-Omiri,1 Ameen Sameh Khraisat,1 and Asem Ata Shehabi2


ABSTRACT

Antibiotics are prescribed by dentists for treatment as well as prevention of infection. Indications for the use of systemic antibiotics in dentistry are limited, since most dental and periodontal diseases are best managed by operative intervention and oral hygiene measures. However, the literature provides evidence of inadequate prescribing practices by dentists, due to a number of factors ranging from inadequate knowledge to social factors. Here we review studies that investigated the pattern of antibiotic use by dentists worldwide. The main defects in the knowledge of antibiotic prescribing are outlined. The main conclusion is that, unfortunately, the prescribing practices of dentists are inadequate and this is manifested by over-prescribing. Recommendations to improve antibiotic prescribing practices are presented in an attempt to curb the increasing incidence of antibiotic resistance and other side effects of antibiotic abuse.

RECOMMENDATIONS

Recommended treatment modalities for common inflammatory oral conditions are shown in Figure 1.

Recommended treatment modalities for common inflammatory oral lesions.

Drainage is the recommended treatment for periapical periodontitis and for localized dentoalveolar abscess, with incisional drainage rather than via the root canal preferred.31

Empirical antibiotic therapy and drainage are recommended for more severe infections such as facial cellulitis, pericoronitis, lateral periodontal abscess, and necrotizing ulcerative gingivitis.

The type of antibiotic chosen and its dosing regimen are dependent upon the severity of infection and the predominant type of causative bacteria.

According to the BNF, amoxicillin is recommended for dental infections in doses ranging from 250 mg to 500 mg, every 8 hours. The use of 3 g amoxicillin repeated after 8 hours is also mentioned, as a short course of oral therapy. Another antibiotic that is also recommended by the BNF is co-amoxiclav, which can be used in doses ranging from 375 mg to 625 mg every 8 hours. In patients allergic to penicillin, clindamycin can be used in doses ranging from 150 mg to 450 mg every 6 hours. Another option for penicillin-allergic patients (as recommended by the BNF) is metronidazole, which can be used in a dose of 200 mg every 8 hours for 3–7 days.

For severe odontogenic infections, higher doses of a broad-spectrum antibiotic may be required. Lewis et al have shown that only 5% of the main isolates from dental abscesses are resistant to amoxicillin/clavulanic acid. A more recent study found that bacteria associated with endodontic infections are completely
susceptible to amoxicillin/clavulanic acid. Furthermore, some researchers observed that amoxicillin/clavulanic acid and clindamycin are the only orally administered antimicrobials with adequate pharmacokinetic/pharmacodynamic properties to be effective against the most commonly isolated oral pathogens for the treatment of orofacial infections. When amoxicillin/clavulanic acid is used, a dosing regimen of 1 g twice daily provides a successful clinical outcome, better patient convenience and compliance, and less gastrointestinal upset owing to the minimizing of the clavulanic acid dose. As mentioned previously, patients can be seen after 2 or 3 days to determine whether treatment should be stopped or continued.

Patients who are allergic to penicillin should benefit from clindamycin; it is active against some oral anaerobes and facultative bacteria, and has the advantage of good bone penetration. However, increasing the dose may increase the possibility of serious side effects such as pseudomembranous colitis, Sweet’s syndrome, and neutropenia.

Infections in which anaerobic bacteria are implicated (such as pericoronitis, periodontal abscess and necrotizing ulcerative gingivitis) are better treated with metronidazole; the best dosage regimen in terms of pharmacodynamic/pharmacokinetic aspect is 250 mg every 8 hours.39

Other inflammatory/painful oral conditions such as cracked tooth, dentine hypersensitivity, and bacterial sialad-entitis are outside the scope of this review and their management is thoroughly explained in specialized references.

In addition to the proper dosing regimens and professionally responsible prescribing practices, the general public needs to be educated about the importance of restricting the use of antibiotics to only cases of severe infection. Patients have become accustomed to being given an antibiotic for a range of medical complaints. Unfortunately, patients presenting at dental surgeries also routinely expect an antibiotic for the treatment of ‘toothache’.

Dental patients not only pressure their dentist to get an antibiotic prescription, they also self-medicate. Self-medication with antibiotics was found to be alarmingly high in some developing countries. Also in Europe, self-prescription of antibiotics was reported, particularly in eastern and southern parts.

In conclusion, prescribing practices of dentists can be improved by increasing awareness among dental practitioners of the recommended guidelines. Furthermore, the importance of initiating awareness programs among the general public should not be overlooked.

*Link to full study*
8. **Antibiotic prescribing by dentists has increased: Why?**

Marra F, George D, Chong M, Sutherland S, Patrick DM.


**ABSTRACT**

**BACKGROUND:**

Although the overall rate of antibiotic prescribing has been declining in British Columbia, Canada, the authors conducted a study to explain the increased rate of prescribing by dentists.

**METHODS:**

The authors obtained anonymized, line-listed data on outpatient prescriptions from 1996 to 2013 from a centralized, population-based prescription database, including a variable coding prescriber licensing body. Analyses used Anatomical Therapeutic Classification standard codes and defined daily dose (DDD) values. The authors normalized prescribing rates to the population and expressed the rates in DDDs per 1,000 inhabitants per day (DID). The Canadian Dental Association released a webinar that invited correspondence from dentists about the drivers of the trend.

**RESULTS:**

From 1996 to 2013, overall antibiotic use declined from 18.24 DID to 15.91 DID, and physician prescribing declined 18.2%, from 17.25 DID to 14.11 DID. However, dental prescribing increased 62.2%, from 0.98 DID to 1.59 DID, and its proportionate contribution increased from 6.7% to 11.3% of antibiotic prescriptions. The rate of prescribing increased the most for dental patients 60 years or older. Communication from dentists in Canada and the United States identified the following explanatory themes: unnecessary prescriptions for periapical abscess and irreversible pulpitis; increased prescribing associated with dental implants and their complications; slow adoption of guidelines calling for less perioperative antibiotic coverage for patients with valvular heart disease and prosthetic joints; emphasis on cosmetic practices reducing the surgical skill set of average dentists; underinsurance practices driving antibiotics to be a substitute for surgery; the aging population; and more dental registrants per capita.

**CONCLUSIONS:**

Emerging themes for dental prescribing should be explored further in future studies; however, themes already identified may guide priorities in antibiotic stewardship for continuing dental education sessions.

**PRACTICAL IMPLICATIONS:**

Antibiotic prescribing should be reviewed to make sure that we are compliant with guidelines. Most practitioners will find opportunities to prescribe less often and for shorter durations.
9. **Antibiotic prescribing by general dentists in the United States, 2013.**

Roberts RM, Bartoces M, Thompson SE, Hicks LA.  

**ABSTRACT**

**BACKGROUND:**  
Dentists prescribe approximately 10% of outpatient antibiotics, but little is known about dentists' antibiotic prescribing patterns. The authors conducted a study to characterize prescribing by dentists according to antibiotic agent and category, patient demographic characteristics, and geographic region in the United States.

**METHODS:**  
The authors identified oral antibiotic prescriptions dispensed during 2013 in the Xponent (QuintilesIMS) database. The authors used the total number of prescriptions and county-level census population denominators to calculate prescribing rates. In addition, the authors analyzed prescribing according to individual agent, drug category, and patient demographic characteristics and the total number of prescriptions calculated for general dentists overall.

**RESULTS:**  
Dentists prescribed 24.5 million courses of antibiotics in 2013, a prescribing rate of 77.5 prescriptions per 1,000 people. Penicillins were the most commonly prescribed antibiotic category. Dentists prescribed most antibiotics for adults older than 19 years. The Northeast census region had the highest prescribing rate per 1,000 people. The District of Columbia had the highest prescribing rate of 99.5 per 1,000 people, and Delaware had the lowest prescribing rate of 50.7 per 1,000 people.

**CONCLUSIONS:**  
Dentists prescribe large quantities of antibiotics in outpatient settings, and there is considerable geographic variability. Additional study is needed to better understand the reasons for this variability and identify areas of possible intervention and improvement.

**PRACTICAL IMPLICATIONS:**  
Continued efforts to combat antibiotic resistance will require all prescribers, including dentists, to examine prescribing behaviors for appropriateness and the effectiveness of guidelines to identify opportunities to optimize antibiotic use.
10. *Trends in antibiotic use and microbial diagnostics in periodontal treatment: comparing surveys of German dentists in a ten-year period.*

Falkenstein S1, Stein JM2, Henne K1, Conrads G3.


**ABSTRACT**

**OBJECTIVES:**

The use of antibiotics and microbial tests in periodontal treatment among German dental practitioners was investigated in 2012-2013 and compared with 2002-2003 data.

**MATERIALS AND METHODS:**

One thousand four hundred representative German practitioners received a postal questionnaire requesting their prescribing habits concerning type, dose, frequency, and sequence of antibiotics adjunctive to mechanical debridement. Additionally, the use of local antimicrobials and microbial tests were recorded.

**RESULTS:**

The response rate was 29.1 % (407 reports). Drug combinations, especially amoxicillin plus metronidazole, were prescribed most frequently (32.8 %) with an increase of 7.4 % during the past decade, followed by clindamycin (29.3 %). Amoxicillin monotherapy was used unexpectedly frequently (17.0 %) and doxycycline (2.8 %) very infrequently. Then, 24.7 % prescribed antibiotics prior to mechanical therapy, while most dentists followed the recommended sequence. The use of local antimicrobials increased by 6.2 % and of microbial diagnostics by 20.8 %.

**CONCLUSIONS:**

Positive trends regarding position-paper-conform prescribing habits including the scheduling of systemic antibiotics and increasing use of local antimicrobials and microbial tests were observed. However, deficits and malpractice still exist in German practices. Unexpected is the widespread and increasing use of clindamycin. Continuing educational campaigns and strictly expressed real guidelines are needed.

**CLINICAL RELEVANCE:**

Indication and choice of antibiotic agents in causal periodontal therapy among German dentists have changed between 2003 and 2013 toward a more position-paper-based concept, but inappropriate prescriptions of second choice antibiotics still remain conspicuous.

Cope AL¹, Francis NA², Wood F², Chestnutt IG¹.


ABSTRACT

OBJECTIVES:
To assess the extent to which antibiotic prescribing in general dental practice conforms to clinical guidelines and to describe factors associated with antibiotic prescription in the absence of spreading infection or systemic involvement.

METHODS:
A cross-sectional study of the management of adult patients with acute dental conditions by General Dental Practitioners (GDPs) in Wales, UK. Clinical information on the management of patients was compared to clinical and prescribing guidelines published by the Scottish Dental Clinical Effectiveness Programme and the Faculty of General Dental Practice (UK). Multilevel logistic regression was used to identify patient, practitioner and consultation characteristics predictive of antibiotic prescribing in the absence of infection.

RESULTS:
Antibiotics were prescribed to 57.4% of 568 patients. Over half of antibiotics (65.6%) were prescribed in situations where there was no evidence of spreading infection, and 70.6% were used without the provision of an operative intervention. Only 19.0% of antibiotics were prescribed in situations where their use was indicated by clinical guidelines. Factors associated (P < 0.05) with antibiotic prescription in the absence of infection were failure of previous operative treatment (Odds Ratio (OR) 13.57), shortage of clinical time to undertake treatment (OR 10.21), patients who were unable or unwilling to accept operative treatment (OR 4.89), patient requests for antibiotics (OR 3.69) and acute periodontal conditions (OR 3.37).

CONCLUSIONS:
A high level of inappropriate antibiotic prescribing was observed amongst the GDPs studied. Features of the healthcare environment, such as clinical time pressures, and patient-related characteristics, such as expectations for antibiotics and refusal of operative treatment, are associated with antibiotic prescribing in the absence of infection. Individuals responsible for the commissioning and delivery of dental services should seek to develop targeted interventions addressing these issues in order to ensure optimal antimicrobial stewardship within dentistry.


ABSTRACT

OBJECTIVE:

To determine the potential economic impact from the practice of antibiotic prophylaxis for dental procedures.

STUDY DESIGN:

We estimated the prevalence of patients in the United States with 15 medical conditions and devices. We multiplied the prevalence for each patient population by the percentage of specialists recommending prophylaxis, then by the estimated number of dental office visits per year, and then by an average pharmacy cost to arrive at a total estimated range of annual cost for this practice.

RESULTS:

The 15 medical conditions and devices included in the present study involve upward of 20 million people and an estimated annual cost between $19,880,279 and $143,685,823. The actual cost may be far greater because of an underestimation of these prevalence figures and the use of antibiotic prophylaxis for additional patient populations.

CONCLUSIONS:

Our data suggest a significant cost for antibiotic prophylaxis in the dental practice setting and the need for evidence-based recommendations concerning this practice.
13. **Overview of patient compliance with medication dosing: A literature review**

Greenberg, R.N. Department of Internal Medicine, St. Louis University School of Medicine, Clinical Therapeutics, Volume 6, Issue 5, 1984, Pages 592-599

**ABSTRACT**

The literature was reviewed in an effort to relate frequency of dosing and other influences with patient compliance in medication taking. Once-a-day and twice-a-day regimens were associated with significantly better compliance (73% and 70%, respectively) than were three-times-daily (52%) and four-times-daily (42%) regimens. Compliance is not related to income, social class, occupation, or educational background, and it cannot be accurately predicted by physicians. Unintentional errors in taking medication are made by 50% to 90% of patients.


ABSTRACT

OBJECTIVE:
To compare self-reported doxycycline compliance in men and women attending an STD clinic with indications for Chlamydia trachomatis treatment to compliance measured using microprocessor-containing medication vials to count each time and date medication vials were opened. A secondary objective was to correlate outcomes of therapy, as measured by symptom resolution and persistence of chlamydial nucleic acids, with measured doxycycline compliance.

METHODS:
Between September 1995 and July 1997, Medication Event Monitoring System (MEMS) caps were used to measure compliance with recommended doxycycline therapy (14 doses over 7 days) in patients treated for presumed C. trachomatis infections. Polymerase chain reaction (PCR) assays for C. trachomatis were performed on urine specimens collected at the time of follow-up evaluation.

RESULTS:
Of 221 evaluable participants, although 90% reported taking their medication as directed, only 33 (16%) managed this level of compliance according to data obtained from the MEMS cap. Although 144 (65%) patients took more than 11 of 14 doses over 8 days, 147 (67%) participants had at least one interval of 24 hours or longer between doses in an 8-day period. Of 81 participants with positive C. trachomatis cultures at enrollment, follow-up urine PCR for C. trachomatis was positive in 5 (6%). Medication Event Monitoring System data for four of the five patients with positive PCR tests as follow-up showed each had two or more 24-hour intervals when their medication vials were not opened and three of four had opened their vials less than 11 times.

CONCLUSIONS:
This study suggests that few patients take medications as prescribed and that self-report substantially underestimates medication noncompliance. Despite poor compliance, there were few treatment failures.

From SJ, Weinberg MA.


ABSTRACT

In past decades, warnings about over prescription and misuse of antibiotics—which are now considered to be responsible for antimicrobial resistance, allergies, ineffectiveness, and supra-infections have been made to both medical and dental clinicians. To help assess the antibiotic prescribing habits of dentists, a survey was created and emailed through the Survey Monkey tool to 102 randomly selected board-certified periodontists. Each was asked to answer multiple-choice questions regarding their use of an antibiotic protocol in 10 specific periodontal or implant-related clinical circumstances. This group of practitioners and the 10 clinical circumstances were chosen to limit the wide variety of clinical conditions treated by dentists and to narrow the scope of variables when antibiotics are considered. All 102 participants returned the questionnaire, and 96% to 100% of respondents reported that they had treated 8 of the 10 circumstances, with 89.9% and 80.8% having treated the other two conditions listed in the survey; this allowed subsequent questioning of the respondents on their antibiotic prescribing protocols. Although the validity of antibiotics for dental procedures may be questioned based on present information, as many as 50% or more of the dentists answering the survey prescribed antibiotics. The prescription, initiation, and duration of antibiotics varied considerably in many of the 10 specific circumstances, including treatment of acute and chronic periodontitis, sinus or ridge augmentation, and immediate or delayed implant placement. Based on the results of the survey, it was obvious that definitive guidelines and protocols are needed as well as expanded postgraduate training regarding antibiotic use.

Johnson TM, Hawkes J.


ABSTRACT

Dentists in primary care account for approximately one in ten of all therapeutic antibiotic prescriptions, but many of these prescriptions may be unnecessary and will contribute to the critically important problem of bacterial resistance. Emerging guidance on antimicrobial stewardship is discussed and the annual European Antibiotic Awareness Day (EAAD), which takes place on 18 November, is highlighted.
17. **Antibacterial Drug Resistance and its impact on Dentistry**

G.S. Ajantha, M.D.; Veda Hegde, M.D.S.


**ABSTRACT**

The continuing emergence of antimicrobial resistant bacteria is a global health problem. Multi-drug resistance is now widespread. Resistance rates differ noticeably on a worldwide, regional and even institutional basis. Because antibiotics are commonly used in dentistry, the dental community is not spared from this threat of microbial resistance to antibiotics. This article presents an overview of antimicrobial drug resistance, discusses how this large and expensive problem affects the dental community and what we can do to change the situation, both as concerned citizens and as dental practitioners.
18. **Antibiotic resistance in general dental practice—a cause for concern?**

Louise C. Sweeney, Jayshree Dave Philip A. Chambers and John Heritage  

**ABSTRACT**

This review examines the contribution dental prescribing makes to the selection of antibiotic resistance in bacteria of the oral flora. The antibiotics commonly used in dental prescribing in the UK are discussed, together with the problems of resistance in members of the oral flora. The antibiotic prescribing habits of general dental practitioners are then reviewed with respect to therapeutic prescriptions and those drugs that are prescribed prophylactically. Not all antibiotic prescriptions for dental problems are written by dentists; prescribing outside the dental profession is also considered. The review then considers the support available to dentists from clinical diagnostic microbiology laboratories. It concludes that better use of diagnostic services, surveillance and improvements in dental education are required now to lessen the impact of antibiotic resistance in the future.
Systemic versus Local Antibiotics: experiences in dental and other medical fields; implications for the dental industry

19. Mechanisms of action of systemic antibiotics used in periodontal treatment and mechanisms of bacterial resistance to these drugs

Geisla Mary Silva SOARES, Luciene Cristina FIGUEIREDO, Marcelo FAVERI, Sheila Cavalca CORTELLI, Poliana Mendes DUARTE, and Magda FERES

ABSTRACT

Antibiotics are important adjuncts in the treatment of infectious diseases, including periodontitis. The most severe criticisms to the indiscriminate use of these drugs are their side effects and, especially, the development of bacterial resistance. The knowledge of the biological mechanisms involved with the antibiotic usage would help the medical and dental communities to overcome these two problems. Therefore, the aim of this manuscript was to review the mechanisms of action of the antibiotics most commonly used in the periodontal treatment (i.e. penicillin, tetracycline, macrolide and metronidazole) and the main mechanisms of bacterial resistance to these drugs. Antimicrobial resistance can be classified into three groups: intrinsic, mutational and acquired. Penicillin, tetracycline and erythromycin are broad-spectrum drugs, effective against gram-positive and gram-negative microorganisms. Bacterial resistance to penicillin may occur due to diminished permeability of the bacterial cell to the antibiotic; alteration of the penicillin-binding proteins, or production of β-lactamases. However, a very small proportion of the subgingival microbiota is resistant to penicillins. Bacteria become resistant to tetracyclines or macrolides by limiting their access to the cell, by altering the ribosome in order to prevent effective binding of the drug, or by producing tetracycline/macrolide-inactivating enzymes. Periodontal pathogens may become resistant to these drugs. Finally, metronidazole can be considered a prodrug in the sense that it requires metabolic activation by strict anaerobe microorganisms. Acquired resistance to this drug has rarely been reported. Due to these low rates of resistance and to its high activity against the gram-negative anaerobic bacterial species, metronidazole is a promising drug for treating periodontal infections.
20. Local Antibiotic Therapy in the Treatment of Bone and Soft Tissue Infections

Stefanos Tsourvakas, Orthopedic Department, General Hospital of Trikala

Conclusion

The appropriate use of antimicrobial agents has decreased morbidity and mortality from orthopedic-related infections. Although systemic antibiotic use has been used for many years, new methods of local antibiotic delivery may result in increased antibiotic levels, decreased toxicity, and possibly greater efficacy. Antibiotic impregnated polymethylmethacrylate beads are currently being used in a variety of applications, but this method requires a second procedure for removal of the antibiotic delivery system.

There is considerable interest in finding methods of delivering effective doses of antimicrobial drugs locally, not only in orthopedics, but across a range of specialists. While most of the antibacterial agent contained within a biodegradable system may be eluted, only 25% is actually released from polymethylmethacrylate beads. Biodegradable materials could mimic bone substances like calcium phosphate based carriers can be chosen for local drug delivery system in osteomyelitis with potential clinical application in orthopedic surgery.

Widespread research is currently being conducted in the area of local drug delivery systems to treat osteomyelitis. Despite this fact, much work is still desired in the areas of biodegradable and biocompatible materials, the kinetics of antibiotic release, and further development of current systems before many of these formulations can be used. The seer diversity of available systems and the lack of suitable trials comparing them in-vivo makes their evaluation difficult. Nonetheless, it is apparent that while collagen fleece is currently the most widely used antimicrobial carrier system, the duration of its antibiotic delivery is the shortest. Other delivery systems have shown greater promise, and these that are able both to stimulate the formation of new bone and provide a scaffold, such as composite antibiotic carriers, are most likely to gain widespread acceptance in the future. In future, researchers remain optimistic that many of these systems can be developed with ideal zero-order release kinetics profiles, in-vivo, over long periods of time, allowing for widespread use in chronic osteomyelitis patients. By utilizing newer forms of sustained release antibiotic delivery systems, it will be possible to deliver such antibiotics at constant rates over a prolonged period of time and would eliminate the need for multiple dosing. It is hoped that in the future, development of new implantable systems would be helpful to reduce the cost of drug therapy, increase the efficacy of drugs, and could enhance the patient’s compliance.
21. **Topical versus systemic antimicrobial therapy for treating mildly infected diabetic foot ulcers: a randomized, controlled, double-blinded, multicenter trial of pexiganan cream.**

Lipsky BA, Holroyd KJ, Zasloff M.


**ABSTRACT**

**BACKGROUND:**

Topical antimicrobial therapy of infected diabetic foot ulcers can focus on the wound and avoid the adverse effects of systemic anti-infective agents. We compared the efficacy of outpatient treatment using an investigational topical antimicrobial peptide, pexiganan acetate cream, with the efficacy of systemic therapy using an oral fluoroquinolone antibiotic, ofloxacin, for mildly infected diabetic foot ulcers.

**METHODS:**

In 2 consecutive, double-blind, controlled trials (study 303 and study 304), we randomized diabetic patients with a mildly infected diabetic foot ulcer to receive the active topical agent or active oral antibiotic, plus a respective inactive placebo. The primary outcome of interest was clinical cure or improvement of the infection. Secondary outcomes included eradication of wound pathogens and wound healing, which was documented by a semiquantitative scoring system.

**RESULTS:**

Overall, 835 patients were randomized; those in each treatment arm were similar with regard to demographic and clinical characteristics. Although study 303 failed to demonstrate equivalence, study 304 and the combined data for the 2 trials demonstrated equivalent results (within the 95% confidence interval) for topical pexiganan and oral ofloxacin in clinical improvement rates (85%-90%), overall microbiological eradication rates (42%-47%), and wound healing rates. The incidence of worsening cellulitis (2%-4%) and amputation (2%-3%) did not differ significantly between treatment arms. Bacterial resistance to ofloxacin emerged in some patients who received ofloxacin, but no significant resistance to pexiganan emerged among patients who received pexiganan.

**CONCLUSIONS:**

Topical pexiganan might be an effective alternative to oral antibiotic therapy in treating diabetic patients with a mildly infected foot ulcer, and might reduce the risk of selecting antimicrobial-resistant bacteria.
22. **Comparison of local and systemic ciprofloxacin ototoxicity in the treatment of chronic media otitis.**

Samarei R\(^1\).

*Glob J Health Sci.* 2014 Sep 18;6(7 Spec No):144-9. doi: 10.5539/gjhs.v6n7p144

**ABSTRACT**

**INTRODUCTION:**

Chronic media otitis is a common cause of reference to ear, nose and throat clinics and the treatment is one of the health problems among ENT specialists. Ciprofloxacin drop that is of fluoroquinolone drug class due to good treatment effect is now widely used in the treatment of chronic media otitis. Due to the widespread use, it seems proper research on the human population has not been taken to ensure its non-toxicity in the inner ear, therefore comparison of local ciprofloxacin ototoxicity with systemic in chronic media otitis is investigated in this study.

**MATERIALS & METHODS:**

This study was conducted as a randomized clinical trial. Prospective methods were considered and the number of samples in the study group was 40 patients that were treated with ciprofloxacin drops. And in the control group 32 patients with chronic media otitis who were treated with ciprofloxacin tablets. The collected data was analyzed using SPSS software.

**RESULTS:**

Statistical indicators of different frequencies in air conduction (AC) in both groups showed, there was significant improvement in hearing thresholds at frequencies of 250, 8000, 1000 in air conduction for the group receiving drops compared to the group receiving tablet. Based on statistical indicators in different frequencies of bone conduction in the two treated groups, there was significant difference in the two groups receiving tablets and drops only at a frequency of 4000 Hz that drop impact improves hearing threshold and in contrast in the group receiving tablet hearing loss was seen in the frequency of 4000.

**DISCUSSION:**

Topical ciprofloxacin is a safe and uncomplicated ototoxic drug that is an effective antibiotic used in the treatment of refractory chronic otitis those dregs such as pseudomonas aerogenusa and staphylococci resistant to methicillin are responsible for it, which in the usual doses has not harmful effects on hearing hairy cells.
23. From the book “Evidence based Otitis Media”

by Richard M. Rosenfeld, Charles D. Bluestone

2003 BC Decker Inc – Hamilton London, UK

<table>
<thead>
<tr>
<th>Table 28-4</th>
<th>Topical versus Systemic Antimicrobials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Topical</strong></td>
</tr>
<tr>
<td>Local concentration</td>
<td>High</td>
</tr>
<tr>
<td>Bacterial resistance</td>
<td>Rare</td>
</tr>
<tr>
<td>Adverse reactions</td>
<td>Rare</td>
</tr>
<tr>
<td>Cost (expense)</td>
<td>Lower</td>
</tr>
</tbody>
</table>
24. **Local and Systemic Levels of Tobramycin Delivered from Calcium Sulfate Bone Graft Substitute Pellets**

Thomas M. Turner, DVM; Robert M. Urban, AS; Deborah J. Hall, BS; Ping C. Chye, MD; John Segreti, MD; and Steven Gitelis, MD


ABSTRACT

We asked if tobramycin-loaded calcium sulfate pellets could be used to maintain high local site antibiotic concentrations for an extended period with minimal systemic levels and without adverse effects on vital organs. Calcium sulfate pellets loaded with 10% tobramycin were implanted in contained medullary defects in the proximal humeri of canines. The number of pellets implanted was calculated to yield an equivalent human maximum prescribed dose, and 1.8-fold this dose. These doses converted to approximately 20 mg/kg, and 36 mg/kg, respectively, for the canine. Local and systemic tobramycin levels, pellet resorption, bone response, clinical pathology parameters, and histopathologic responses of potential target organs were analyzed to determine if there was any adverse response for a 28-day period. Serum tobramycin was elevated for less than one day while local levels remained elevated for at least 14 days, and in some animals, 28 days. Tobramycin delivered locally from calcium sulfate pellets had no apparent adverse effect on clinical pathology parameters or on any of the organs that were analyzed. In addition, bone formation and pellet resorption followed patterns typically seen with calcium sulfate materials.

[Link to full study](#)
25. Effects of systemic ornidazole, systemic and local compound ornidazole and pefloxacin mesylate on experimental periodontitis in rats.


ABSTRACT

BACKGROUND:

The purpose of the current study is to evaluate the effects of systemic ornidazole (SO) and systemic and local compound ornidazole and pefloxacin mesylate (SCOPM/LCOMP) on the inflammatory response associated with rat experimental chronic periodontitis (ECP) in sites with subgingival debridement.

MATERIAL/METHODS:

Periodontitis was induced in male Sprague-Dawley rats by placing a thin steel ligature around the upper first molars and inoculating them with Porphyromonas gingivalis 381. After the successful induction of the rat ECP, the periodontitis rats were randomly divided into 3 different combined treatment groups: (A) SO with scaling and root planing (SRP); (B) SCOMP with SRP; and (C) LCOMP with SRP. After 2 weeks the effects of the treatments were evaluated based on gingivitis, plaque index, probing pocket depth, aspartate aminotransferase, alveolar bone loss, and hematoxylin-eosin staining of the region around the first molars.

RESULTS:

After treatment, comparison with ECP was performed. The mean percentage reductions of SBI in SO, SCOPM, and LCOMP were 27.73%, 33.61%, and 58.82%, respectively. Those of PI were 33.20%, 42.80%, and 60.00%; those of PPD were 48.66%, 55.70%, and 72.48%; those of GCF-AST were 41.64%, 49.03%, and 66.42%; and those of ABL were 41.19%, 43.63%, and 54.47%, respectively. The inflammatory score of H&E showed median scores of 2.5, 1.75, 1.63, and 0.95 for ECP, SO, SCOMP, and LCOMP, respectively. All 3 treatment groups exhibited significantly reduced inflammation indicators (P<0.05). Of the 3, group C was the most effective (P<0.05).

CONCLUSIONS:

Although all the combined treatment groups responded to therapy with significant resolution of the infection, adjunctive LCOMP therapy is more effective for periodontitis.
26. Periodontal Treatment: The Delivery and Role of Locally Applied Therapeutics

A Peer-Reviewed Publication

Written by Fiona Collins, BDS, MBA, MA and Rob Veis, DDS

ABSTRACT

The majority of adults in the United States suffer from moderate periodontal disease. Following the onset of infection, an active and progressive inflammatory process occurs. Goals of periodontal treatment include eliminating pathogens, halting disease progression and obtaining host healing and gains in clinical attachment levels. Mechanical scaling and root planning are the accepted standard treatment for periodontal disease. Challenges following mechanical treatment include how to manage and maintain plaque and microbial control. The presence of periodontal pathogens threatens the periodontal stability and health of treated sites. Systemically and locally delivered therapeutics have been found to be effective adjunctive therapies to scaling and root planning in treating periodontal disease. Of the two methods, locally-applied antimicrobials have been found to produce higher local concentrations of the drug and lower systemic concentrations, increasing the effectiveness at the site and decreasing the risk of systemic side effects. While not eliminating bacterial resistance, the use of locally-delivered antimicrobials reduces the risk of this occurring. Several local delivery vehicles are available for application of therapeutics, including fibers, chips, polymers and trays. In choosing a systemic or local administration, consideration should be given to effectiveness, patient compliance, ease of use, patient comfort, whether or not chairside application is required, the number of sites requiring treatment, systemic health issues or contraindications, efficiency and reliability, and clinician and patient preference.

Link to the full article: www.dentalacademyofce.com/courses/1476/pdf/periotreatment_thedelivery.pdf
About the AB choice according to activity levels and high spectrum as well as penicillin allergies

27. Antianaerobic Antimicrobials: Spectrum and Susceptibility Testing

Itzhak Brook, Hannah M. Wexler, and Ellie J. C. Goldstein


SUMMARY

Susceptibility testing of anaerobic bacteria recovered from selected cases can influence the choice of antimicrobial therapy. The Clinical and Laboratory Standards Institute (CLSI) has standardized many laboratory procedures, including anaerobic susceptibility testing (AST), and has published documents for AST. The standardization of testing methods by the CLSI allows comparisons of resistance trends among various laboratories. Susceptibility testing should be performed on organisms recovered from sterile body sites, those that are isolated in pure culture, or those that are clinically important and have variable or unique susceptibility patterns. Organisms that should be considered for individual isolate testing include highly virulent pathogens for which susceptibility cannot be predicted, such as Bacteroides Prevotella, Fusobacterium, and Clostridium spp.; Bilophila wadsworthia; and Sutterella wadsworthensis. This review describes the current methods for AST in research and reference laboratories. These methods include the use of agar dilution, broth microdilution, Etest, and the spiral gradient endpoint system. The antimicrobials potentially effective against anaerobic bacteria include beta-lactams, combinations of beta-lactams and beta-lactamase inhibitors, metronidazole, chloramphenicol, clindamycin, macrolides, tetracyclines, and fluoroquinolones. The spectrum of efficacy, antimicrobial resistance mechanisms, and resistance patterns against these agents are described.

<table>
<thead>
<tr>
<th>TABLE 1</th>
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<tbody>
<tr>
<td>Antimicrobial agents effective against mixed infection &lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Antimicrobial agent</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Penicillin&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chloramphenicol&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cephalothin</td>
</tr>
<tr>
<td>Cefoxitin</td>
</tr>
<tr>
<td>Carbapenems</td>
</tr>
<tr>
<td>Clindamycin&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ticarcillin</td>
</tr>
<tr>
<td>Amoxicillin + clavulante&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Piperacillin + tazobactam</td>
</tr>
<tr>
<td>Metronidazole&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Moxifloxacin</td>
</tr>
<tr>
<td>Tigecycline</td>
</tr>
</tbody>
</table>

<sup>a</sup> Degrees of activity from 0 to +++.

<sup>b</sup> Also available in an oral form.

<sup>d</sup>
## Antianaerobic Antimicrobials: Spectrum and Susceptibility Testing

### TABLE 3

Percent resistance of *Racketobacter fragilis* group isolates and other anaerobes to antimicrobial agents.\(^a, b\)

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>MIC breakpoint (µg/ml)</th>
<th>% resistance to antimicrobial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Susceptible</td>
<td>Resistant</td>
</tr>
<tr>
<td>Ampicillin- sulbactam</td>
<td>≤8/4</td>
<td>≥32/16</td>
</tr>
<tr>
<td>Amoxicillin- clavulanate</td>
<td>≤4/2</td>
<td>≥16/8</td>
</tr>
<tr>
<td>Piperacillin- tazobactam</td>
<td>≥32/4</td>
<td>≥128/4</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>≥16</td>
<td>≥64</td>
</tr>
<tr>
<td>Ertapenem</td>
<td>≤1</td>
<td>≥16</td>
</tr>
<tr>
<td>Imipenem</td>
<td>≤1</td>
<td>≥16</td>
</tr>
<tr>
<td>Meropenem</td>
<td>≤1</td>
<td>≥16</td>
</tr>
<tr>
<td>Doripenem</td>
<td>≤1</td>
<td>≥16</td>
</tr>
<tr>
<td>Tigecycline</td>
<td>≤4</td>
<td>≥16</td>
</tr>
</tbody>
</table>

\(^{a}\) Including intermediate-resistant strains. Metronidazole is not included since >99% of Gram-negative strains are susceptible.

\(^{b}\) Adapted from reference 78 with permission from Elsevier.
28. Antimicrobial susceptibility testing of Actinomyces species with 12 antimicrobial agents

A. J. Smith, V. Hall, B. Thakker and C. G. Gemmell

OBJECTIVE

This study was conducted to assess the susceptibility of human clinical isolates of Actinomyces species to 12 antimicrobial agents. Methods: Human clinical isolates of Actinomyces spp. were collected from stored collections held at the Microbiology Department, Edinburgh University, Anaerobe Reference Laboratory, Cardiff, Glasgow Dental Hospital and Glasgow Royal Infirmary. Each isolate was identified by restriction analysis of amplified 16S ribosomal DNA. MICs of 12 antibiotics comprising benzyl penicillin, amoxicillin, ceftriaxone, linezolid, tetracycline, doxycycline, clindamycin, erythromycin, clarithromycin, ciprofloxacin, meropenem and piperacillin/tazobactam for 87 strains of Actinomyces species were obtained by Etest methodology. Results: The Actinomyces species identified for this study comprised: Actinomyces israelii, Actinomyces gerencseriae, Actinomyces turicensis, Actinomyces funkei, Actinomyces graevenitzii and Actinomyces europaeus. All isolates were susceptible to penicillin and amoxicillin. All but one strain of A. turicensis was susceptible to linezolid. A number of A. europaeus and A. graevenitzii isolates were resistant to ceftriaxone and piperacillin/tazobactam. A number of isolates of A. turicensis and A. europaeus also demonstrated resistance to erythromycin. All Actinomyces species tested appeared resistant to ciprofloxacin.

CONCLUSIONS

Actinomyces species appear to be susceptible to a wide range of b-lactam agents and these, when combined with b-lactamase inhibitors, should be regarded as agents of first choice. Ciprofloxacin performed poorly. Tetracyclines also demonstrated poor performance. This is the first study of antimicrobial susceptibilities for a number of accurately identified clinical isolates of Actinomyces spp. There are a number of species differences in susceptibility profiles to the antimicrobials tested, suggesting that accurate identification and speciation may have an impact on clinical outcome.

Link to the full study:
29. Comparative in vitro activities of amoxicillin-clavulanate, ampicillin-sulbactam and piperacillin-tazobactam against strains of *Escherichia coli* and *proteus mirabilis* harbouring known beta-lactamases.

Gatermann S1, Marre R.

**ABSTRACT**

Strains of *Escherichia coli* (N = 124) and *Proteus mirabilis* (N = 29) harboring known beta-lactamases were analyzed as to their susceptibility to ampicillin, amoxicillin, and piperacillin alone and in combination with sulbactam, clavulanate, and tazobactam. With TEM 1-producing *E. coli*, a correlation between specific beta-lactamase activity and the MIC of piperacillin and ampicillin-sulbactam was observed. These strains also showed significant differences in susceptibilities to the various combinations, suggesting that, at least in strains resistant to one combination, several beta-lactam/beta-lactamase inhibitor combinations should be tested in the laboratory. All combinations tested enhanced the activity of the beta-lactam towards TEM 1-producing *E. coli*, piperacillin-tazobactam being the most active. The drugs were less active to OXA 1 enzymes; solely with piperacillin-tazobactam 90% of strains were within the therapeutic range of the drug. Sulbactam acted synergistically to chromosomally encoded beta-lactamases, whereas amoxicillin-clavulanate was inactive. Piperacillin and piperacillin-tazobactam inhibited all strains producing chromosomally encoded beta-lactamases at concentrations within the therapeutic range of the drugs. In contrast, TEM 2 of *P. mirabilis* was not sensitive to ampicillin-sulbactam, but to the other combinations; here again piperacillin-tazobactam was the most active.
30. Susceptibility of 539 Gram-positive and Gram-negative anaerobes to new agents, including RP59500, biapenem, trospectomycin and piperacillin/tazobactam

P. C. Appelbaum, S. K. Spangler, M. R. Jacobs

ABSTRACT

Susceptibilities of 539 Gram-positive and Gram-negative anaerobes were tested by agar dilution against 15 new and existing antimicrobial agents. Organisms included 218 Bacteroides fragilis group strains, 15 non-fragilis group Bacteroides, 130 Porphyromonas/Prevotella, 49 fusobacteria, 50 peptostreptococci, 53 clostridia and 24 Gram-positive non-sporoforming bacilli. Of 412 Gram-negative bacilli, 89% were β-lactamase-positive, while only two of the Gram-positive strains (both clostridia) produced this enzyme. Using established and preliminary breakpoints, all strains were susceptible to biapenem and imipenem (MIC90s 1 mg/L) and chloramphenicol (MIC90 8 mg/L). Only one of all the strains tested (a Cl. innocuum) was resistant (MIC > 4 mg/L) to RP59500; the latter had MIC90 2 mg/L, while 98% of strains were susceptible to trospectomycin (MIC90 16 mg/L). Ninety-nine per cent of strains were susceptible to piperacillin/tazobactam (MIC90 8 mg/L) compared to 86% to piperacillin (MIC90 > 64 mg/L). Corresponding data for ticarcillin/clavulanate versus ticarcillin were 97% susceptible (MIC90 8 mg/L) compared to 83% (MIC90 > 64 mg/L). Enhancement of the β-lactam by the inhibitors was only seen in β-lactamase-producing strains. Amoxycillin and cefoperazone were less often active (36% susceptible, MIC90 > 256 mg/L and 66% susceptible, MIC90 64 mg/L, respectively). Cefoxitin had greater activity than cefotetan (90% susceptible, MIC90 32 mg/L, compared to 72% susceptible, MIC90 > 64 mg/L). Metronidazole was active against 94% of strains (MIC90 4 mg/L). All metronidazole-resistant strains were Gram-positive (75% of non-sporoforming bacilli, 9% of clostridia and 6% of peptostreptococci). Ninety per cent of strains were susceptible to clindamycin (MIC90 4 mg/L).

Link to the article: https://academic.oup.com/jac/article-abstract/32/2/223/824512/Susceptibility-of-539-Gram-positive-and-Gram
31. THE FACTS ABOUT PENICILLIN ALLERGY: A REVIEW

Sanjib Bhattacharya1,

ABSTRACT

Hypersensitivity reactions are the major problem in the use of penicillins. True penicillin allergy is rare with the estimated frequency of anaphylaxis at 1-5 per 10 000 cases of penicillin therapy. Hypersensitivity is however, its most important adverse reaction resulting in nausea, vomiting, pruritus, urticaria, wheezing, laryngeal oedema and ultimately, cardiovascular collapse. Identification of patients who erroneously carry β-lactam allergy leads to improved utilization of antibiotics and slows the spread of multiple drug-resistant bacteria. Cross-reactivity between penicillin and second and third generation cephalosporin is low and may be lower than the cross-reactivity between penicillin and unrelated antibiotics.

Link to the full article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3255391/

II) Supporting studies for Gelseide

Periodontal disease prevalence


Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ; CDC Periodontal Disease Surveillance workgroup: James Beck (University of North Carolina, Chapel Hill, USA), Gordon Douglass (Past President, American Academy of Periodontology), Roy Page (University of Washington)


ABSTRACT

This study estimated the prevalence, severity, and extent of periodontitis in the adult U.S. population, with data from the 2009 and 2010 National Health and Nutrition Examination Survey (NHANES) cycle. Estimates were derived from a sample of 3,742 adults aged 30 years and older, of the civilian non-institutionalized population, having 1 or more natural teeth. Attachment loss (AL) and probing depth (PD) were measured at 6 sites per tooth on all teeth (except the third molars). Over 47% of the sample, representing 64.7 million adults, had periodontitis, distributed as 8.7%, 30.0%, and 8.5% with mild, moderate, and severe periodontitis, respectively. For adults aged 65 years and older, 64% had either moderate or severe periodontitis. Eighty-six and 40.9% had 1 or more teeth with AL ≥ 3 mm and PD ≥ 4 mm, respectively. With respect to extent of disease, 56% and 18% of the adult population had 5% or more periodontal sites with ≥ 3 mm AL and ≥ 4 mm PD, respectively. Periodontitis was highest in men, Mexican Americans, adults with less than a high school education, adults below 100% Federal Poverty Levels (FPL), and current smokers. This survey has provided direct evidence for a high burden of periodontitis in the adult U.S. population.

Key link: http://www.healthindicators.gov/Indicators/Periodontal-disease-adults-45-74-years_1280/Profile/Chart_Bar_Demographics
33. Periodontal health in Europe: future trends based on treatment needs and the provision of periodontal services--position paper 1.

König J1, Holtfreter B, Kocher T.

ABSTRACT

This review gives an update on recent epidemiologic data on periodontal diseases and a description of current periodontal services in Europe. A Medline search of articles published within the last decade with the keywords epidemiology, prevalence, periodontitis, tooth loss, and Europe was performed. Data on provision of dental services originated from international databases. Epidemiologic data on the prevalence of edentulism, the number of missing teeth, the prevalence of probing depth (Community Periodontal Index - CPI >or= 3 or Pocket Depth - PD >or= 4 mm), and clinical attachment loss (CAL >or= 4 mm) displayed a fragmentary picture within Europe. With respect to the limited data on periodontal health, Spain, Sweden, and Switzerland ranked as the healthiest among European countries in contrast to Germany where increased tooth loss and the highest prevalence of CAL >or= 4 mm were reported. The role of dental auxiliaries especially of dental hygienists and/or the medico-legal framework in which they work, appears to be an important factor in provision of effective periodontal care. Actual epidemiologic data on periodontal diseases are non-homogeneous and absent from several European countries. This emphasizes the need for more national representative epidemiological studies with a uniform design to permit comparability between different nations. Merging actual epidemiologic data with former data on provision of periodontal care may help to explain differences in periodontal parameters on a population basis and to define future provision of dental care.

34. Prevalence of periodontitis in an adult population from an urban area in North Italy: findings from a cross-sectional population-based epidemiological survey.

Aimetti M1, Perotto S2, Castiglione A3, Mariani GM1, Ferrarotti F1, Romano F1.

ABSTRACT

AIM:

There is a paucity of up-to-date data regarding prevalence and risk indicators of periodontitis in Italy. Therefore, the aim of this study was to evaluate the prevalence of periodontitis and its risk indicators among adults from an urban area in North Italy.

MATERIAL AND METHODS:

This cross-sectional survey used a stratified two-stage probability sampling method to draw a representative sample of the adult population of the city of Turin. About 1600 individuals, 20-75 years old, were randomly selected and 736 subjects agreed to participate (47% of the sampled subjects). Clinical parameters were assessed using a full-mouth protocol. Logistic models were applied to assess associations between periodontitis and its putative risk indicators. Age was included as restricted cubic spline.

RESULTS:

Based on CDC/AAP case definition, the prevalence estimates of severe and moderate periodontitis were 34.94% (95% CI: 31.23-38.74) and 40.78% (95% CI: 36.89-44.79). The probability of periodontitis increased in smokers (adjusted OR 2.06, 95% IC: 1.26-3.37, p = 0.004) and with age but leveled off in the 50+ year-old group (p < 0.001).

CONCLUSION:

Periodontitis was highly prevalent in the Turin population. The present data will enable development of appropriate public health programs and allocation of resources.
Bacteria found in pockets and complementing the mechanical debridement with adjunctive treatments

35. Identification of intracellular oral species within human crevicular epithelial cells from subjects with chronic periodontitis by fluorescence in situ hybridization.


ABSTRACT

BACKGROUND AND OBJECTIVE:
Interactions between oral bacteria and gingival epithelial cells play an important role in the pathogenesis of periodontal diseases. This study used in situ hybridization with 16 rRNA probes and confocal microscopy to detect the periodontal pathogens Porphyromonas gingivalis, Actinobacillus actinomycetemcomitans, Tannerella forsythia, and Treponema denticola within epithelial cells from periodontal pockets, gingival crevice, and buccal mucosa collected from subjects with chronic periodontitis (n = 14) and good periodontal health (n = 8).

MATERIAL AND METHODS:
Each green fluorescent species-specific and universal probe was hybridized with all 58 epithelial samples from the 22 patients. The samples were observed by confocal microscopy to confirm the intracellular localization of oral species of bacteria. The mean frequency of detection and number of intracellular bacteria per epithelial cell were computed for each sample.

RESULTS:
The frequency of cells with internalized bacteria was higher in samples from the gingival crevice than in samples from the oral mucosa. Epithelial cells from all subjects harbored intracellular bacteria; however, patients with periodontitis presented significantly higher counts of bacteria per cell than periodontally healthy individuals (p < 0.05). Periodontal pathogens showed a trend to be detected in higher numbers in epithelial cells from periodontitis patients. In particular, T. forsythia and T. denticola were significantly more prevalent in periodontal pocket cells than healthy sulci and buccal cell samples in the periodontitis group (p < 0.05).

CONCLUSION:
Those findings indicate that crevicular and buccal cells present internalized bacteria, regardless of periodontal status. However, higher bacterial loads are detected in cells from subjects with periodontitis.
36. **Primer for antimicrobial periodontal therapy.**

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**ABSTRACT**

Successful prevention and treatment of periodontitis is contingent upon effective control of the periodontopathogenetic microbiota. Periodontal pathogens reside in subgingival sites but also colonize supragingival plaque, tongue dorsum and other oral sites. Controlling destructive periodontal disease warrants a comprehensive antimicrobial approach that targets periodontal pathogens in various ecological niches of the oral cavity. Also, to effectively combat periodontal pathogens, the various elements of antimicrobial periodontal therapy should be engaged within a short period of time. Scaling and root planing, with or without periodontal surgery, along with proper oral hygiene, constitute the primary approach to controlling periodontopathogens. Antimicrobial agents administered systemically or locally can help suppress periodontal pathogens in periodontal sites and in the entire mouth. Microbiological testing aids the clinician in selecting the most effective antimicrobial agent or combination of agents, and in monitoring the effectiveness of periodontal treatment. The present paper considers theoretical and practical aspects of effective antimicrobial treatment of destructive periodontal disease.
37. Rationale for use of antibiotics in periodontics.

Walker C1, Karpinia K.

ABSTRACT

The purpose of this review is to provide the clinician with some practical rationale for the selection and use of antibiotics in the treatment of destructive periodontal diseases. We have attempted to integrate approximately 20 years of periodontal literature describing antibiotic therapy with personal experience and 21st century ideas. This article addresses antibiotic use during treatment of aggressive periodontitis with emphasis on juvenile disease and adult refractory diseases. The literature review revealed few large, controlled studies that compared efficacy of adjunctive antibiotic use to mechanical therapy alone. Even fewer studies evaluated the efficacy of one antibiotic relative to another. However, based on the evidence available, certain conclusions were drawn.

Adjunctive use of an antibiotic along with mechanical debridement is recommended for the treatment of Actinobacillus actinomycetemcomitans-associated periodontitis as an acceptable therapeutic regimen. Due to the emergence of tetracycline-resistant A. actinomycetemcomitans, the combination of metronidazole and amoxicillin may be preferable. In aggressive refractory periodontitis, compelling evidence exists that the use of an appropriate adjunctive antibiotic frequently gives a more favorable clinical response than mechanical therapy alone. Unfortunately, the selection of antibiotic is not as clear and is probably case-dependent. Positive responses have been reported with amoxicillin/clavulanic acid, clindamycin, metronidazole, and the combination therapy metronidazole plus amoxicillin. The introduction of local delivery antibiotics specifically for the treatment of periodontitis offers a novel concept for the treatment of localized disease. The latter, in particular, may prove useful in the treatment of recurrent disease activity or where only a few individual sites are involved.
38. A systematic review on the effect of systemic antimicrobials as an adjunct to scaling and root planing in periodontitis patients.

Herrera D1, Sanz M, Jepsen S, Needleman I, Roldán S.

ABSTRACT

BACKGROUND:

Scaling and root planing (SRP) are the bases of non-surgical therapy in the treatment of periodontitis. However, results from this therapy are often unpredictable and dependable from many different factors.

OBJECTIVES:

The aim of this systematic review was to evaluate the effectiveness of the adjunctive use of systemic antimicrobials with scaling and root planing (SRP) vs. SRP alone in the treatment of chronic (CP) or aggressive periodontitis (AgP).

SEARCH STRATEGY:

Use of computerized databases, namely MEDLINE, the Cochrane Oral Health Group Specialty Trials Register and EMBASE; reference lists from relevant articles were hand-searched; and a hand-search of selected journals until April 2001.

SELECTION CRITERIA:

Studies were selected if they were designed as controlled clinical trials in which systemically healthy patients with either AgP or CP were treated with SRP plus systemic antimicrobials in comparison with SRP alone or with placebo, for a minimum of 6 months. Main outcome measures were clinical attachment level (CAL) change and probing pocket depth (PPD) change.

DATA COLLECTION AND ANALYSIS:

Two reviewers extracted independently information regarding quality and study characteristics, in duplicate. Kappa scores determined their agreement. Main results were collected and grouped by drug, disease and PPD category. For the quantitative data synthesis, the data was pooled (when mean differences and standard errors were available), and either a Fixed Effects or Random Effects meta-analysis was used for the analysis.

RESULTS:

After an initial selection, 158 papers were identified by the manual and electronic searches; 25 papers were eligible for inclusion. Their quality assessment showed that randomization and allocation concealment methods were seldom reported and blindness was usually not defined clearly. In general, selected studies showed high variability and lack of relevant information for an adequate assessment. Overall, SRP plus systemic antimicrobial groups demonstrated better results in CAL and PPD change than SRP alone or with placebo groups. Only limited meta-analyses could be performed, due to the difficulties in pooling the studies and the lack of appropriate data. This analysis showed a statistically significant additional benefit for spiramycin (PPD change) and amoxicillin/metronidazole (CAL change) in deep pockets.

CONCLUSION:

Systemic antimicrobials in conjunction with SRP, can offer an additional benefit over SRP alone in the treatment of periodontitis, in terms of CAL and PPD change, and reduced risk of additional CAL loss. However, differences in study methodology and lack of data precluded an adequate and complete pooling of data for a more comprehensive analyses. It was difficult to establish definitive conclusions, although patients with deep pockets, progressive or ‘active’ disease, or specific microbiological profile, can benefit more from this adjunctive therapy.


**ABSTRACT**

**AIM:**
We investigated the long-term impact of adjunctive systemic antibiotics on periodontal disease progression. Periodontal therapy is frequently supplemented by systemic antibiotics, although its impact on the course of disease is still unclear.

**MATERIAL & METHODS:**
This prospective, randomized, double-blind, placebo-controlled multi-centre trial comprising patients suffering from moderate to severe periodontitis evaluated the impact of rational adjunctive use of systemic amoxicillin 500 mg plus metronidazole 400 mg (3x/day, 7 days) on attachment loss. The primary outcome was the percentage of sites showing further attachment loss (PSAL) ≥1.3 mm after the 27.5 months observation period. Standardized therapy comprised mechanical debridement in conjunction with antibiotics or placebo administration, and maintenance therapy at 3 months intervals.

**RESULTS:**
From 506 participating patients, 406 were included in the intention to treat analysis. Median PSAL observed in placebo group was 7.8% compared to 5.3% in antibiotics group (Q25 4.7%/Q75 14.1%; Q25 3.1%/Q75 9.9%; p < 0.001 respectively).

**CONCLUSIONS:**
Both treatments were effective in preventing disease progression. Compared to placebo, the prescription of empiric adjunctive systemic antibiotics showed a small absolute, although statistically significant, additional reduction in further attachment loss. Therapists should consider the patient's overall risk for periodontal disease when deciding for or against adjunctive antibiotics prescription.
Comparing local with systemic adjunctive treatments


Bollen CM, Quirynen M.


**ABSTRACT**

The recognition of the microbial origin and the specificity of periodontal infections has resulted in the development of several adjunctive therapies (antibiotics and/or antiseptics) to scaling and root planning in the treatment of chronic adult periodontitis. This article aims to review the "additional" effect of a subgingival irrigation with chlorhexidine, or a local or systemic application of tetracycline or metronidazole, performed in combination with a single course of scaling and root planning in patients with chronic adult periodontitis. All treatment modalities are compared with scaling and root planning, based on their impact on: the probing depth (PD); total number of colony forming units per ml (CFU/ml); the proportions and/or the detection-frequency of Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, and Prevotella intermedia; and/or on the percentages of cocci, spirochetes, motile, and other micro-organisms on dark field microscopy examination.

All treatment modalities, including scaling and root planning without additional chemical therapy, resulted in significant reductions in the probing depth and the proportions of periodonto pathogens, at least during the first 8 weeks’ post-therapy. However, in comparison to a single course of scaling and root planning, the supplementary effect of adjunctive therapies seems to be limited. In general, only the irrigation with chlorhexidine 2%, the local application of minocycline, and the systemic use of metronidazole (in case of large proportions of spirochetes) or doxycycline (in case of large proportions of A. actinomycetemcomitans) seem to result in a prolonged supplementary effect when compared to scaling and root planning. Therefore, the use of antibiotics on a routine basis, especially in a systemic way, in the treatment of chronic adult periodontitis, can no longer be advocated, considering the increasing danger for the development of microbial resistance.
41. A systematic review on the effects of local antimicrobials as adjuncts to subgingival debridement, compared with subgingival debridement alone, in the treatment of chronic periodontitis.


ABSTRACT

AIMS:
To update the existing scientific evidence on the efficacy of local antimicrobials as adjuncts to subgingival debridement in the treatment of chronic periodontitis.

MATERIAL AND METHODS:
Fifty-six papers were selected, reporting data from 52 different investigations. All the studies reported changes in probing pocket depth (PPD) and clinical attachment level (CAL) and most in plaque index (PII) and/or bleeding on probing (BOP). Meta-analyses were performed with the data retrieved from the studies fulfilling the inclusion criteria.

RESULTS:
The overall effect of the subgingival application of antimicrobials was statistically significant (p = 0.000) for both changes in PPD and CAL with a weighted mean difference (WMD) of -0.407 and -0.310 mm respectively. No significant differences occurred for changes in BOP and PII. Subgingival application of tetracycline fibres, sustained released doxycycline and minocycline demonstrated a significant benefit in PPD reduction (WMD between 0.5 and 0.7 mm). The rest of the tested outcomes demonstrated a high heterogeneity. The local application of chlorhexidine and metronidazole showed a minimal effect when compared with placebo (WMD between 0.1 and 0.4 mm).

CONCLUSIONS:
The scientific evidence supports the adjunctive use of local antimicrobials to debridement in deep or recurrent periodontal sites, mostly when using vehicles with proven sustained release of the antimicrobial.
42. **Topical antibiotic prophylaxis for bacteremia after dental extractions.**


**ABSTRACT**

**OBJECTIVE:**

Current prophylaxis for endocarditis in patients undergoing dental procedures consists of oral administration of amoxicillin. There is concern that the risk of anaphylaxis from systemically administered antibiotics might approach the incidence of endocarditis. Emergence of resistance among bacteria is also favored by systemically administered antibiotics. The present study was designed to assess the efficacy of topical amoxicillin given prophylactically as a mouthwash in reducing the incidence of bacteremia after dental extraction.

**STUDY DESIGN:**

Thirty-six outpatients in a dental clinic were randomized in a 3:2:2 ratio to experimental prophylaxis of topical amoxicillin (3 g per mouthwash rinse; 15 patients), standard prophylaxis of oral amoxicillin (3 g in a single dose; 11 patients), or no prophylaxis (10 patients), respectively. Patients were stratified by severity of periodontal disease and number of teeth extracted. Data were analyzed for differences in the incidence of bacteremia by means of the 2-tailed Fisher exact test.

**RESULTS:**

Breakthrough bacteremia after dental extraction was observed in 60% (6 of 10 patients) who received topical amoxicillin and in 89% (8 of 9 patients) who received no prophylaxis (P =.30). By comparison, breakthrough bacteremia after dental extraction was observed in 10% (1 of 10 patients) who received standard prophylaxis with oral amoxicillin (60% vs 10%; P =.05).

**CONCLUSIONS:**

Topical amoxicillin decreased the incidence of bacteremia in comparison with no prophylaxis, but statistical significance was not achieved (P =.30). **Topical amoxicillin was significantly less effective than standard prophylaxis with oral amoxicillin in decreasing the incidence of bacteremia after dental extractions.**
43. Direct medication delivery modifies the periodontal biofilm

Duane C. Keller* and Marissa Buechel
Oral Biology and Dentistry ISSN 2053-5775 | Volume 5 | Article 1

ABSTRACT

Background:
Conventional periodontal treatment is inadequate in controlling the periodontal biofilm. This is due to the nature and size of the bacteria, biofilm adaptive and reproductive capacity and an inability to mechanically remove the bacteria. The composition at the beginning of conventional treatment is the same as at the end.

Method:
Management involving a direct medication delivery of hydrogen peroxide, oxygen and an antioxidant (Perio Tray, Perio Protect LLC St. Louis, MO) was evaluated by scanning electron microscopy imagery (SEM) and DNA analysis to determine what bacteria were present before, during and after treatment. The biofilm by SEM analysis was changed in the number of bacteria while the DNA analysis demonstrated changes in the biofilm constituency.

Results:
The biofilm composition shifted from predominantly Gram negative obligate anaerobes before treatment to Gram positive anaerobes, Gram positive and negative facultative anaerobes and aerobic bacteria during the first month to the end of treatment. There was a –log2 to a –log4 change in the number of bacteria during the course of the treatment.

Conclusion:
This study indicates that direct medication delivery of medicaments with a custom formed tray modifies the biofilm from a more virulent anaerobic to a less virulent aerobic composition and reduces the number of pathogens. Fewer bacteria that are less virulent should provide better treatment results.
44. The adjunctive use of locally delivered tetracyclines in periodontal therapy: A narrative review of the recent literature

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ABSTRACT

Antibiotics belonging to the category of tetracycline have been widely used in periodontal therapy due to their specific characteristics that makes them effective both against the microorganisms responsible of the periodontal disease and against the enzymatic products responsible of the periodontal breakdown. A search of the recent literature (January 2009-December 2014) was conducted in order to make a review of the use of tetracycline for local use in periodontal therapy.

From this review we can infer that the use of local tetracycline brings significant advantages in periodontal therapy. However, to date, it is not possible to establish guidelines on the use of these agents given the heterogeneity in the protocols used in the various studies and the lack of a consensus accepted by the scientific community. The local locally delivered tetracycline is effective in the treatment of periodontal disease when used in addition to the mechanical therapy and is particularly effective in cases of localized acute lesions or individual sites unresponsive to the causal therapy.
INTRODUCTION

Bone and soft tissue infections are serious problems in orthopedic and reconstructive surgery. Especially, chronic osteomyelitis is a difficult infection to treat and eradicate. Long term parenteral antibiotics with multiple surgical debridements are often required for effective therapy (Cierny & Mader, 1984). Therefore, it is understandable that continuous efforts are being made and complete one or other element in the treatment of bone and soft tissue infections. There is a long history of local antibiotic use for the treatment of bone and soft tissue infections. During World War I, Alexander Fleming observed that locally applied antisepsics failed to sterilize chronically infected wounds, but they did reduce the burden of bacteria (Fleming, 1920). In 1939, the instillation of sulfanilamide crystals, along with thorough debridement, hemostasis, primary closure and immobilization, resulted in a reduced infection rate for open fractures (Jensen et al, 1939). As additional systemic antimicrobial agents became available, interest in the topical treatment of wounds waned, but the management of established osteomyelitis remained problematic. In the 1960s, the method of closed wound irrigation-suction was popularized as a method which could be used to deliver high concentrations of an antibiotic after debridement (Dombrowski & Dunn, 1965). An alternative method for delivering high concentrations of an antibiotic to sites of lower extremity osteomyelitis was isolation and perfusion (Organ, 1971). The delivery of local antibiotics for the treatment of musculoskeletal infection has become increasingly popular for a variety of reasons. The basis for developing and using local antibiotic delivery systems in the treatment of bone and soft tissue infection is either to supplement or to replace the use of systemic antibiotics. High local levels of antibiotics facilitate delivery of antibiotics by diffusion to avascular areas of wounds that are inaccessible by systemic antibiotics and in many circumstances the organisms that are resistant to drug concentrations achieved by systemic antibiotic are susceptible to the extremely high local drug concentrations provided by local antibiotic delivery. The local use of antibiotics to prevent and treat bone and soft tissue infections was revived in Germany with the widespread use of prosthetic joint replacement, a situation in which infections were not anticipated consequence of trauma or sepsis but a devastating complication of elective surgery (Buchholz & Engelbrecht, 1970). However, it is from the 18 Selected Topics in Plastic Reconstructive Surgery year 2000 that research on local delivery of antibiotics to bone has gained considerable attention. Note that the numbers of publications in the last five years are double and decuple published in earlier decades (Soundrapandian et al, 2009). Bacterial infection in orthopedic and reconstructive surgery can be devastating, and is associated with significant morbidity and poor functional outcomes (Haddad et al, 2004). Operative treatments (excision of infected and devascularized tissues, obliteration of dead space, restoration of blood supply and soft tissue coverage, stabilization and reconstruction of the damaged bone), removal of all foreign bodies and systemic antimicrobial therapy are three crucial components of the treatment of these cases (Lazzarini et al, 2004). A long-term course of systemic antibiotic therapy has been considered essential, but these prolonged therapies can result in side effects or toxicity. In order to achieve therapeutic drug concentration in the affected area, high systemic doses are generally required which can further worsen toxic side effects (Nandi et al, 2009). Antibiotic treatment may be inadequate or ineffective in patients with poorly vascularized infected tissues and osteonecrosis, which is often present in cases of osteomyelitis. Moreover, normal doses of systemic antibiotics may be insufficient to breach the glycocalyx or biofilm produced by the infecting bacteria (El-Husseiny et al, 2011). Despite intensive therapy, advances in surgical techniques, and development of new antimicrobials, relapse rate are still significant and treatment of bone and soft tissue infections remain challenging. New methods such as local delivery of antibiotics have evolved in an attempt to improve the prognosis of patients with musculoskeletal infections. The use of local antibiotic delivery system has become an accepted treatment method that continues to evolve for a variety of reasons. There has been an explosion of new technologies that are designed to facilitate the delivery of local antibiotics in new and creative ways. The primary reason for using these local antibiotic delivery vehicles is the ability to achieve very high local concentrations of antibiotics without associated systemic toxicity. In the typical
infected wound environment, which frequently has zones of avascularity, the ability to achieve high levels of antibiotics in these otherwise inaccessible areas is highly desirable (Cierny, 1999). Additional reasons for use of these delivery vehicles include the desire to treat remaining planktonic organisms and sessile organisms in biofilms more effectively with high concentrations of antibiotics (Hanssen et al, 2005). Because bone regeneration often is required as a part of the treatment plan, a recent trend has been simultaneously to provide a frame work of osteoinductive and osteoconductive materials along with antibiotics (Gitelis & Brebach, 2002). Despite the rapid acceptance of these antibiotic delivery vehicles, there are many unanswered questions related to their use, particularly when viewed within the environment of biofilms. Considerable investigation and development still are required to develop the necessary data to help determine a number of unknown variables associated with the use of local antibiotic delivery systems. In the application of a local antibiotic therapy for bone and soft tissue infections the following aspects should be considered: a) delivery technique; b) type of antibiotic that can be used; c) pharmacokinetics; d) possibility of application to a coating and to fillers; e) possibility of combination with osteoconductive and osteoinductive factors; f) use as prophylaxis and/or therapy; g) drawbacks. This review introduces bone and soft tissue infection-its present options for drug delivery systems and their limitations, and the wide range of carrier materials and effective drug choices. Also, I will describe and contrast the different local antibiotic delivery vehicles to Local Antibiotic Therapy in the Treatment of Bone and Soft Tissue Infections 19 provide a context for their current clinical use and to discuss the emerging investigate and developmental directions of these biomaterials.

**Conclusion**

The appropriate use of antimicrobial agents has decreased morbidity and mortality from orthopedic-related infections. Although systemic antibiotic use has been used for many years, new methods of local antibiotic delivery may result in increased antibiotic levels, decreased toxicity, and possibly greater efficacy. Antibiotic impregnated polymethylmethacrylate beads 34 Selected Topics in Plastic Reconstructive Surgery are currently being used in a variety of applications, but this method requires a second procedure for removal of the antibiotic delivery system. There is considerable interest in finding methods of delivering effective doses of antimicrobial drugs locally, not only in orthopedics, but across a range of specialists. While most of the antibacterial agent contained within a biodegradable system may be eluted, only 25% is actually released from polymethylmethacrylate beads. Biodegradable materials could mimic bone substances like calcium phosphate based carriers can be chosen for local drug delivery system in osteomyelitis with potential clinical application in orthopedic surgery. Widespread research is currently being conducted in the area of local drug delivery systems to treat osteomyelitis. Despite this fact, much work is still desired in the areas of biodegradable and biocompatible materials, the kinetics of antibiotic release, and further development of current systems before many of these formulations can be used. The serer diversity of available systems and the lack of suitable trials comparing them in-vivo makes their evaluation difficult. Nonetheless, it is apparent that while collagen fleece is currently the most widely used antimicrobial carrier system, the duration of its antibiotic delivery is the shortest. Other delivery systems have shown greater promise, and these that are able both to stimulate the formation of new bone and provide a scaffold, such as composite antibiotic carriers, are most likely to gain widespread acceptance in the future. In future, researchers remain optimistic that many of these systems can be developed with ideal zero-order release kinetics profiles, in-vivo, over long periods of time, allowing for widespread use in chronic osteomyelitis patients. By utilizing newer forms of sustained release antibiotic delivery systems, it will be possible to deliver such antibiotics at constant rates over a prolonged period of time and would eliminate the need for multiple dosing. It is hoped that in the future, development of new implantable systems would be helpful to reduce the cost of drug therapy, increase the efficacy of drugs, and could enhance the patient’s compliance.

*Link to full study*
46. **Topical and systemic antibiotics in the management of periodontal diseases.**

Mombelli A, Samaranayake LP.

**ABSTRACT**

Both systemic and topical antibiotics are increasingly used in the management of periodontal infections. Whilst these drugs are used mostly on an empirical basis, some contend that rational use of antibiotics should be the norm due to their wide abuse and consequential global emergence of antibiotic resistance organisms. Here we review the rationale and principles of antimicrobial therapy, treatment goals, drug delivery routes and various antibiotics that are used in the management of periodontal diseases. The pros and cons of systemic and local antibiotic therapy are described together with practical guidelines for their delivery.

The available data indicate, in general, that mechanical periodontal treatment alone is adequate to ameliorate or resolve the clinical condition in most cases, but adjunctive antimicrobial agents, delivered either locally or systemically, can enhance the effect of therapy in specific situations. This is particularly true for aggressive (early onset) periodontitis, in patients with generalized systemic disease that may affect host resistance and in case of poor response to conventional mechanical therapy. Locally delivered antibiotics together with mechanical debridement are indicated for non-responding sites of focal infection or in localized recurrent disease. After resolution of the periodontal infection, the patient should be placed on an individually tailored maintenance care program. Optimal plaque control by the patient is of paramount importance for a favorable clinical and microbiological response to any form of periodontal therapy.
47. **A comparative evaluation of the clinical effects of systemic and local doxycycline in the treatment of chronic periodontitis**

Ferda Alev Akalı§, Esra Baltacioglu§, Direk Sengün§, Süeda Hekimoglu†, Müge Taskın†, İker Etikan‡ and Inci Fisenk*


**ABSTRACT**

In this study, the clinical efficacies of systemic doxycycline (SD) and local doxycycline (LD) in the treatment of chronic periodontitis were compared. Forty-five patients were studied in 3 main groups with 5 treatments: SD alone, SD + scaling-root planing (SD+SRP), LD alone, LD+SRP and SRP alone. Antibiotic-treated patients were given doxycycline treatment alone in 1 quadrant of their upper jaws, and doxycycline + SRP was given in the contralateral quadrant. The areas included at least 4 teeth with ≥ 5 mm pockets. Probing depth (PD), clinical attachment level, gingival index, sulcular bleeding index and plaque index values were recorded at baseline and the 7th week. The results were statistically analyzed. All of the clinical parameters were significantly reduced by all treatments (P ≤ 0.05). The SD and LD treatments alone provided significant clinical healings. The significant differences among the groups were only in PD at the 7th week. The SD treatment provided significantly higher PD reduction than the SD treatment (P ≤ 0.05). No significant difference was found between the SD+SRP and the LD+SRP treatments. There was no significant difference between SD+SRP and SRP alone treatment (P > 0.05). The SD group showed lower PD reduction than SRP group (P ≤ 0.05), while no significant difference was found between LD and SRP treatments. The LD alone treatment seemed more effective than SD alone treatment on PD reduction, but no significant difference was found between them when combined with the SRP. LD may be more preferable than SD as an adjunct to mechanical treatment since LD seems more effective than SD on PD reduction and does not have the side effects of SD.

*Link to the full study*
48. Antimicrobial advances in treating periodontal diseases.

Mombelli A

ABSTRACT

Antibiotics are generally an efficient means of treating bacterial infections, and therefore are an obvious candidate in the treatment of periodontal diseases. Systemically and locally administered antimicrobial agents of all kinds have been evaluated in multiple clinical trials. The vast majority of studies have tested antibiotics as adjuncts to non-surgical debridement. No regime has demonstrated superiority over systemically administered amoxicillin and metronidazole in the treatment of any clinically or microbiologically defined variant of periodontal disease. The frequency and consequences of adverse effects of antibiotics have always to be balanced against the potential consequences of not rapidly suppressing a periodontal infection. Proposed strategies to reduce the risk of bacterial antimicrobial resistance include: prescribing two drugs with a synergistic or complementary effect, the administration of antibiotics at a high dose for a short period, a combined approach with mechanical debridement to disrupt biofilms, and the focus on therapeutic rather than prophylactic use. Derivatives of existing antibiotic classes and new compounds that act on unique targets are the subject of preclinical investigations with a focus on action against antibiotic-resistant medical pathogens. In light of the excellent results of a combination therapy with well-established drugs that are cheap and efficient, clinical trials should compare newly proposed protocols for periodontal therapy to a positive control. Future studies should focus not only on the action against the microorganisms directly involved in periodontal diseases, but also on those relevant to other medical concerns.
49. *Magic Bullet to treat Periodontitis: A targeted approach*

Vidya Dodwad, Shubra Vaish, Mehak Chhokra, Aakriti Mahajan  
JOURNAL OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES, JPBMS, 2012, 20 (19)

**ABSTRACT**

Periodontitis is a disease attributable to multiple infectious agents and interconnected with cellular and humoral host responses. It results from extension of the inflammatory process initiated in the gingiva to the supporting periodontal tissues. Periodontal pockets provide natural reservoir bathed by gingival crevicular fluid that is easily accessible for the insertion of a delivery device. Controlled release delivery of antimicrobials is a therapeutic intervention directly into periodontal pockets and is available in various forms like gels, monolithic devices, irrigation systems, chips, films, strips, microspheres, fibres etc. It is an effective monotherapy that has evoked a great interest and appears to hold a sound promising result in periodontal treatment. It does not substitute the local instrumentation but acts as an adjunct to it.

These local agents bypass the adverse effects of systemically administered antimicrobial agents, as well stabilize the attachment apparatus and reduce the probing depth thereby allowing better control and management of periodontal disease.

**CONCLUSION**

There are several drugs such as metronidazole, tetracycline, doxycycline, azithromycin, minocycline, chlorhexidine as well as herbal products like neem, pomegranate, propolis that are used and are also under further trial for their administration as local drug into the periodontal pocket.

Prudent administration of antimicrobial agents following judicious pharmacologic principles will preclude the abuse of chemotherapeutic agents and reduce the potential of developing or selecting drug resistant bacterial strains.

Local drug delivery system with controlled release properties have the potential to be used as a therapeutic component in the management of periodontal diseases. It aims to minimize drug degradation and loss, prevent harmful side-effects and increase drug bioavailability and the fraction of the drug accumulated in the required zone.

Various drug delivery and drug targeting systems are currently under development to obtain increased dissolution velocity, increased saturation solubility, improved bioadhesivity and versatility in surface modification so that better and effective administration of desired and newer drug can be done through the best possible system.

*Link to the full study*
50. Effect of local drug delivery in chronic periodontitis patients: A meta-analysis

Rupali Kalsi, K. L. Vandana, Shobha Prakash

ABSTRACT

Periodontal diseases are multi-factorial in etiology, and bacteria are one among these etiologic agents. Thus, an essential component of therapy is to eliminate or control these pathogens. This has been traditionally accomplished through mechanical means (scaling and root planing (SRP)), which is time-consuming, difficult, and, sometimes, ineffective. From about the past 30 years, locally delivered, anti-infective pharmacological agents, most recently employing sustained-release vehicles, have been introduced to achieve this goal. This systematic review is an effort to determine the efficacy of the currently available anti-infective agents, with and without concurrent SRP, in controlling chronic periodontitis. Four studies were included, which were all randomized controlled trials, incorporating a total patient population of 80, with 97 control sites and 111 test sites. A meta-analysis completed on these four studies including SRP and local sustained-release agents compared with SRP alone indicated significant adjunctive probing depth (PD) reduction for 10% Doxycycline hyclate (ATRIDOX), minocycline hydrochloride (ARESTIN), tetracycline hydrochloride (PERIODONTAL PLUS AB), and chlorhexidine gluconate (PERIOCHIP). Essentially, all studies reported substantial reductions in gingival inflammation, plaque scores, and bleeding indices, which were similar in both the control and the experimental groups. Use of antimicrobial sustained-release systems as an adjunct to SRP does not result in significant patient-centered adverse events.

Local drug delivery combined with SRP appears to provide additional benefits in PD reduction compared with SRP alone.

Link to the full study
51. Clinical and microbiological results following nonsurgical periodontal therapy with or without local administration of piperacillin/tazobactam

Marc Lauenstein & Marion Kaufmann & G. Rutger Persson

ABSTRACT

Objectives
We assessed if adjunct administration of piperacillin/tazobactam added clinical and microbiological treatment benefits.

Materials and methods
Thirty-six subjects (mean age 52.1 years (SD±10.3)) (NS by group) with chronic periodontitis were randomly enrolled receiving subgingival debridement and the local administration of piperacillin/tazobactam (test group) or debridement alone (control group). Bleeding on probing (BOP), probing pocket depth (PPD), and microbiological counts of 74 species were studied by checkerboard DNA-DNA hybridization up to month 6 after treatment.

Results
Mean PPD changes between baseline and month 6 in the test and control groups were 1.5 and 1.8 mm, respectively (NS between groups). BOP in both groups decreased from about 80 to 40%. At 4 and 12 weeks, lower counts of the following bacteria were found in the test group (site level): Fusobacterium species, Parvimonas micra, Pseudomonas aeruginosa, Staphylococcus aureus, Tannerella forsythia, Treponema denticola, and a composite load of nine pathogens (p<0.01). At week 26, subjects receiving local antibiotics had a lower prevalence at tested sites for Fusobacterium nucleatum sp. polymorphum, Fusobacterium periodonticum, P. micra, and T. denticola.

Conclusions
At 26 weeks, treatment with or without piperacillin/tazobactam resulted in similar BOP and PPD improvements. At week 26 and at the subject level, the prevalence of 4/74 pathogens was found at lower counts in the group receiving local antibiotics.

Clinical relevance
Administration of piperacillin/tazobactam reduces the prevalence of Fusobacterium, P. micra, and T. denticola to a greater extent than debridement alone but with no short-term differences in PPD or BOP.

DISCUSSION
There are currently no other clinical data on the efficacy to reduce bacterial counts in periodontal pockets by a single administration of piperacillin/tazobactam in subjects with moderate to advanced periodontitis. P. gingivalis was chosen as the target pathogen and as the primary outcome measure because it has been studied extensively in association with periodontitis [8, 23–25, 30, 35, 37]. Several other bacterial species demonstrated a greater susceptibility to the intervention in the test group and this effect remained also at week 26 for some species but not for P. gingivalis, T. forsythia, or A. actinomycetemcomitans.

The limitation of the present study is that the control subjects were not treated with a placebo drug administration. Nevertheless, the clinical examiner and the laboratory staff members were blinded to the protocol assignment to control for bias. Another limitation is that the evidence of bacterial changes following periodontal interventions from other studies does not easily provide information that can be utilized for statistical power analysis. Thus, we assumed based on our laboratory experiences that a 20–25% difference could be anticipated. A decrease amounting to approximately 20–25% was obtained in the test
group at weeks 2 and 4 for P. gingivalis and P. aeruginosa. At week 26, this remained the case for P. aeruginosa, suggesting that the administration of piperacillin/tazobactam has a relevant effect but limited to the control of P. aeruginosa subgingival colonization. One of the reasons why the reduction in bacterial counts was limited may be the result of less than optimal control of gingival inflammation as noticed by the rather high proportion of BOP at study endpoint.

The decreases in PPD and BOP obtained in the present study are consistent with the other studies on subgingival debridement not using antibiotics [1–7]. The extent of PPD reduction and decrease in BOP in the present study suggested a clinical effective outcome of therapy provided in both groups.

Furthermore, the extent of PPD reduction in both study groups in the present study was comparable, or greater to PPD reductions after combined local debridement and local antibiotics in other studies [30, 50]. In the present study, we treated subjects who were diagnosed with moderate to severe chronic periodontitis, and we only assessed interproximal conditions. In other similar studies, periodontal sites with more shallow PPDs have been studied [18, 21, 38]. It is well known that the reduction of PPD in the range of 1.5 to 2.0mm can be obtained by debridement alone in deep periodontal pockets [1–3]. The extent of possible probing depth reduction may also be limited by anatomical factors such as the extent and topography of alveolar bone loss and attachment loss. Some data have shown that local administration of doxycycline orminocycline in addition to debridement in subjects who smoke results in greater reduction in the frequency of P. gingivalis [22, 25]. In the present study, smoking did not seem to have an impact on the study outcomes neither on PPD nor BOP changes or microbiological changes. This may be explained by the low prevalence of smokers in the study.

Smoking, subject age, and gender were included as covariates in the subject-based analysis but did not significantly influence the results.

Although subject-based factors must be considered, it is generally perceived that chronic periodontitis is tooth/site specific [13–17]. In the present study, each subject contributed four individual test sites representing the sites with the most advanced periodontitis. Thus, no subject was overrepresented providing more data than any other subject. Several studies have used site-based analysis and performed microbiological sampling only from mesio-buccal surfaces [8, 22, 24, 50–56]. There appears to be a defined order in bacterial species succession in early supragingival and subgingival biofilm redevelopment after professional cleaning. The site-specific development of periodontitis may be the result of the symbiotic effects due to co-aggregation in subgingival biofilms including P. gingivalis, T. denticola, and T. forsythia [53]. Thus, the presence and counts of P. gingivalis, T. denticola, and T. forsythia may suggest the stability of periodontal conditions at individual sites at teeth. The observations that local treatment with antibiotics can reduce the counts of these species are important [31, 50]. In the present study, the adjunct administration of piperacillin/tazobactam resulted in more reduction of not only P. gingivalis, T. denticola, and T. forsythia but also other species associated with co-aggregation in biofilms (i.e., F. nucleatum) and other bacteria that are associated with several diseases (P. aeruginosa and S. aureus) and identified not only in periodontitis but also in subjects with peri-implantitis [48, 57–60].

It should also be noticed that the changes in bacterial counts over time were not consistently the same by different species. This may reflect the fluctuating state of bacterial growth and changes in the development of biofilms at different sites from which samples were taken. To some extent, it may also reflect measurement errors in sampling which might be the greatest error and by the laboratory procedures. The fact that the bacterial counts of P. aeruginosa and S. aureus at study endpoint did not differ by study group could be viewed as a positive finding in that these two species did not show evidence in counts that might suggest antibiotic resistance or other advantages by the medication.

The present study identified that without the use of the antibiotic, limited changes were found after debridement among the target bacteria. Recolonization of bacteria also occurred in the test group, and this is consistent with other studies [35]. Recolonization of bacteria following periodontal surgery in newly established shallow periodontal pockets also occurs soon after surgery [60]. This is consistent with the general concept that mechanical elimination of bacteria in a biofilm is not possible. Oral bacteria in biofilm comprise a complex community depending on the interface between the host and the microbial community as a whole [61]. Elimination of bacteria associated with periodontitis may therefore not be possible using local administration of antibiotics [32]. In addition to plasmid transfer and antibiotic resistance, there is a
mechanical protective glycolax layer that protects the biofilm and prevents penetration of antibiotics, and debridement may not effectively eliminate this glycolax in deep periodontal pockets.

In the present study, high counts of P. aeruginosa were found in the post-treatment findings in subjects in the control group. While piperacillin/tazobactam appears to be effective against P. aeruginosa [43, 44], this may explain why lower counts of P. aeruginosa were found in the test groups.

In the present study, high counts of A. actinomycetemcomitans were found both at baseline and especially throughout the study in the control group, suggesting that subgingival debridement alone cannot significantly reduce or eliminate this microorganism. This observation is consistent with other studies suggesting that A. actinomycetemcomitans is difficult to manage through mechanical debridement alone [32, 62, 63]. The reduction of A. actinomycetemcomitans was, however, also limited in the test group. Although bacteria commonly viewed as putative pathogens in periodontitis, i.e., T. forsythia and P. gingivalis, were similarly affected by study procedures, the pathogenic capacities of P. micra, Fusobacterium species, and T. denticola should not be minimized. The lower prevalence of these species in the test group should be considered as having a beneficial impact on periodontal status. There are many studies to suggest that P. micra, Fusobacterium species, and T. denticola are present at high counts in cases with periodontitis (i.e., [8–10]).

In conclusion, the present study identified similar improvements in clinical periodontal outcomes at week 26 in subjects treated with nonsurgical debridement with or without a onetime administration of a local antibiotic (piperacillin/tazobactam).

At the subject level, the local antibiotic therapy controlled the colonization of T. denticola, F. nucleatum polymorphum, F. periodonticum, and P. micra.

*Link to the full study*
III) Supporting studies for the Implantline

**Definition, Etiology, differences with Periodontitis of peri-implant diseases**

52. **Management of peri-implantitis**
Jayachandran Prathapachandran1 and Neethu Suresh

**ABSTRACT**

Peri-implantitis is a site-specific infectious disease that causes an inflammatory process in soft tissues, and bone loss around an osseointegrated implant in function. The etiology of the implant infection is conditioned by the status of the tissue surrounding the implant, implant design, degree of roughness, external morphology, and excessive mechanical load. The microorganisms most commonly associated with implant failure are spirochetes and mobile forms of Gram-negative anaerobes, unless the origin is the result of simple mechanical overload. Diagnosis is based on changes of color in the gingiva, bleeding and probing depth of peri-implant pockets, suppuration, X-ray, and gradual loss of bone height around the tooth. Treatment will differ depending upon whether it is a case of peri-implant mucositis or peri-implantitis. The management of implant infection should be focused on the control of infection, the detoxification of the implant surface, and regeneration of the alveolar bone. This review article deals with the various treatment options in the management of peri-implantitis. The article also gives a brief description of the etiopathogenesis, clinical features, and diagnosis of peri-implantitis. Peri-implantitis is a site-specific infectious disease that causes an inflammatory process in soft tissues, and bone loss around an osseointegrated implant in function. The etiology of the implant infection is conditioned by the status of the tissue surrounding the implant, implant design, degree of roughness, external morphology, and excessive mechanical load. The microorganisms most commonly associated with implant failure are spirochetes and mobile forms of Gram-negative anaerobes, unless the origin is the result of simple mechanical overload. Diagnosis is based on changes of color in the gingiva, bleeding and probing depth of peri-implant pockets, suppuration, X-ray, and gradual loss of bone height around the tooth. Treatment will differ depending upon whether it is a case of peri-implant mucositis or peri-implantitis. The management of implant infection should be focused on the control of infection, the detoxification of the implant surface, and regeneration of the alveolar bone. This review article deals with the various treatment options in the management of peri-implantitis. The article also gives a brief description of the etiopathogenesis, clinical features, and diagnosis of peri-implantitis.

**Link to the full article:** [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612185/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612185/)
53. Are peri-implantitis lesions different from periodontitis lesions?


ABSTRACT

AIM:
To compare histopathological characteristics of peri-implantitis and periodontitis lesions.

METHODS:
A search was conducted on publications up to July 2010. Studies carried out on human biopsy material and animal experiments were considered.

RESULTS:
While comprehensive information exists regarding histopathological characteristics of human periodontitis lesions, few studies evaluated peri-implantitis lesions in human biopsy material. Experimental peri-implantitis lesions were evaluated in 10 studies and three of the studies included comparisons to experimental periodontitis. Human biopsy material: the apical extension of the inflammatory cell infiltrate (ICT) was more pronounced in peri-implantitis than in periodontitis and was in most cases located apical of the pocket epithelium. Plasma cells and lymphocytes dominated among cells in both types of lesions, whereas neutrophil granulocytes and macrophages occurred in larger proportions in peri-implantitis.

EXPERIMENTAL STUDIES:
Placement of ligatures together with plaque formation resulted in loss of supporting tissues and large ICTs around implants and teeth. Following ligature removal, a "self-limiting" process occurred in the tissues around teeth with a connective tissue capsule that separated the ICT from bone, while in peri-implant tissues the ICT extended to the bone crest.

CONCLUSION:
Despite similarities regarding clinical features and aetiology of peri-implantitis and periodontitis, critical histopathological differences exist between the two lesions.
Prevalence of Peri-Implant diseases

54. Definition and prevalence of peri-implant diseases.

Zitzmann NU, Berglundh T.

ABSTRACT

OBJECTIVES:
The aim of the current review was to describe the prevalence of peri-implant diseases including peri-implant mucositis and peri-implantitis.

MATERIAL AND METHODS:
A MEDLINE search (PubMed) until December 2007 was conducted and different keywords related to the prevalence of peri-implant diseases were used. Cross-sectional and longitudinal studies including > or =50 implant-treated subjects exhibiting a function time of > or =5 years were considered.

RESULTS AND CONCLUSION:
The current review revealed that only a few studies provided data on the prevalence of peri-implant diseases. Cross-sectional studies on implant-treated subjects are rare and data from only two study samples were available. Peri-implant mucositis occurred in approximately 80% of the subjects and in 50% of the implants. Peri-implantitis was found in 28% and > or =56% of subjects and in 12% and 43% of implant sites.


Salvi GE, Cosgarea R, Sculean A.

ABSTRACT

The aim of the present critical review is to summarize recent evidence on the prevalence of peri-implant diseases and their similarities and differences with periodontal diseases with a focus on their pathogenetic mechanisms. Reports on the extent and severity of peri-implant diseases are influenced by different case definitions. The prevalence of peri-implant diseases is reported at the subject or implant level and affected by the type of population samples analyzed (e.g., randomly selected population samples or convenience samples). The outcomes of studies on animals and humans indicate that experimental biofilm accumulation leads to a higher frequency of bleeding sites around implants as compared with teeth. Despite the proof of principle that experimentally induced mucositis may be reversible, early diagnosis and management of naturally occurring peri-implant mucositis are clinically relevant. Tissue destruction at experimental peri-implantitis sites is faster and more extensive when compared with that at experimental periodontitis sites. Although human periodontitis and peri-implantitis lesions share similarities with respect to etiology and clinical features, they represent distinct entities from a histopathologic point of view. To avoid implant loss, patients diagnosed with peri-implantitis should be treated without delay.
56. The epidemiology of peri-implantitis.

Mombelli A, Müller N, Cionca N.

ABSTRACT

AIM:
To review the literature on the prevalence and incidence of peri-implantitis.

METHODS:
Out of 322 potentially relevant publications we identified 29 articles concerning 23 studies, with information on the presence of signs of peri-implantitis in populations of at least 20 cases.

RESULTS AND CONCLUSIONS:
All studies provided data from convenience samples, typically from patients who were treated in a clinical center during a certain period, and most data were cross-sectional or collected retrospectively. Based on the reviewed papers one may state that the prevalence of peri-implantitis seems to be in the order of 10% implants and 20% patients during 5-10 years after implant placement but the individual reported figures are rather variable, not easily comparable and not suitable for meta-analysis. Factors that should be considered to affect prevalence figures are the disease definition, the differential diagnosis, the chosen thresholds for probing depths and bone loss, differences in treatment methods and aftercare of patients, and dissimilarities in the composition of study populations. Smoking and a history of periodontitis have been associated with a higher prevalence of peri-implantitis.
57. Effectiveness of implant therapy in Sweden

Jan Derks

ABSTRACT

Dental implants are commonly used in restorative therapy in patients with partial or full edentulism. Knowledge regarding the outcome of this kind of treatment has been limited to evaluations of efficacy, i.e. therapy performed under optimal conditions. The current series of studies evaluated effectiveness of dental implant therapy including patient-reported outcomes, the occurrence of implant loss as well as peri-implantitis.

Using the national data registry of the Swedish Social Insurance Agency, 4,716 patients were randomly selected. All had been provided with implant-supported restorations in 2003/2004. Patient-reported outcomes were analyzed by questionnaire 6 years after completion of therapy (Study I). Patient files of 2,765 patients were collected from more than 800 clinicians. Information on patients, treatment procedures, and outcomes related to the implant-supported restorative therapy was extracted from the files. 596 of the 2,765 subjects attended a clinical examination 9 years after therapy. Early implant loss was assessed in patient files, while late implant loss was recorded at the clinical examination (Study II). The prevalence of peri-implantitis was determined from clinical and radiographic data collected at the 9-year examination (Study III). Radiographs obtained from the patient files were used to evaluate the onset and pattern of progression of peri-implantitis (Study IV).

It was demonstrated that:

- the overall patient satisfaction was high but influenced by (i) age and gender of the patient, (ii) the extent of restorative therapy and (iii) the training of the clinician performing the treatment (Study I).
- implant loss occurred in 7.6% of all patients over a follow-up of 9 years; patient and implant characteristics influenced the outcome (Study II).
- 14.5% of all patients exhibited moderate/severe peri-implantitis, and several patient- and implant-related characteristics were identified as risk indicators (Study III).
- progression of peri-implantitis occurred in a non-linear, accelerating pattern, and, in the majority of cases, the onset of the disease had occurred early (Study IV).

PATTERN PROGRESSION OF PERI-IMPLANTITIS AS A DEGENERATIVE CONDITION

![Figure 16: Estimated pattern of bone loss for each implant diagnosed with moderate/severe peri-implantitis at the 9-year examination (n=165, implants with 3 radiographic measurements); the red regression line indicates the mean estimated bone loss over time including the 95% CI.](image)
FINDINGS

Patient-reported outcome measures

Results from the assessments of PROMs (Study I) indicated a high degree of patient satisfaction with implant-supported restorations. These findings are in agreement with reports from studies covering similar periods of follow-up (Pjetursson et al., 2005; Simonis et al., 2010). Thus, it may be concluded that the large majority of patients are satisfied with long-term outcomes of implant therapy. It is noteworthy that the perception of patients treated under everyday conditions was similar to perceptions described in studies on cohorts treated in specialist clinics.

Implant loss

The proportion of patients experiencing implant loss reported in Study II is in general agreement with the few studies presenting patient data following different follow-up periods. Roos-Jansäker et al. (2006a), after 9 to 14 years, and Jemt et al. (2014), after 1 to 28 years, both recorded implant loss in 10.1% of patients. Balshe et al. (2009) found that 8.6% of patients had lost at least one implant after 2 to 7 years of follow-up. It is noteworthy that the proportion of implant loss in the present patient cohort (7.6%) compares favorably to results reported in above-mentioned studies, all describing patient samples treated in specialist clinics. On the other hand, the one registry study published (Antalainen et al., 2013) reported lower numbers of implant loss (3.1% of patients affected) than the present cohort study. This discrepancy between the study from Finland and the present findings may be related to the validity of the data in the Finnish registry. It also supports the concept that registry studies should be complemented by clinical examinations for validation.

The level of training of the surgeon has been discussed as an important factor for failure rates in implant dentistry. Albrektsson et al. (2012) stated that, when experienced, well-trained clinicians are involved in the therapy, the collective rate for implant loss and peri-implantitis over 10 years is expected to be below 5% on the implant level. In the present patient cohort, the level of clinical training (specialist vs. general practitioner) did not influence the odds for implant loss or peri-implantitis. In fact, 22% of all patients in the present sample received (surgery) their implants in a general practice setting, and implant loss in this subgroup was not different from outcomes in patients treated in specialist clinics.

In the analysis of risk indicators of implant loss, we included a multitude of potential factors. While we controlled for the extent of therapy, augmentation, number of implants, etc., we were not able to adjust for the inherent complexity of each individual case. It may be assumed that more complicated clinical situations were handled by more experienced clinicians. Therefore, the observed lack of differences between categories of clinicians may have been confounded by the complexity of cases not considered in the statistical analysis.

Peri-implantitis

While almost 50% of all patients presented with clinical and radiographic signs of peri-implantitis at the 9-year examination, a subgroup of 14.5% was diagnosed with moderate/severe peri-implantitis (Study III). Moderate/severe peri-implantitis entailed, in addition to soft tissue inflammation, a crestal bone loss exceeding 2 mm. These affected implants (8% of all implants) had, on the average, lost 29% of their bone support. The overall estimate of peri-implantitis, including inflammation and crestal bone loss >0.5 mm, on the patient level (45%) was considerably higher than results obtained from a recent meta-analysis presented by Derks & Tomasi (2015). The authors reported a weighted mean patient prevalence of 22% (95% CI: 14–30%). This lower proportion of peri-implantitis is in agreement with our findings on the prevalence of moderate/severe peri-implantitis. Furthermore, it was stated in the review that the case definitions for peri-implantitis applied in the different studies influenced the reported disease prevalence. We used the radiographic thresholds suggested by Koldsland et al. (2010; 2011) and found similar proportions of overall and moderate/severe peri-implantitis. Eke et al. (2012; 2015) reported that 8% of all adults above the age of 30 exhibited signs of advanced periodontitis (≥2 interproximal sites with ≥6 mm attachment loss and ≥1 interproximal sites with ≥5 mm PPD). The corresponding value for moderate/severe peri-implantitis in the present project was 14.5%. In this context it should be realized that, even though the prevalence of the two diseases - periodontitis and peri-implantitis - appears similar, important histopathological differences between the two disorders exist (Berglundh et al., 2011; Carcuac and Berglundh, 2014).
The results of Study IV were generated from a statistical model and indicated that the majority of patients diagnosed with moderate/severe peri-implantitis at the 9-year examination showed early signs of crestal bone loss already after 3 years.

This may indicate that bone loss, as part of peri-implantitis, may start early following implant placement and, if not treated, may progress over time. This is in general agreement with findings presented by Fransson et al. (2010) and Cecchinato et al. (2014) but stands in apparent contrast to results by Koldsland et al. (2010), who identified groups exhibiting different levels of disease severity but no differences in mean follow-up time.

**Consequences of complications**

It is obvious that the consequences of a complication, rather than the diagnosis itself, may be the primary concern of the patient. Results from Study II demonstrated that early and late implant loss entailed potentially severe consequences for the majority of patients, ranging from changes in treatment planning to complete loss of applied restorations. Health economics of implant loss and peri-implantitis were not analyzed in the current studies, but it may be assumed that costs associated with complications were high, both for the patient, for the clinician and providers of health insurance. Zitzmann et al. (2013) compared the cost-effectiveness of tooth-supported 3-unit restorations and single implants in the anterior dentition. The implant-supported solutions were found to be more cost-effective in a probability model based on an average observation period of 4 years. Results from Studies III & IV indicated that peri-implantitis is common and that its onset and progression may be time-dependent. Therefore, the 4-year observation period in the study by Zitzmann et al. (2013) may have underestimated the effects of peri-implantitis, particularly the costs related to its treatment. In two separate 10-year reports, Roccuzzo et al. (2012; 2014) calculated the need for invasive treatment of peri-implantitis in patient cohorts treated in a private specialist clinic. Surgical therapy and/or the use of systemic antibiotics were considered necessary in 11% to 67% of all patients, depending on the periodontal classification of the subjects. Data from the SSIA registry in Stockholm indicated that, while approximately 15,000 subjects received implants in Sweden annually over the last three years (2012-2014, Table 1), around 2,000 were, on an annual basis, treated surgically for peri-implantitis during the same time period (data from SSIA register, based on reimbursed surgeries with associated diagnosis of peri-implantitis). It may, again, be assumed that associated costs were high, and that consequences of peri-implantitis also, from a patient point of view, may be severe and, at times, dramatic.

*Link to full study*
58. *Prevalence of Peri-Implantitis Related to Severity of the Disease With Different Degrees of Bone Loss*

Koldsland OC, Scheie AA, Aass AM.
Prevalence of Peri-Implantitis Related to Severity of the Disease With Different Degrees of Bone Loss J Periodontol 2010;81:231-238

**ABSTRACT**

Several measurements are combined to diagnose peri-implant disease, and different thresholds are used to describe the disease. The purpose of this study was to evaluate the prevalence of peri-implant disease and to apply different diagnostic thresholds to assess its prevalence in relation to severities of peri-implantitis with different degrees of bone loss. A total of 164 subjects with dental implants inserted at the Institute of Clinical Odontology, University of Oslo, between 1990 and 2005, were invited to join the project, and 109 subjects attended the examination (mean age: 43.8 years; range: 18 to 80 years). The mean functional loading time was 8.4 years (SD: 4.6 years). The participants were examined clinically and radiographically. The following aspects of disease were assessed to describe the peri-implant condition: detectable radiographic peri-implant bone loss and inflammation, the presence of bleeding on probing at a probing depth $\geq 4$ or $\geq 6$ mm, and radiographic peri-implant bone loss assessed at $\geq 2.0$ and $\geq 3.0$ mm. Assessing peri-implantitis at different levels of severity yielded a substantial variance in prevalence (11.3% to 47.1%) in the present study population. Peri-implant inflammation was a frequent finding with and without peri-implant bone loss.

Link to the full article:
Implaprotect: Peri-implantitis mucositis treatment and antibiotic at implant placement

59. Peri-Implant Mucositis and Peri-Implantitis: A Current Understanding of Their Diagnoses and Clinical Implications

Academy Report

CLINICAL IMPLICATIONS

Peri-implant mucositis and peri-implantitis differ with respect to treatment. To date, evidence suggests that peri-implant mucositis can be successfully treated if detected early and when combined with effective non-surgical efforts. Non-surgical therapy has not been shown to be effective for the treatment of peri-implantitis. Currently, different surgical treatment modalities have been proposed and have shown promising results. However, long-term controlled studies are needed to validate which treatment modality may be optimal, given the different clinical scenarios. It has been suggested, as with many inflammatory diseases, that the earlier the diagnosis and intervention, the better the treatment outcome. To that end, routine monitoring of dental implants as a part of a comprehensive periodontal evaluation and maintenance is essential.

To conclude, it is suggested to:

• Identify risk factors associated with developing peri-implant diseases
• Establish radiographic baseline at the time of implant placement
• Establish clinical and radiographic baseline at final prosthesis insertion
• Employ methods that monitor implant health and determine inflammatory complications as part of an ongoing periodontal maintenance program
• Establish an early diagnosis and intervention, which will contribute to more effective management of peri-implant diseases

Renvert S1, Roos-Jansäter AM, Claffey N.

ABSTRACT

OBJECTIVES:
To review the literature on non-surgical treatment of peri-implant mucositis and peri-implantitis.

MATERIAL AND METHODS:
A search of PubMed and The Cochrane Library of the Cochrane Collaboration (CENTRAL) as well as a hand search of articles were conducted. Publications and articles accepted for publication up to November 2007 were included.

RESULTS:
Out of 437 studies retrieved a total of 24 studies were selected for the review. Thus the available evidence for non-surgical treatment of peri-implant mucositis and peri-implantitis is scarce.

CONCLUSIONS:
It was observed that mechanical non-surgical therapy could be effective in the treatment of peri-implant mucositis lesions. Furthermore, the adjunctive use of antimicrobial mouth rinses enhanced the outcome of mechanical therapy of such mucositis lesions. In peri-implantitis lesions non-surgical therapy was not found to be effective. Adjunctive chlorhexidine application had only limited effects on clinical and microbiological parameters. However, adjunctive local or systemic antibiotics were shown to reduce bleeding on probing and probing depths. Minor beneficial effects of laser therapy on peri-implantitis have been shown; this approach needs to be further evaluated. There is a need for randomized-controlled studies evaluating treatment models of non-surgical therapy of peri-implant mucositis and peri-implantitis.
61. Peri-implant mucositis treatments in humans: a systematic review

Blerina Zeza, DDS, MS and Andrea Pilloni, MD, DDS, MS,

ABSTRACT

AIM

Peri-implant mucositis affects 39.4–80% of patients restored with dental implants. If left untreated it evolves in peri-implantitis. Thus far no predictable successful treatment has been reported for peri-implantitis, resulting in implant failure. Proper diagnosis and treatment of peri-implant mucositis is of crucial importance. This study aims to provide a comprehensive review of the available data regarding the effectiveness of peri-implant mucositis treatments in humans, parameters used for the diagnosis and treatment effect evaluation.

MATERIALS AND METHODS

A literature search for RCT and observational studies on peri-implant mucositis treatments in humans was conducted on Pubmed up to January 2012. CONSORT/STROBE and PRISMA checklists guided the evaluation of studies found and the writing of this review, respectively.

RESULTS

Only 5 studies fulfilled the selection criteria. Few possibly effective treatments were studied. Diagnostic parameters reported were clinical only, while treatment effect evaluation was based on clinical and microbiological changes, except for one study reporting biochemical analysis. An evident heterogeneity characterized the follow-up intervals and methods used for reporting parameters changes.

CONCLUSIONS

Neither of studied treatments gave complete resolution of peri-implant mucositis. Different treatment strategies need to be studied. Authors suggest guidelines for a protocol of parameters used for determining the sample size, diagnosis and treatment effect, as well as follow-up periods, in order to permit evidence and comparison of different treatments effectiveness.

Link to the full article: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3555467/
62. Interventions for replacing missing teeth: antibiotics at dental implant placement to prevent complications.

Esposito M1, Worthington HV, Loli V, Coulthard P, Grusovin MG.

ABSTRACT

BACKGROUND:

Some dental implant failures may be due to bacterial contamination at implant insertion. Infections around biomaterials are difficult to treat and almost all infected implants have to be removed. In general, antibiotic prophylaxis in surgery is only indicated for patients at risk of infectious endocarditis, for patients with reduced host-response, when surgery is performed in infected sites, in cases of extensive and prolonged surgical interventions and when large foreign materials are implanted. To minimize infections after dental implant placement various prophylactic systemic antibiotic regimens have been suggested. More recent protocols recommended short term prophylaxis, if antibiotics have to be used. With the administration of antibiotics adverse events may occur, ranging from diarrhea to life-threatening allergic reactions. Another major concern associated with the widespread use of antibiotics is the selection of antibiotic-resistant bacteria. The use of prophylactic antibiotics in implant dentistry is controversial.

OBJECTIVES:

To assess the beneficial or harmful effects of systemic prophylactic antibiotics at dental implant placement versus no antibiotic/placebo administration and, if antibiotics are of benefit, to find which type, dosage and duration is the most effective.

SEARCH STRATEGY:

The Cochrane Oral Health Group's Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE and EMBASE were searched up to 2nd June 2010. Several dental journals were handsearched. There were no language restrictions.

SELECTION CRITERIA:

Randomised controlled clinical trials (RCTs) with a follow up of at least 3 months comparing the administration of various prophylactic antibiotic regimens versus no antibiotics to patients undergoing dental implant placement. Outcome measures were prosthesis failures, implant failures, postoperative infections and adverse events (gastrointestinal, hypersensitivity, etc).

DATA COLLECTION AND ANALYSIS:

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted in duplicate and independently by two review authors. Results were expressed as random-effects models using risk ratios (RRs) for dichotomous outcomes with 95% confidence intervals (CIs). Heterogeneity was to be investigated including both clinical and methodological factors.

MAIN RESULTS:

Four RCTs were identified: three comparing 2 g of preoperative amoxicillin versus placebo (927 patients) and the other comparing 1 g of preoperative amoxicillin plus 500 mg 4 times a day for 2 days versus no antibiotics (80 patients). The meta-analyses of the four trials showed a statistically significant higher number of patients experiencing implant failures in the group not receiving antibiotics: RR = 0.40 (95% CI 0.19 to 0.84). The number needed to treat (NNT) to prevent one patient having an implant failure is 33 (95% CI 17 to 100), based on a patient implant failure rate of 5% in patients not receiving antibiotics. The other outcomes were not statistically significant, and only two minor adverse events were recorded, one in the placebo group.
AUTHORS' CONCLUSIONS:

There is some evidence suggesting that 2 g of amoxicillin given orally 1 hour preoperatively significantly reduce failures of dental implants placed in ordinary conditions. No significant adverse events were reported. It might be sensible to suggest the use of a single dose of 2 g prophylactic amoxicillin prior to dental implant placement. It is still unknown whether postoperative antibiotics are beneficial, and which is the most effective antibiotic.
Peri-implantitis treatment

63. Management of peri-implant mucositis and peri-implantitis.


ABSTRACT

Peri-implant diseases are defined as inflammatory lesions of the surrounding peri-implant tissues and include peri-implant mucositis (an inflammatory lesion limited to the surrounding mucosa of an implant) and peri-implantitis (an inflammatory lesion of the mucosa that affects the supporting bone with resulting loss of osseointegration). This review aims to describe the different approaches to manage both entities and to provide a critical evaluation of the evidence available on their efficacy. Therapy of peri-implant mucositis and nonsurgical therapy of peri-implantitis usually involve mechanical debridement of the implant surface using curettes, ultrasonic devices, air-abrasive devices or lasers, with or without the adjunctive use of local antibiotics or antiseptics. The efficacy of these therapies has been demonstrated for mucositis: controlled clinical trials show an improvement in clinical parameters, especially in bleeding on probing. For peri-implantitis, the results are limited, especially in terms of probing pocket-depth reduction. Surgical therapy of peri-implantitis is indicated when nonsurgical therapy fails to control the inflammatory changes. Selection of the surgical technique should be based on the characteristics of the peri-implant lesion. In the presence of deep circumferential and intrabony defects, surgical interventions should aim to provide thorough debridement, implant-surface decontamination and defect reconstruction. In the presence of defects without clear bony walls or with a predominant supragingival component, the aim of the surgical intervention should be the thorough debridement and the reposisioning of the marginal mucosa to enable the patient to perform effective oral-hygine practices, although this aim may compromise the esthetic result of the implant-supported restoration.
64. Management of peri-implantitis
Jayachandran Prathapachandran and Neethu Suresh

ABSTRACT

Peri-implantitis is a site-specific infectious disease that causes an inflammatory process in soft tissues, and bone loss around an osseointegrated implant in function. The etiology of the implant infection is conditioned by the status of the tissue surrounding the implant, implant design, degree of roughness, external morphology, and excessive mechanical load. The microorganisms most commonly associated with implant failure are spirochetes and mobile forms of Gram-negative anaerobes, unless the origin is the result of simple mechanical overload. Diagnosis is based on changes of color in the gingiva, bleeding and probing depth of peri-implant pockets, suppuration, X-ray, and gradual loss of bone height around the tooth. Treatment will differ depending upon whether it is a case of peri-implant mucositis or peri-implantitis. The management of implant infection should be focused on the control of infection, the detoxification of the implant surface, and regeneration of the alveolar bone. This review article deals with the various treatment options in the management of peri-implantitis. The article also gives a brief description of the etiopathogenesis, clinical features, and diagnosis of peri-implantitis.

Link to the full article: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612185/
65. Surgical Treatment of Peri-implantitis: Treatment Results - a pilot study

Lina Bengtzböe Stina Öskog
Not yet published

ABSTRACT

Peri-implantitis is an infectious disease and one of the treatment methods involves surgical debridement of the infected area. The aim of this pilot study was to investigate treatment outcome after surgical treatment of peri-implantitis in humans. Outcome measures were reduction in pocket probing depth (PPD) and bleeding on probing and/or suppuration (BOP/Sup). Eight patients, with a total amount of 28 implants, who were diagnosed with peri-implantitis were surgically treated with a non-regenerative surgical method including debridement and removal of granulation tissue combined with osteoplasty. Oral hygiene instructions were given and after 6 to 18 months a clinical reexamination was performed by two dental students at Umeå University. PPD and BOP/Sup data at the re-examination were retrospectively compared to baseline data. The results of the study showed a reduction in mean PPD and BOP/Sup after surgery at patient level. A significant reduction in mean PPD was shown (p> 0.05), while the reduction in BOP/Sup was not significant. At patient level, the mean reduction in mean PPD was 1.6 mm and in BOP/Sup 26%. Results varied among patients, suggesting that treatment outcome is influenced by several different factors. Tendencies that risk factors such as smoking and poor oral hygiene may have affected the treatment result were noted. In conclusion, our study shows that surgical therapy may be a beneficial treatment method for peri-implantitis in terms of reduction of PPD and BOP/Sup.

Link to full study
66. The Therapy of Peri-implantitis: A Systematic Review

Lisa J. A. Heitz-Mayfield, BDS, MDSc, Odont Dr/Andrea Mombelli, Prof Dr Med Dent

ABSTRACT

PURPOSE.

To evaluate the success of treatments aimed at the resolution of peri-implantitis in patients with osseointegrated implants.

MATERIALS AND METHODS

The potentially relevant literature was assessed independently by two reviewers to identify case series and comparative studies describing the treatment of peri-implantitis with a follow-up of at least 3 months. Medline, Embase, and The Cochrane Library were searched. For the purposes of this review, a composite criterion for successful treatment outcome was used which comprised implant survival with mean probing depth < 5 mm and no further bone loss.

RESULTS

A total of 43 publications were included: 4 papers describing 3 nonsurgical case series, 13 papers describing 10 comparative studies of nonsurgical interventions, 15 papers describing 14 surgical case series, and 11 papers describing 6 comparative studies of surgical interventions. No trials comparing nonsurgical with surgical interventions were found. The length of follow-up varied from 3 months to 7.5 years. Due to the heterogeneity of study designs, peri-implantitis case definitions, outcome variables, and reporting, no meta-analysis was performed. Eleven studies could be evaluated according to a composite success criterion.

Successful treatment outcomes at 12 months were reported in 0% to 100% of patients treated in 9 studies and in 75% to 93% of implants treated in 2 studies. Commonalities in treatment approaches between studies included (1) a pretreatment phase, (2) cause-related therapy, and (3) a maintenance care phase.

CONCLUSIONS

While the available evidence does not allow any specific recommendations for the therapy of peri-implantitis, successful treatment outcomes at 12 months were reported in a majority of patients in 7 studies. Although favorable short-term outcomes were reported in many studies, lack of disease resolution as well as progression or recurrence of disease and implant loss despite treatment were also reported. The reported outcomes must be viewed in the context of the varied peri-implantitis case definitions and severity of disease included as well as the heterogeneity in study design, length of follow-up, and exclusion/inclusion.

Link to the full study
67. **Surgical treatment of peri-implantitis.**

Claffey N1, Clarke E, Polyzois I, Renvert S.

**ABSTRACT**

**OBJECTIVES:**
To review the literature on surgical treatment of peri-implantitis.

**MATERIAL AND METHODS:**
A search of PubMed and as well as a hand search of articles were conducted. Publications and articles accepted for publication up to November 2007 were included.

**RESULTS:**
A total of 43 studies were selected for the review. Only 13 of these were studies in humans and only one study directly addressed disease resolution. Thus the available evidence for surgical treatment of peri-implantitis is extremely limited.

**ANIMAL STUDIES:**
Re-osseointegration can occur on previously contaminated surfaces. The surface characteristics are decisive for regeneration and re-osseointegration. No single surface decontamination method appears to be distinctly superior. Open debridement with surface decontamination can achieve resolution.

**HUMAN STUDIES:**
Access surgery has been investigated in one study demonstrating that resolution occurred in 58% of the lesions. No single method of surface decontamination (chemical agents, air abrasives and lasers) was found to be superior. The use of regenerative procedures such as bone graft techniques with or without the use of barrier membranes has been reported with various degrees of success. However, it must be stressed that such techniques do not address disease resolution but rather merely attempt to fill the osseous defect.

Romeo E1, Ghisolfi M, Murgolo N, Chiapasco M, Lops D, Vogel G.

ABSTRACT

The purpose of this randomized clinical trial was to compare the clinical outcome of two different surgical approaches for the treatment of peri-implantitis. Seventeen patients with ITI(R) implants were included consecutively over a period of 5 years. The patients were randomized with a lottery assignment. Ten patients were treated with resective surgery and modification of surface topography (test group). The remaining seven patients were treated with resective surgery only (control group). Clinical parameters (suppuration, modified plaque index - mPI, modified bleeding index - mBI, probing pocket depth - PPD, pseudopocket - DIM, mucosal recession - REC, probing attachment level - PAL) were recorded at baseline, as well as 6, 12, 24 and 36 months after treatment. The cumulative survival rate for the implants of the test group was 100% after 3 years. After 24 months, two hollow-screw implants of control group were removed because of mobility. Consequently, the cumulative survival rate was 87.5%. The recession index in the control group was significantly lower than in the test group at 24 months (Student's t-value of -2.14). On the contrary, control group showed higher PPD, PAL and mBI indexes than test group (Student's t-values of +5.5, +2.4 and +9.61, respectively). The PPD and mBI indexes for the implants of the control group were significantly higher at baseline than 24 months later (Student's t-values of +3.18 and +3.33, respectively). Recession and PAL indexes resulted in values significantly lower than baseline (Student's t-values of -4.62 and -2.77, respectively). For the implants of the test group PPD and mBI indexes were significantly higher at baseline than 36 months after (Student's t-values of +11.63 and +16.02, respectively). Recession index resulted in values significantly lower at baseline (Student's t-value of -5.05). No statistically significant differences were found between PAL index measurement at baseline and 36 months later (Student's t-value of +0.89). In conclusion, resective therapy associated with implantoplasty seems to influence positively the survival of oral implants affected by inflammatory processes.


ABSTRACT

OBJECTIVES:
This clinical study on therapy of peri-implantitis aimed to compare the marginal bone loss of implants treated with different surgical approaches: implantoplasty and peri-implant resective surgery only.

MATERIAL AND METHODS:
Over a period of 6 years, 10 patients (20 implants) were treated with implantoplasty (test group) and 9 had resective surgery (control group). A computerized analysis of radiographs was performed to calculate marginal bone loss (MBL) values mesial and distal to the implants. The measurement system was set by means of known implant sizes. Data on MBL were collected at the time of peri-implantitis diagnosis, 1, 2 and 3 years after surgery.

RESULTS:
There was no difference between the mean MBL values three years after implantoplasty in the test group: 0 and 0.01 mm of MBL mesial and distal to the implant were found (P>0.05). Conversely, the mean MBL values recorded in the control group were statistically different: 1.44 and 1.54 mm of MBL mesial and distal to the implant were found (P<0.05) 3 years after resective surgery. Moreover, the variation of peri-implant marginal bone after peri-implantitis surgical treatment was significantly lower in the test group than in the control group (P<0.05).

CONCLUSIONS:
The results of this radiographic research suggested that implantoplasty was an effective treatment of peri-implant infections and peri-implantitis progression.
70. **Managing peri-implant bone loss: current understanding.**

Aljateeli M1, Fu JH, Wang HL.

**ABSTRACT**

**PURPOSE:**

With the improved macro- and micro-designs, dental implants enjoy a high survival rate. However, peri-implant bone loss has recently emerged to be the focus of implant therapy. As such, researchers and clinicians are in need of finding predictable techniques to treat peri-implant bone loss and stop its progression.

**MATERIALS AND METHODS:**

Literature search on the currently available treatment modalities was performed and a brief description of each modality was provided.

**RESULTS:**

Numerous techniques have been proposed and none has been shown to be superior and effective in managing peri-implant bone loss. This may be because of the complex of etiological factors acting on the implant-supported prosthesis hence the treatment approach has to be individually tailored.

**CONCLUSION:**

Due to the lack of high-level clinical evidence on the management of peri-implant bone loss, the authors, through a literature review, attempt to suggest a decision tree or guideline, based on sound periodontal surgical principles, to aid clinicians in managing peri-implantitis associated bone loss.
71. Treatment Alternatives to Negotiate Peri-
Implantitis

Eli E. Machtei *
Advances in Medicine Volume 2014 (2014), Article ID 487903,

ABSTRACT

Peri-implant diseases are becoming a major health issue in dentistry. Despite the magnitude of this problem and the potential grave consequences, commonly acceptable treatment protocols are missing. Hence, the present paper reviews the literature treatment of peri-implantitis in order to explore their benefits and limitations. Treatment of peri-implantitis may include surgical and nonsurgical approaches, either individually or combined. Nonsurgical therapy is aimed at removing local irritants from the implants' surface with or without surface decontamination and possibly some additional adjunctive therapies agents or devices. Systemic antibiotics may also be incorporated. Surgical therapy is aimed at removing any residual subgingival deposits and additionally reducing the peri-implant pockets depth. This can be done alone or in conjunction with either osseous respective approach or regenerative approach. Finally, if all fails, explantation might be the best alternative in order to arrest the destruction of the osseous structure around the implant, thus preserving whatever is left in this site for future reconstruction. The available literature is still lacking with large heterogeneity in the clinical response thus suggesting possible underlying predisposing conditions that are not all clear to us. Therefore, at present time treatment of peri-implantitis should be considered possible but not necessarily predictable.

Link to the full article: [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590969/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590969/)
72. **Interventions for replacing missing teeth: treatment of peri-implantitis.**

Esposito M1, Grusovin MG, Worthington HV.
Cochrane Database Syst Rev. 2012 Jan 18;

**ABSTRACT**

**BACKGROUND:**

One of the key factors for the long-term success of oral implants is the maintenance of healthy tissues around them. Bacterial plaque accumulation induces inflammatory changes in the soft tissues surrounding oral implants and it may lead to their progressive destruction (peri-implantitis) and ultimately to implant failure. Different treatment strategies for peri-implantitis have been suggested, however it is unclear which are the most effective.

**OBJECTIVES:**

To identify the most effective interventions for treating peri-implantitis around osseointegrated dental implants.

**SEARCH METHODS:**

We searched the Cochrane Oral Health Group's Trials Register, CENTRAL, MEDLINE and EMBASE. Hand searching included several dental journals. We checked the bibliographies of the identified randomised controlled trials (RCTs) and relevant review articles for studies outside the hand searched journals. We wrote to authors of all identified RCTs, to more than 55 dental implant manufacturers and an Internet discussion group to find unpublished or ongoing RCTs. No language restrictions were applied. The last electronic search was conducted on 9 June 2011.

**SELECTION CRITERIA:**

All RCTs comparing agents or interventions for treating peri-implantitis around dental implants.

**DATA COLLECTION AND ANALYSIS:**

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted in duplicate and independently by two review authors. We contacted the authors for missing information. Results were expressed as random-effects models using mean differences for continuous outcomes and risk ratios for dichotomous outcomes with 95% confidence intervals (CI). Heterogeneity was to be investigated including both clinical and methodological factors.

**MAIN RESULTS:**

Fifteen eligible trials were identified, but six were excluded. The following interventions were compared in the nine included studies: different non-surgical interventions (five trials); adjunctive treatments to non-surgical interventions (one trial); different surgical interventions (two trials); adjunctive treatments to surgical interventions (one trial). Follow-up ranged from 3 months to 4 years. No study was judged to be at low risk of bias. Statistically significant differences were observed in two small single trials judged to be at unclear or high risk of bias. After 4 months, adjunctive local antibiotics to manual debridement in patients who lost at least 50% of the bone around implants showed improved mean probing attachment levels (PAL) of 0.61 mm (95% confidence interval (CI) 0.40 to 0.82) and reduced probing pockets depths (PPD) of 0.59 mm (95% CI 0.39 to 0.79). After 4 years, patients with peri-implant infrabony defects > 3 mm treated with Bio-Oss and resorbable barriers gained 1.4 mm more PAL (95% CI 0.24 to 2.56) and 1.4 mm PPD (95% CI 0.81 to 1.99) than patients treated with a nano crystalline hydroxyapatite.

**AUTHORS’ CONCLUSIONS:**

There is no reliable evidence suggesting which could be the most effective interventions for treating peri-implantitis. This is not to say that currently used interventions are not effective. A single small trial at unclear
risk of bias showed the use of local antibiotics in addition to manual subgingival debridement was associated with a 0.6 mm additional improvement for PAL and PPD over a 4-month period in patients affected by severe forms of peri-implantitis. Another small single trial at high risk of bias showed that after 4 years, improved PAL and PPD of about 1.4 mm were obtained when using Bio-Oss with resorbable barriers compared to a nano crystalline hydroxyapatite in peri-implant infrabony defects. There is no evidence from four trials that the more complex and expensive therapies were more beneficial than the control therapies which basically consisted of simple subgingival mechanical debridement. Follow-up longer than 1 year suggested recurrence of peri-implantitis in up to 100% of the treated cases for some of the tested interventions. As this can be a chronic disease, re-treatment may be necessary. Larger well-designed RCTs with follow-up longer than 1 year are needed.

Comment in: No reliable evidence suggesting what is the most effective interventions for treating peri-implantitis. [Evid Based Dent. 2012]
73. A follow-up study of peri-implantitis cases after treatment.

Charalampakis G1, Rabe P, Leonhardt A, Dahlén G.

ABSTRACT

AIM:
The aim of this retrospective study was to follow patient cases in a longitudinal manner after peri-implantitis treatment.

MATERIALS AND METHODS:
Two hundred and eighty-one patient cases were selected consecutively from the archives of the Oral Microbiological Diagnostic Laboratory, Gothenburg, Sweden based on microbial analysis of bacterial samples taken from diseased implants. It was feasible to follow-up 245 patients after treatment for a period ranging from 9 months to 13 years.

RESULTS:
In 54.7% of the patients it was not feasible to arrest progression of peri-implantitis. Smoking and smoking dose were found to be significantly correlated to failure of peri-implantitis treatment (p<0.05). Early disease development was also significantly associated with failure (p<0.05). Bone plasty in conjunction to antibiotics during surgery was significantly associated with arrested lesions (p<0.05). In a multiple regression model disease development was the only independent variable to significantly predict the likelihood of treatment success.

CONCLUSIONS:
Peri-implant health may not be easy to establish, especially in cases that develop disease early. Homogenous treatment protocols rather than empirical treatment attempts should be adopted.
74. Analysis of oral antibiotic therapy’s potency in perimplantitis

E.M. Polizzi*, G. Pasini
Prevenzione & Assistenza Dentale 2010;36:73-78

ABSTRACT

Objectives:
To assess the effect of non-surgical perimplant treatment using a local antibiotic and to compare them with a standard treatment of non-surgical root planing of the perimplant, evaluating clinical, microbiological, and radiological parameters in a randomized controlled trial.

Materials and methods:
Forty implants with perimplantitis diagnosed with clinical and radiological exams meeting predefined criteria of inclusion and exclusion were included in the study. The presence of inflammation and gingival redness, suppuration and/or bleeding on probing, pathological depth probing, circumferential bone reabsorption evidenced with periapical rx. Patients were allocated to a test group and a control group.

The study protocol involved baseline clinical parameters (PD, BOP, Suppuration, Plaque index, Morphology of perimplant soft tissues, radiography, microbiological test), root planing of the defect to break up the biofilm, flushing with saline solution and topical application of an antibiotic (Implacid) in the test group. It also involved the registration of parameters, follow-up Rx, and microbiological test at three months.

Results:
After three months, the patients in the test group treated with a topical antibiotic in addition to the standard non-surgical treatment for perimplantitis showed a more dramatic improvement of perimplant tissues than the patients in the control group who underwent only the usual non-surgical treatment. This trend was statistically significant as far as bleeding on probing and bacterial load in the perimplant pocket were concerned, whereas for PPD and superficial bacterial plaque such difference was not statistically significant, although after three months the average improvement was more prominent in the test group than in the control group.

Conclusions:
The use of a topical antibiotic in patients with perimplantitis is a clinical procedure widely recognized by the scientific community. Implacid showed to be a valid agent and to be able to significantly improve the perimplant tissue inflammation and the bacterial load in marginal tissues. However, a further evaluation of clinical and microbiological parameters would be advisable at six and 12 months to support these preliminary results.
Co-adjuvant treatments to surgical protocol for peri-implantitis: Implantoplasty, Decontamination and Antibiotics


ABSTRACT

AIM:
The aim of this prospective cohort study was to evaluate an anti-infective surgical protocol for the treatment of peri-implantitis.

MATERIALS AND METHODS:
Thirty-six implants in 24 partially dentate patients with moderate to advanced peri-implantitis were treated using an anti-infective surgical protocol incorporating open flap debridement and implant surface decontamination, with adjunctive systemic amoxicillin and metronidazole. Treatment outcomes were assessed at 3, 6 and 12 months. Patient-based statistical analyses using multiple regression analyses were performed.

RESULTS:
There was 100% survival of treated implants at 12 months. At 3 months, there were statistically significant (P < 0.01) reductions in mean probing depths (PD), Bleeding on Probing (BoP) and suppuration. The greater the mean PD at baseline, the greater the PD reduction at 3 months. At 3 months, there was also a significant mean facial mucosal recession of 1 mm (P < 0.001). All these changes were maintained at 6 and 12 months. At 12 months, all treated implants had a mean PD < 5 mm, while 47% of the implants had complete resolution of inflammation (BoP negative). At 12 months, 92% of implants had stable crestal bone levels or bone gain. There were no significant effects of smoking on any of the treatment outcomes.

CONCLUSIONS:
For the treatment of peri-implantitis, an anti-infective protocol incorporating surgical access, implant surface decontamination and systemic antimicrobials followed by a strict postoperative protocol was effective at 3 months with the results maintained for up to 12 months after treatment.
76. Detoxification of Implant Surfaces Affected by Peri-Implant Disease: An Overview of Surgical Methods

Pilar Valderrama1 and Thomas G. Wilson Jr2

ABSTRACT

PURPOSE.
Peri-implantitis is one of the major causes of implant failure. The detoxification of the implant surface is necessary to obtain re-osseointegration. The aim of this review was to summarize in vitro and in vivo studies as well as clinical trials that have evaluated surgical approaches for detoxification of the implant body surfaces.

MATERIALS AND METHODS
A literature search was conducted using MEDLINE (PubMed) from 1966 to 2013. The outcome variables were the ability of the therapeutic method to eliminate the biofilm and endotoxins from the implant surface, the changes in clinical parameters, radiographic bone fill, and histological re-osseointegration. Results. From 574 articles found, 76 were analyzed. The findings, advantages, and disadvantages of using mechanical, chemical methods and lasers are discussed.

CONCLUSIONS
Complete elimination of the biofilms is difficult to achieve. All therapies induce changes of the chemical and physical properties of the implant surface. Partial re-osseointegration after detoxification has been reported in animals. Combination protocols for surgical treatment of peri-implantitis in humans have shown some positive clinical and radiographic results, but long-term evaluation to evaluate the validity and reliability of the techniques is needed.

DISCUSSION
As more dental implants are placed and remain in function for longer periods the prevalence of peri-implant diseases increases. From this overview of the available literature, it can be said that no reliable and valid therapy can be made based on the published articles available and that the accuracy of the data varies. This agrees with the results of network meta-analysis [6] and systematic reviews [78, 79]. Most of the human studies published are cases series with follow-up periods ranging from 6 months to 24 months making it difficult to determine the stability of the newly formed tissues over time. In the present review it was found that most of the studies do not report rates of implant failures but other surrogate measurements like probing depths or clinical attachment levels. Therefore, it is difficult to determine what approach will improve implant survival. This is in agreement with data reported by Faggion Jr. [80, 81].

It can also be stated that presently reattachment of bone to previously diseased implant surfaces is at best unpredictable. Histologic proof of re-osseointegration to previously contaminated implant surfaces in humans was not found. At present a combination of physical and chemical approaches possibly with appropriate laser therapy may prove to provide more predictable results. It should be noted that the profession is early in its understanding of these diseases and their treatment. It can be stated with some assurance that physical alteration (smoothing) of the implant surface using metallic instruments has been demonstrated to slow or halt the progression of bone loss in humans as well as animals. While this application is certainly useful, the drawbacks include soft tissue retraction and esthetic compromises. From this review it can be argued that further investigation of optimal ways to treat implants affected by peri-implantitis and peri-implant mucositis as well as the prevention of these problems is warranted.

Link to the full article: http://www.hindawi.com/journals/ijd/2013/740680/
77. Efficiency and thermal changes during implantoplasty in relation to bur type.

Sharon E1, Shapira L, Wilensky A, Abu-Hatoum R, Smidt A.

ABSTRACT

BACKGROUND:
Implantoplasty is one of the options in treating peri-implantitis. The efficacy of the dental bur used can reduce the time needed for the procedure and, as a consequence, minimize the risk of overheating that can negatively affect the remaining bone surrounding the implant.

PURPOSE:
The aim of this study was to evaluate the efficacy of three dental burs in removing implant substance (titanium) and to determine the amount of heat generated by each bur.

MATERIALS AND METHODS:
Four burs with different surface properties (diamond, diamond - Premium Line, carbide, and smooth bur - control [Strauss Co., Raanana, Israel]) were attached to a high-speed handpiece and applied to a titanium implant for a total of 60 seconds after cooling by water spray. Variations in temperature were recorded every 5 seconds, and the amount of implant substance removed (reduction in weight of the implant) was evaluated.

RESULTS:
The diamond Premium Line bur removed 59.24 mg; carbide, 29.39 mg; diamond, 11.35 mg; and smooth bur (control) 0.19 mg, statistically significant. Only minimum thermal changes (∼1.5°C) were recorded for all four burs.

CONCLUSIONS:
There are considerable differences in efficiency of different burs working on titanium. Selecting the proper bur can reduce working time. Under proper cooling conditions, implantoplasty does not generate excess temperature increases that can damage soft tissue or bone surrounding the treated implant.
78. Impact of implantoplasty on strength of the implant-abutment complex.
Chan HL, Oh WS, Ong HS, Fu JH, Steigmann M, Sierraalta M, Wang HL.

ABSTRACT

PURPOSE:
Implantoplasty, a procedure that is done to smooth contaminated implant surfaces, has been used in the treatment of peri-implantitis. It reduces the implant diameter, which might compromise the implant's strength. This in vitro study was designed to evaluate the effect of implantoplasty on implant strength.

MATERIALS AND METHODS:
Thirty-two tapered implants were used; half were 3.75 mm in diameter (narrow) and the other half were 4.7 mm in diameter (wide). All implants were connected to 20-degree angled abutments. The apical half of each implant was embedded in acrylic resin. Eight 3.75-mm- and eight 4.7-mm-diameter implants were randomly assigned to receive implantoplasty. The remaining implants did not receive implantoplasty (control group). Implantoplasty was performed with a series of diamond and polishing burs. The specimens were then loaded 30 degrees off-axis in a universal testing machine until fracture failure occurred. Bending and fracture strength values were recorded and analyzed statistically (α = .05). The fractured surfaces were evaluated under a scanning electron microscope.

RESULTS:
All narrow implants failed by fracture at the implant platform. The mean bending strength of narrow implants was statistically significantly reduced by implantoplasty (511.4 ± 55.9 N versus 613.9 ± 42.8 N). Implantoplasty did not affect the strength of wide implants; fracture failures occurred at the abutment screw. The fracture mode was ductile and the crack growth was oblique in direction, indicating complex stress distribution and concentration under loading.

CONCLUSION:
Within the limits of this study, implantoplasty appeared to weaken the strength of narrower implants. Therefore, this procedure should be performed with caution on narrower, freestanding implants that are subject to greater occlusal force (eg, posterior regions). Validation of these results is needed for different implant systems.

Gehrke SA, Aramburú Júnior JS, Dedavid BA, Shibli JA.

ABSTRACT

PURPOSE:
The aim of this in vitro study was to assess the resistance to static fatigue of implants with different connections before and after implantoplasty.

MATERIALS AND METHODS:
Sixty conical implants and 60 abutments were used; 4-mm-diameter versions were available for each model. Three groups (n = 20) were established based on the following implant connections: external hexagon (group 1), internal hexagon (group 2), and Morse taper (group 3). The implants of each group were submitted to a compressive load before (n = 10) and after the implantoplasty (n = 10). The wear was performed in a mechanical lathe machine using a carbide bur, and the final dimensions of each sample were measured. All groups were subjected to quasi-static loading at a 30-degree angle to the implant axis in a universal testing machine and 5 mm out of the implant support.

RESULTS:
After the implantoplasty, the mean final diameter was 3.13 ± 0.033 mm for group 1, 3.23 ± 0.023 mm for group 2, and 3.25 ± 0.03 mm for group 3. The mean fracture strengths for the groups before and after the implantoplasty were, respectively, 773.1 ± 13.16 N and 487.1 ± 93.72 N in group 1; 829.4 ± 14.12 N and 495.7 ± 85.24 N in group 2; and 898.1 ± 19.25 N and 717.6 ± 77.25 N in group 3.

CONCLUSION:
Resistance to loading decreased significantly after implantoplasty, and varied among the three implant connection designs.
80. Comparison of the thermal and surface changes of dental implant using rotary instruments and piezoelectric device after implantoplasty: an in vitro study

1 Saeed Raoofi *2 Mehrnoosh Sabzeghabaie 3 Reza Amid

ABSTRACT

PURPOSE.
Peri-implantitis is an irreversible inflammatory reaction in the soft and hard tissues around a functional implant. One of the treatment approaches of this disease include smoothing and polishing the rough surface and removing threads on the implants using rotary instruments, which is called implantoplasty. Clinicians should perform implantoplasty with caution because it may raise the temperature of the implant body as well as the surrounding bone. This study aimed to compare micromorphology and thermal changes obtained with different rotary instruments and piezoelectric device after implantoplasty.

METHODS
In this in vitro study 48 Intra Lock fixture surfaces were processed in 60 seconds with six polishing procedures using 6,12 bladed carbide burs, 90, 30 µm mean-particles-size diamond burs, and piezosurgery inserts OT1 (grain size= 91 µm) and OP5 (grain size= 30 µm). These instruments were applied in single or sequences procedures. Variations in temperature were recorded every 5 seconds. The roughness of treated surfaces was evaluated with a profilometer for Ra1, Rz1 (single polish procedures), Ra2, and Rz2 (sequence polish procedures) parameters. Also, surfaces were observed using a field emission scanning electron after each step of implantoplasty.

RESULTS
The piezosurgery group showed statistically significant differences with the other two groups (maximum temperature 1.2°C). No statistically significant differences were observed between the carbide and diamond burs regarding the temperature changes and the temperature decreased from the start point in both groups. The mean Ra value in piezoelectric group (1.53 (0.23)) was significantly lower than diamond (2.45 (0.40), p<0.05) and carbide (2.10 (0.28), p< 0.05) groups. Besides, this measure in the carbide group was significantly lower than that of the diamond group (p< 0.05). Rz1 value was significantly greater in diamond and carbide groups compared to piezoelectric group. The results revealed significant differences among the three groups concerning Rz2. The minimum Rz2 value was seen in piezoelectric group, while the diamond group showed the highest Rz2 parameter.

CONCLUSIONS
This in vitro study showed that in suitable cooling conditions, implantoplasty with rotary and piezoelectric devices does not produce excessive heat increases which can damage the soft tissue or bone around the affected implant. The piezoelectric device produced smoother surfaces in single or sequence procedures compared to the burs and can be useful for implantoplasty.

81. Bactericidal activity of phosphoric acid, citric acid, and EDTA solutions against Enterococcus faecalis.


ABSTRACT

OBJECTIVES:
The objectives of this study were to evaluate the minimal bactericidal concentration (MBC) for Enterococcus faecalis of phosphoric acid, citric acid, and ethylene diamin tetra acetic acid (EDTA) solutions, and to determine the contact time required for 2.5% and 5% phosphoric acid, 10% and 25% citric acid, and 17% EDTA to exert bactericidal activity.

STUDY DESIGN:
Bactericidal activity was tested by means of the dilution neutralization method in accordance with BS-EN-1040:2005 norm, using contact times of 0.5 to 60 minutes.

RESULTS:
The MBCs of citric and phosphoric acid were 20% and 2.5%, respectively. EDTA solution lacks bactericidal activity, even after 60 minutes of contact. The 2.5% and 5% phosphoric acid solutions required 5- and 3-minute contact times, and the 10% and 25% citric acid solutions required 10- and 3-minute contact times, respectively.

CONCLUSIONS:
Phosphoric acid revealed bactericidal activity against E. faecalis and required less time than citric acid to exert its activity.
82. Antimicrobial and cytotoxic effects of phosphoric acid solution compared to other root canal irrigants.


ABSTRACT

Phosphoric acid has been suggested as an irrigant due to its effectiveness in removing the smear layer.

OBJECTIVES:

The purpose of this study was to compare the antimicrobial and cytotoxic effects of a 37% phosphoric acid solution to other irrigants commonly used in endodontics.

MATERIAL AND METHODS:

The substances 37% phosphoric acid, 17% EDTA, 10% citric acid, 2% chlorhexidine (solution and gel), and 5.25% NaOCl were evaluated. The antimicrobial activity was tested against Candida albicans, Staphylococcus aureus, Enterococcus faecalis, Escherichia coli, Actinomyces meyeri, Parvimonas micra, Porphyromonas gingivalis, and Prevotella nigrescens according to the agar diffusion method. The cytotoxicity of the irrigants was determined by using the MTT assay.

RESULTS:

Phosphoric acid presented higher antimicrobial activity compared to the other tested irrigants. With regard to the cell viability, this solution showed results similar to those with 5.25% NaOCl and 2% chlorhexidine (gel and solution), whereas 17% EDTA and 10% citric acid showed higher cell viability compared to other irrigants.

CONCLUSION:

Phosphoric acid demonstrated higher antimicrobial activity and cytotoxicity similar to that of 5.25% NaOCl and 2% chlorhexidine (gel and solution).

Link to the full article: [https://www.ncbi.nlm.nih.gov/pubmed/26018307](https://www.ncbi.nlm.nih.gov/pubmed/26018307)
83. Hyaluronic acid-based hydrogels functionalized with heparin that support controlled release of bioactive BMP-2

Gajadhar Bhakta,a Bina Rai,a Zophia X.H. Lim,a James H. Hui,b Gary S. Stein,c Andre J. van Wijnen,c Victor Nurcombe,a Glenn D. Prestwich,d and Simon M. Cool,a,b,*

ABSTRACT

Bone morphogenetic protein-2 (BMP-2) is a potent osteoinductive factor, yet its clinical use is limited by a short biological half-life, rapid local clearance and propensity for side effects. Heparin (HP), a highly sulfated glycosaminoglycan (GAG) that avidly binds BMP-2, has inherent biological properties that may circumvent these limitations. Here, we compared hyaluronan-based hydrogels formulated to include heparin (Heprasil™) with similar gels without heparin (Glycosil™) for their ability to deliver bioactive BMP-2 in vitro and in vivo. The osteogenic activity of BMP-2 released from the hydrogels was evaluated by monitoring alkaline phosphatase (ALP) activity and SMAD 1/5/8 phosphorylation in mesenchymal precursor cells. The osteoinductive ability of these hydrogels was determined in a rat ectopic bone model by 2D radiography, 3D µ-CT and histological analyses at 8 weeks post-implantation. Both hydrogels sustain the release of BMP-2. Importantly, the inclusion of a small amount of heparin (0.3% w/w) attenuated release of BMP-2 and sustained its osteogenic activity for up to 28 days. In contrast, hydrogels lacking heparin released more BMP-2 initially but were unable to maintain BMP-2 activity at later time points. Ectopic bone-forming assays using transplanted hydrogels emphasized the therapeutic importance of the initial burst of BMP-2 rather than its long-term osteogenic activity. Thus, tuning the burst release phase of BMP-2 from hydrogels may be advantageous for optimal bone formation.

Link to the full article: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3628623/
84. Action of hyaluronic acid on the wound healing process following extraction

by Eric Baisse, Bernard Piotrowski, Philippe Piantoni, Gérard Brunel

DENTAL INFORMATION - N° 7 - FEBRUARY 18 2004

DISCUSSION

The results presented here confirm those of a pilot study conducted in the same animal model but with a preparation containing one-quarter the concentration of HA. Thus, HA appears to promote wound healing and bone consolidation following tooth extraction. In a more general way, the ability of HA to promote wound healing has been demonstrated in a variety of situations.

HA has been shown to promote the migration and maturation of keratinocytes in mucosal re-epithelialization (7, 10), and it has even been proposed as a possible marker for effective healing in soft tissues prior to implantation (4). Its activity is manifest in granulation tissue where it is abundantly produced and counters the damage induced by reactive oxygen intermediates (11). In the results presented here, the presence of HA in the alveoli appeared to promote and accelerate replacement of the blood clot with granulation tissue in that this phenomenon occurred earlier at HA-treated sites than it did at control sites.

Its physio-chemical properties mean that exogenous HA is readily incorporated into the extracellular matrix where it promotes interactions between the various molecular species which compose this ground substance. Apart from structural considerations, HA's biological activities include control of the migration and differentiation of various cells through receptor-dependent mechanisms regulating gene expression (1). This activity vis-à-vis cellular metabolism has been demonstrated by direct HA treatment following pulpar amputation, which strategy promoted the differentiation of odontoblasts and the deposition of reparative dentine (8). Members of another polysaccharide family—the chitosans, the structure of which is similar to that of HA—have been shown to promote the differentiation of immature bone cell progenitors and the formation of new bone tissue in tissue culture (5). These in vitro observations have been reproduced in vivo using an esterified form of HA (3) which stimulated the formation of new bone on the ventral and dorsal sides of the murine calvaria, an observation which led the authors to posit the osteogenic potential of HA. In the course of alveolar wound healing in rabbits, this potential manifests by the early differentiation of granulation tissue into osteogenic, mesenchymatous blastema, followed by the deposition of newly formed bone tissue as of day 7 after the insult. In the experiment reported here, HA-treated sites maintained their lead over control sites throughout the 30 days of the study. Comparable results have been reported following femoral trephination in rats (9): HA-treated lesions were filled in half the time that it took to fill control lesions.

In conclusion, in line with previous reports, the results presented here indicate that HA promotes wound healing and bone consolidation following tooth extraction. This suggests that HA treatment could be used to cut down the interval between extraction and implantation.
85. Stimulation of Osteoinduction in Bone Wound Healing by High-Molecular Hyaluronic Acid

T. SASAKI’ and C. WATANABE’
Bone, Vol. 16, No. 1 January 1995: 15

ABSTRACT

To study the osteoinductive action of hyaluronic acid (HA), we examined the effects of applying an elastoviscous highmolecular HA preparation on bone wound healing after bone marrow ablation. The middiaphyses of cortical bones from rat femurs were perforated with a round bar, and excavated marrow cavities were filled immediately with high-molecular HA. Bone marrow ablation without HA was used to prepare controls. On post-ablation days 1, 2, 4, 7, and 14, animals were perfusion-fixed with an aldehyde mixture, and dissected femurs were examined by means of light, transmission-, and scanning-electron microscopy. In controls, the wounded marrow cavities were first filled with blood and fibrin clots (days 1 and Z), then with granulated tissues containing macrophages, neutrophils, and fibroblastic cells (day 4). New bone formation by differentiated osteoblasts was observed at 1 week post-ablation; at 2 weeks, the perforated cortical bones and marrow cavities were filled mostly with newly formed trabecular bone. In bones to which HA had been applied, new bone formation already had been induced by day 4 on both the peri- and endosteal surfaces of the existing cortical bones. At 1 week post-ablation, marrow cavities were completely filled with newly formed trabecular bones, in which active bone remodeling by osteoblasts and osteoclasts had occurred. Granulated tissues were replaced rapidly by normal marrow cells. These results suggest that high-molecular HA is capable of accelerating new bone formation through mesenchymal cell differentiation in bone wounds.

86. Implant surgery: treatment with a fluid gel compound with hyaluronic acid and piperacillin plus tazobactam

Giacomo Bartoloni Saint Omer
Doctor Os, January 2015

ABSTRACT

AIM

Evaluation of applicability, clinical benefits and tolerability of a biomaterial as an organic scaffold with hyaluronic acid and piperacillin + tazobactam used alone or in combination with bone allograft and re-absorbable collagen membrane in the restoration of bone defects as well as in prevention and treatment of peri-implant infections.

METHOD AND MATERIALS:

A group of 43 patients with peri-implantitis and peri-implant bone defects or requiring sinus lift and extractive surgery were treated using the product in addition to standard procedures, the product was also used to wash sockets and applied on the implant before its placement in order to prevent early infections.

RESULTS AND CONCLUSIONS

The results of this preliminary study on selected patients, showed a good applicability of the product in surgical cases, with higher benefits and an excellent clinical tolerability. The biomaterial helped the processes of tissue repair creating a favourable environment for healing through the prevention of bacterial infections, owing to the presence of piperacillin and tazobactam, an antibiotic with broad spectrum activity against Gram + and Gram

RESULTS

The results of clinical assessment of signs and symptoms after 8 days were excellent in 51% of patients, good in 46% and poor in 3%. After 3-6 months, the results of clinic assessment were excellent in all the patients treated (Tab. 1).

In the 37 patients belonging to the 5 groups listed in Table 1, no local or systemic side effects were recorded, with the exception of 4 patients (3 in the extractions group and 1 in the peri-implant defects group) who reported a “bad taste” on the first day after surgery.

Table 2 summarises the pre- and post-treatment data for the three groups of patients on whom at least one implant was inserted.

The group suffering from severe peri-implantitis consisted of 6 patients with 6 implants. Table 3 summarises the pre- and post-treatment changes in soft tissues, and Table 4 the radiographic variations in bone levels. The results for the 6 implants with severe peri-implantitis were a gain of bone tissue around the implant, which varied from 50 to 80% (Fig. 1).

No local or systemic side effects were detected.

Link to the full study
Other options for Peri-implantitis treatment: lack of consistent long term results

87. Treatment of peri-implantitis using an Er:YAG laser or an air-abrasive device: a randomized clinical trial.

Renvert S1, Lindahl C, Roos Jansåker AM, Persson GR.

ABSTRACT

BACKGROUND:
Non-surgical peri-implantitis therapies appear to be ineffective. Limited data suggest that ER:YAG laser therapy improves clinical conditions. The present study aimed at comparing the treatment effects between air-abrasive (AM) and Er:YAG laser (LM) mono-therapy in cases with severe peri-implantitis.

MATERIALS AND METHODS:
Twenty-one subjects in each group were randomly assigned to one time intervention by an air-abrasive device or an Er:YAG laser. Clinical data were collected before treatment and at 6 months. Data analysis was performed using repeat univariate analysis of variance controlling for subject factors.

RESULTS:
No baseline subject characteristic differences were found. Bleeding on probing and suppuration decreased in both the groups (p<0.001). The mean probing depth (PPD) reductions in the AM and LM groups were 0.9 mm (SD 0.8) and 0.8 mm (SD ± 0.5), with mean bone-level changes (loss) of -0.1 mm (SD ± 0.8) and -0.3 mm (SD ± 0.9), respectively (NS). A positive treatment outcome, PPD reduction ≥0.5 mm and gain or no loss of bone were found in 47% and 44% in the AM and LM groups, respectively.

CONCLUSIONS:
The clinical treatment results were limited and similar between the two methods compared with those in cases with severe peri-implantitis.
88. Mechanical, chemical and laser treatments of the implant surface in the presence of marginal bone loss around implants.

Meyle J1.

ABSTRACT

PURPOSE:
The objective of this review was to summarise current evidence with regard to the decontamination of implant surfaces by mechanical, chemical and physical methods in the presence of marginal bone loss arising from peri-implant infections.

MATERIALS AND METHODS:
A PubMed search identified studies and publications dealing with ‘peri-implantitis’, ‘treatment’, ‘surface decontamination’, ‘laser application’ ‘air-abrasive treatment’ and ‘photodynamic therapy’. Only studies in international peer-reviewed journals were selected for further evaluation; case reports were not included.

RESULTS:
Several therapeutic approaches were identified such as mechanical treatment, antiseptics and air-abrasive treatment, photodynamic treatment, and laser applications. Since treatment of infected surfaces with air-powder +/- citric acid, gauze soaked with saline + citric acid or gauze soaked with chlorhexidine led to similar results in experimental studies, cotton pellets with saline may be adequate for cleaning micro-rough surfaces. Antimicrobial photodynamic therapy can effectively reduce the prevalence of pathogens on implant surfaces, but the clinical benefits remain unknown. The increase in temperature of the implant surface caused by the CO2 laser poses a risk. The Er:YAG laser is considered to possess the best properties for implant surface decontamination. In vivo, no single method of surface decontamination (chemical agents, air abrasives or lasers) was found to be superior. In several animal experiments, thorough cleaning of the infected implant surfaces and implantation of these previously infected devices into freshly prepared sites resulted in re-osseointegration, while currently there are no controlled clinical trials where re-osseointegration has been demonstrated in patients.

CONCLUSIONS:
For decontamination of the infected implant surfaces, rinsing with saline (or cleaning with cotton pellets soaked with sterile saline) and air-abrasive treatment seem to work. Laser decontamination of the surface does not improve healing results. Non-surgical therapy of implants with peri-implantitis does not lead to successful treatment outcomes.
89. Nonsurgical antimicrobial photodynamic therapy in moderate vs severe peri-implant defects: a clinical pilot study.

Deppe H1, Mücke T, Wagenpfeil S, Kesting M, Sculean A.

ABSTRACT

OBJECTIVE:
Recent review articles have shown that open debridement is more effective in the treatment of peri-implantitis than closed therapy. However, surgery may result in marginal recession and compromise esthetics. The purpose of this study was to assess the efficacy of nonsurgical antimicrobial photodynamic therapy (aPDT) in moderate vs severe defects.

METHOD AND MATERIALS:
The study encompassed 16 patients with a total of 18 ailing implants. Ten of these implants showed moderate bone loss (< 5 mm; Group 1) and eight implants severe defects (5 through 8 mm; Group 2). All implants received aPDT without surgical intervention. At baseline and 2 weeks, 3 months, and 6 months after therapy, peri-implant health was assessed including sulcus bleeding index (SBI), probing depth (PD), distance from implant shoulder to marginal mucosa (DIM), and clinical attachment level (CAL). Radiographic evaluation of distance from implant to bone (DIB) allowed comparison of peri-implant hard tissues after 6 months.

RESULTS:
Baseline values for SBI were comparable in both groups. Three months after therapy, in both groups, SBI and CAL decreased significantly. In contrast, after 6 months, CAL and DIB increased significantly in Group 2, not in Group 1. However, DIM-values were not statistically different 6 months after therapy in both groups.

CONCLUSION:
Within the limits of this 6-month study, nonsurgical aPDT could stop bone resorption in moderate peri-implant defects but not in severe defects. However, marginal tissue recession was not significantly different in both groups at the end of the study. Therefore, especially in esthetically important sites, surgical treatment of severe peri-implantitis defects seems to remain mandatory.
90. Peri-implantitis Treatment: Long-Term Comparison of Laser Decontamination and Implantoplasty Surgery.


ABSTRACT

PURPOSE:
Periimplantitis is the most frequent cause of late implant failure; however, little is known about the long-term success of periimplantitis treatment and the effectiveness of various therapeutic interventions.

MATERIALS AND METHODS:
A total of 142 patients were referred to the Academy for Oral Implantology in Vienna for the treatment of recurrent periimplantitis around single-tooth implants. Of them, 72 patients (51%) were treated by laser decontamination, 47 patients (33%) by implantoplasty surgery, and 23 patients (16%) by a combination of both approaches.

RESULTS:
Overall success of periimplantitis therapy was 89% after 9 years of follow-up, and it did not differ significantly between female and male patients (P = 0.426). The number of implant failures that could not be prevented by periimplantitis treatment was 6 after laser decontamination (8%), 6 after implantoplasty surgery (13%), and 4 after a combination of both therapies (17%). Implant loss occurred after 4.9 ± 1.9 years of therapy, on average. No significant difference between the 3 treatment groups could be observed (P = 0.393).

CONCLUSION:
The present results suggest that success rates of periimplantitis therapy with either laser decontamination or surgical implantoplasty are high. These success rates do not appear to be associated with patient gender or treatment strategy.
91. Combined surgical therapy of advanced peri-implantitis evaluating two methods of surface decontamination: a 7-year follow-up observation.


ABSTRACT

OBJECTIVES:
To assess the long-term outcomes (>4 years) following combined surgical resective/regenerative therapy of advanced peri-implantitis lesions using two surface decontamination methods.

MATERIAL & METHODS:
Fifteen patients (n = 15 combined suprab- and intrabony defects) completed a follow-up observation period of 7 years. The treatment procedure included access flap surgery, granulation tissue removal and implantoplasty at buccally and supracrestally exposed implant parts, and a randomly assigned decontamination of the unmodified intrabony implant surface areas using either (i) an Er:YAG laser (ERL) or (ii) plastic curettes + cotton pellets + sterile saline (CPS). Intrabony defects were filled using a natural bone mineral and covered by a native collagen membrane.

RESULTS:
At 7 years, both ERL and CPS were associated with similar mean bleeding on probing reductions (CPS: 89.99 ± 11.65% versus ERL: 86.66 ± 18.26%) and clinical attachment level gains (CPS: 2.76 ± 1.92 mm versus ERL: 2.06 ± 2.52 mm).

CONCLUSION:
Combined surgical resective/regenerative therapy of advanced peri-implantitis was effective on the long-term, but not influenced by the initial method of surface decontamination.
92. **Two year clinical results following treatment of peri-implantitis lesions using a nano crystalline hydroxyapatite or a natural bone mineral in combination with a collagen membrane.**


**ABSTRACT**

**OBJECTIVES:**
The aim of the present case series was to evaluate the 2-year results obtained following treatment of peri-implantitis lesions using either a nanocrystalline hydroxyapatite (NHA) or a natural bone mineral in combination with a collagen membrane (NBM+CM).

**MATERIAL AND METHODS:**
Twenty-two patients suffering from moderate peri-implantitis (n=22 intra-bony defects) were randomly treated with (i) access flap surgery (AFS) and the application of NHA, or with AFS and the application of NBM+CM. Clinical parameters were recorded at baseline and after 12, 18, and 24 months of non-submerged healing.

**RESULTS:**
Two patients from the NHA group were excluded from the study due to severe pus formation at 12 months. At 24 months, both groups revealed clinically important probing depth (PD) reductions (NHA: 1.5+/-0.6 mm; NBM+CM: 2.4+/-0.8 mm) and clinical attachment level (CAL) gains (NHA: 1.0+/-0.4 mm; NBM+CM: 2.0+/-0.8 mm). However, these clinical improvements seemed to be better in the NBM+CM group (difference between groups: PD reduction: 0.9+/-0.2 mm; CAL gain: 1.0+/-0.3 mm).

**CONCLUSION:**
Both treatment procedures have shown efficacy over a period of 24 months, however, the application of NBM+CM may result in an improved outcome of healing.
93. Evaluation of an air-abrasive device with amino acid glycine-powder during surgical treatment of peri-implantitis.

Toma S, Lasserre JF, Taieb J, Brecx MC.

**ABSTRACT**

**OBJECTIVE:**
The aim of this retrospective study was to analyze collected data concerning the effect of an air-abrasive device (Perio-Flow®) during surgical treatment of peri-implantitis without addition of any antimicrobials.

**METHOD AND MATERIALS:**
Data reports from 22 implants with peri-implantitis surgically treated using either an air-abrasive device (Perio-Flow) (test group), or plastic curettes and cotton pellets impregnated with saline (control group) were analyzed for the present study. Clinical and radiographic parameters plaque index (PI), gingival index (GI), probing pocket depth (PPD), and bone loss (BL) were previously assessed at baseline, 6 months, and 12 months after treatment. A repeated measures ANOVA test was used for each clinical and radiographic parameter (PI, GI, PPD, and BL). The implant and the patient were considered separately as the statistical unit.

**RESULTS:**
Regarding between group comparisons, PI scores remained low during the entire study period (at implant and patient levels). At the end of the study, GI and PPD reductions were statistically higher (P < .05) in the Perio-Flow group (implant level), and no differences were observed between the two groups at patient level (P > .05) (repeated measures ANOVA test). It was also noted that BL analyses (implant and patient levels) revealed no differences between baseline and 12 months in both groups. Nevertheless, only 8% from each treatment group were considered stabilized after 12 months.

**CONCLUSION:**
Within the limitations of the present study, both groups (Perio-Flow and its control group) revealed a significant reduction of the clinical parameters. Moreover, the air-abrasive device group yielded better improvements regarding GI and PPD when the implant was considered as the statistical unit. However, if the stabilization of the disease was the final objective, these two treatments failed in resolving its activity. A longer follow-up and a larger number of patients would be needed to confirm these results and the benefit of adding this air-abrasive method of decontamination to the surgical procedure.
Competitive relevant studies

94. PBR-161 Basic Research: Evaluation of local 14% doxycycline gel for bacterial decontamination on rough and smooth implant surfaces (Ligosan – Local antibiotic)

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Background:
There is no reliable evidence suggesting which could be the most effective interventions for treating peri-implantitis. Nonsurgical treatment has been shown to be effective in dealing with inflammatory lesions around implant without bone loss. However, when bone loss is noticed, surgical treatment may be needed. Nonetheless, before the surgical approaches can be effective, the contaminated implant surface has to been detoxified. Since peri-implantitis lesions are usually well demarcated, controlled delivery devices, originally developed for the therapy of localized periodontal infections, may be a successful means of treatment for peri-implantitis. Local antibiotics have been showed to be successful in peri-implant decontamination and, in particular, doxycycline has shown to be effective in improving clinical parameters. Anyway, to date no scientific data have validated the effectiveness of 14% locally delivered doxycycline gel in the decontamination of implant surfaces being them machined or rough.

Aim/Hypothesis:
The aim of this study was to evaluate the antimicrobial effect of a locally delivered 14% doxycycline gel (Ligosan, Heraeus Kulzer, Hanau, Germany) applied on machined and rough implant surfaces in an experimental peri-implantitis model.

Material and Methods:
Twenty-four smooth and twenty-four rough sterile 4.2x10 mm implants (i-Fix Uniqo, FMD Medical Devices, Rome, Italy) were placed into screwcap glasses that were then filled with 3½ cc of sterile agar in order to leave the last 2 mm of the apical portion of the implant exposed. The samples were divided into 4, equally divided, groups according to surface and treatment modality: rough test, rough negative control, smooth test, smooth negative control. After agar gelification, the exposed portion of the implant was inoculated with 10 microliters of S sanguinis transported in tryptic soy broth. The glasses were then placed in an incubator with the atmosphere of 5% CO2 at 37 Celsius degrees for 24 hours to allow the bacteria to grow. After 24 hours, the test groups were treated with the doxycycline (Ligosan, Heraeus Kulzer, Hanau, Germany) injecting the gel circumferentially over the exposed surface of the implant for 3 minutes. The gel was then mechanically removed with a sterile excavator and all the implants were took off from the screwcap glasses and placed in microtubes containing 600 cc of tryptic soy broth and vortexed to allow the bacteria to detach from the surface. The samples were then diluted 1:100 and plated on tryptic soy agar plates. The plates were placed in an incubator with the atmosphere of 5% CO2 at 37 Celsius degrees for 48 hours. After incubation, the colony forming units were eye-counted and recorded. The statistical analysis was done through independent samples T-test.

Results:
Our study shows that the use of a 14% doxycycline gel, without considering the differences of surfaces, minimize CFU counts compared to the control groups, with the difference being statistically significant. However, when comparing the surfaces groups separately, although the reduction of CFUs is visibly evident between the rough groups, the difference doesn’t reach statistically significance. The reduction of CFUs between the smooth groups (control and test) is more marked than in the rough groups, with the difference being statistically significant (P < 0.05).
Conclusions and Clinical Implications:

The use of 14% doxycycline gel in implant surface decontamination was efficacious in this in-vitro study regardless the implant surface. Adjunctive use of locally delivered 14% doxycycline gel is a viable option in the management of peri-implantitis and peri-implant mucositis considering its efficacy in reducing bacterial colonization. Further studies with larger samples size should be carried out to validate and strengthen our conclusions.
**IV) Full Studies and other additional information**

- JIndianSocPeriodontol154304-6278746_172627.pdf
- InTech-Local_antibiotic_therapy_in_the_September.pdf
- Delivery Tobramycin S Gitelis.pdf
- Comparative evaluation of system.pdf
- Chhokra Mehak et al.pdf
- Study 1 Implant Bartoloni_en.pdf
- Peri-implant treatment study pilo.pdf
- A follow up study of periimplantitis ca.pdf
- Peri-implant Diseases Pathogene.pdf
- Antibiotic prescribing practice.pdf

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**95. Other useful books/articles/studies**

Goodman and Gilman’s: The pharmacological Basis of Therapeutics. Sixth Edition P. 1094


Mombelli, A.J. Van Winkelhoff, The systemic use of antibiotics in periodontal therapy

Peri-implant diseases: Consensus Report of the Sixth European Workshop on Periodontology. Authors: Jan Lindhe, Joerg Meyle, on behalf of Group D of the European Workshop on Periodontology (First published: 26 August 2008)


Surgical decontamination protocol of peri-implantitis with the use of implantoplasty, guided bone regeneration and local administration of piperacillin /tazobactam. Giacomo Bartoloni Saint Omer, DD - Alessandro Tosetti, MD,DD


http://www.oralhealthgroup.com/features/peri-implantitis-treatment-options/?er=NA