WESTERN SOCIETY OF PERIODONTOLOGY
“Synergy For Success: Innovations in Periodontology”

66TH ANNUAL SCIENTIFIC SESSION
San Diego 2018
THE COLLABORATIVE EVENT OF THE YEAR!
PERIODONTALGY • RESTORATIVE • HYGIENE
APRIL 6 - 8
HOTEL
Manchester Grand Hyatt, San Diego

A COMMITMENT TO COLLABORATIVE CARE
“66 YEARS OF EXCELLENCE IN CONTINUING EDUCATION”

For information on this or other seminars contact Deb Goldman - 813.444.1011  Office - dgoldman@wsperio.org
www.wsperio.org • 877-864-0263 • Look for us on www.facebook.com/WSPerio

PROGRAM

• FRANK SCHWARTZ, PROF. DR. MED. DENT.
  Treatment Concepts For The Management Of Peri-Implantitis

• DENNIS TARNOW, DDS
  Interdisciplinary Approach To Difficult Aesthetic Cases

• RODRIGO NEIVA, DDS, MS
  Current Trends in Periodontics and Implant Dentistry

• STANLEY MALAMED, DDS
  10 Minutes to Save a Life: Emergency Medicine in Dentistry

• SALAH HUWAIS, DDS
  *Hands-On: Osseodensification: Optimize the Site-Optimize the Outcome

• EARNEST CHOLAKIS, DMD, MBA
  The demographic rationale for treating the edentulous and failing dentate patient utilizing a novel, fixed-removable, implant-supported prosthesis.
  *Hands-On: Prosthesis reconstruction of edentulous patients: Conus Concept descriptions

• DHAVAL PATEL, DDS
  Clinical Excellence with In-Office CadCam

• BEN MIRAGLIA, DDS
  Better Periodontal Health with Clear Aligner Therapy

• BOBBY BIRDI, DMD, MS
  Surgical-Prosthetic Synergy in Today’s Implant Treatment

• GEORGIOS E. ROMANOS, DDS, PHD, PROF. DR. MED. DENT.
  Implant Diameter as a Key for Long-Term Success in Implant Dentistry

• BALDWIN MARCHACK, DDS, MBA
  Esthetics & Implant Prosthetics: Avoiding Failures And Complications

• SANDA MOLDOVAN, DDS
  Increase the success of your dental implant practice with your hygiene protocol

• DIANE MILLAR, RDH, MA
  State of the Art Hygiene: A Virtual Reality Trip Through Cutting Edge Scaling Techniques
  *Hands-On: The Secret to Power, Precision and Prevention: Advanced Reinforced Periodontal Scaling Techniques

• SUSAN WINGROVE, RDH, BS
  Manage, Repair or Regenerate? Periodontal & Peri-Implant Disease Therapy

NEW FOR 2018
Improved Schedules
More CE Courses
Corporate Forums
Did you know that most Chlorhexidine rinses contain 11.6% alcohol?

That’s about the same concentration as a merlot.

FDA Approved Alcohol Free Chlorhexidine Rinse

Efficacy without the alcohol!

Available in 4 and 16 fl oz bottles

For Details / Order Now Visit: www.paroex.com
Rethink Synthetics

easy-graft® CLASSIC
alloplastic bone grafting system

PLACING BONE GRAFT HAS NEVER BEEN THIS EASY.

Once the coated granules of GUIDOR® easy-graft® are syringed into the bone defect and come in contact with blood, they change in approximately one minute from a moldable material to a rigid, porous scaffold.

- Designed for ease of use and predictability
- 100% synthetic and fully resorbable
- Contains a macroporous and openly microporous structure with a total porosity of approximately 70%

This product should not be used in pregnant or nursing women.

Watch video @ http://us.guidor.com/InAction

Buy 4, Get 1 at no charge! (same sku only)
Expires 9/30/2017. Free goods ship with order.

To purchase or learn more, visit http://us.GUIDOR.com/easy-graft/ or call 1-877-484-3671. Instructions for Use (IFU), including indications, contraindications, precautions and potential adverse effects, are available at http://us.GUIDOR.com/IFU/.

© 2017 Sunstar Americas, Inc. All rights reserved. GUIDOR® easy-graft® and BioLinker are owned by Sunstar Suisse, SA.
SOCIETY MEMBERSHIP INFORMATION

The purposes of the Western Society of Periodontology are to afford all practitioners of dentistry a sufficient opportunity for the free interchange of ideas in this field; to encourage the practice of periodontics both in prevention and treatment; and to encourage the study of periodontology and its relationship to other branches of dentistry and medicine. In addition to the continuing education provided, your membership includes a subscription to The Journal of the Western Society of Periodontology, Periodontal Abstracts. This is a quarterly publication providing literature reviews, original articles, and abstracts of current literature related to periodontology. Quarterly electronic newsletters include news of meeting sites and course information, as well as news of the WSP.

Periodontists in AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY, Canada (B.C. to Manitoba), and Mexico.

Associate Membership: General dentists in the geographic boundaries of the society, as listed above.

Nonresident Membership: Periodontists, general dentists, and hygienists in all other states and countries.

Affiliate Membership: A non-dentist from a related health discipline (hygienists, assistants, etc.).

Student Membership: A student in an accredited dental program (either predoctoral or postdoctoral) or a dental hygiene program.

Subscribers Please Note

Policy for replacement of missing issues. Requests received for replacement of missed issues within three months of the publication date will be honored at no charge. Requests received later than three months from publication date will be charged $25 for each issue requested.

Notification of change of address. Address correction notices from the Post Office create a needless expense for the Journal. Please promptly inform us of any change in your address (including Zip Code) by notifying the WSP Administrative Office, Post Office Box 1379, Lutz, FL 33548.

MEMBERSHIP APPLICATION

(Please Print)

Name:__________________ Gender: M    F School:__________________________

Degree:____________________________________ Yr. of Graduation:_________

Preferred Address: [ ] Office [ ] Home

OFFICE ADDRESS

Address:____________________________________ Cty:_______________________

Phone:_____________________________ Fax:____________________________

HOME ADDRESS

Address:____________________________________ Cty:_______________________

Phone:_____________________________ Fax:____________________________

DENTAL PRACTICE

[ ] Periodontics [ ] General Practice [ ] Hygienist [ ] Other Specialty:________________________________________________________

RELATED HEALTH DISCIPLINE (NON-DENTIST)

[ ] Hygienist [ ] Assistant [ ] Other:________________________________________

STUDENT (INCLUDE COPY OF STUDENT ID)

[ ] Dental [ ] Undergraduate [ ] Graduate [ ] Dental Hygiene Year of Graduation:_________

School:________________________________________________________

<table>
<thead>
<tr>
<th>DUES</th>
<th>PERIODONTISTS</th>
<th>GEN. DENTIST</th>
<th>HYGIENIST</th>
<th>STUDENT</th>
<th>FULL-TIME FACULTY OR MILITARY DENTISTS</th>
<th>NON RESIDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$295</td>
<td>$255</td>
<td>$99</td>
<td>$60</td>
<td>$149</td>
<td>$169</td>
<td></td>
</tr>
<tr>
<td>Add $75</td>
<td>N/A</td>
<td>N/A</td>
<td>$10</td>
<td>$15</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>INITIATION FEE</td>
<td>$25</td>
<td>$25</td>
<td>$25</td>
<td>N/C</td>
<td>$25</td>
<td>$25</td>
</tr>
</tbody>
</table>

TOTAL DUES & FEES $_______ $_______ $_______ $_______ $_______ $_______

CATEGORY AND SIGNATURE

I hereby apply for membership in The Western Society of Periodontology in one of the following categories. I certify that I am qualified for this category in accordance with the conditions stated in this application.

The appropriate dues and fees must be submitted with this application.

Signature:______________________________ Date:_____________ Credit Card #:__________________________ Exp. Date:_____________ CCV:______________

Return Application to The Western Society of Periodontology
P.O. Box 1379 • Lutz, FL 33548-1379 • www.wsperio.org
EDITORIAL
68  Crisis in Morality
   Gerald I. Drury, MS, DDS, FACD

ABSTRACTS

Review Studies
70  Basic Science
71  Implants
72  Nonsurgical

Clinical Studies
74  Implants
81  Nonsurgical
84  Surgical

Laboratory Studies
87  Implants
87  Nonsurgical
89  Surgical

92  WSP MEETING SCHEDULE AND
    MEETINGS OF INTEREST
Crisis in Morality

It seems we live in times of terrorist attacks on the innocent brought on by ignorance, hatred, dogmatism, and perhaps insanity. We also experience uncertainty in the form of political polarization of our values and the advent of “fake news” and forgetting the implicative meaning of words. This all leads us to feel anxious about the future of our country and our way of life.

I am trying to pause for a moment to comprehend it all. Unfortunately, my ability to fully understand all of this is limited by my education, background, and experience, and so I prefer to refrain from further comment or opinion. I do, however, understand to a much greater degree the field that I have chosen as my specialty, Periodontology.

As a dental student, I learned that periodontitis is usually a chronic, insidious, hidden, inflammatory disease that is frequently asymptomatic, and even when there are signs of the disease, lay people and members of the dental profession unfortunately are not very alarmed by it. Typically, its progression is slow and may eventually lead to tooth loss. It might be acute or chronic, progressive or stagnant, active or inactive, uncomfortable or asymptomatic, disfiguring or unnoticeable, easy or difficult to treat. We consider a bacterial-immune system interaction to be the primary etiology, but there are a variety of local, systemic, genetic, and environmental contributing factors. There is a requirement to evaluate each patient and site separately as the disease can manifest in many ways, and what may be an appropriate treatment for one patient or one site may not be appropriate for another.

What does all this mean? First and foremost, periodontal diseases require a correct diagnosis. This will require diagnostic skills. Once the diagnosis is made, one needs the necessary background and understanding required to assign a proper prognosis. One then needs to understand that this prognosis could change dramatically with appropriate treatment. Unfortunately, not all of us have the same diagnostic, prognosticative, and treatment planning skills necessary to determine the appropriate periodontal therapy, and some of us lack the skills to carry out that therapy.

To become a trained periodontist is not a simple undertaking. It requires three years of study beyond dental school. Part of the purpose of the training is to plant the seeds for the development of an expert in the field. Whether these seeds will be cultivated depends on the individual and sometimes the circumstances he or she finds themselves involved in. Nevertheless, the periodontal residents are trained to be scientists and are familiar with the scientific method. They are taught to be familiar enough with the periodontal literature to understand the pros and cons of various therapeutic options and should have an understanding as to what is required to carry out appropriate periodontal therapy.

What I sometimes see today are a lot of “self-made” experts who are subscribing to and advocating quick-fix technology and pharmacotherapeutics as a routine treatment for periodontal diseases. I see companies advertising in conventional and social media claiming they have a pill, rinse, paste, laser or whatever that they have as the solution for treating their gum disease. I see people with periodontitis being told that they don't have to give up their smile or put up with the ravages of gum disease, just have their “bad teeth” removed and replaced with dental implants and simply screw in a new set of teeth. Never mind that many times these teeth could be saved with appropriate therapy. (The average loss of teeth in patients with periodontitis undergoing proper periodontal maintenance therapy is only one tooth in a ten-year period).

Is this not playing on public ignorance and fear? Aren't there biological and financial consequences to the long-term use of low-dose doxycycline? Do mouthwashes, toothpastes, and trays really do the job? Are lasers really a substitute for, or an improvement to, conventional periodontal therapy? Is there any strong evidence that they can truly regenerate the periodontal or peri-implant tissues as well as conventional therapy? Are implants always the best solution for dealing with compromised teeth (by some accounts, peri-implantitis is approaching epidemic proportions)?

I frequently read articles in non-refereed journals misquoting or deleting relevant scientific literature, then advocating a technique or protocol to treat periodontitis despite little or no scientific evidence to support it. Are we ignoring the potential damage some of these therapies can do; if not directly, indirectly by giving false expectations to our patients?
I see advertisements in reputable dental journals in the form of display ads advocating the use of topical antimicrobials to significantly reduce periodontal pockets when used with scaling and root planing. Have you considered what they consider significant? Is pocket reduction the be-all and end-all of periodontal therapy? Won’t the pockets come back and the disease continue to progress if we leave behind calculus in active therapy and don’t maintain properly? How many of us really know how to scale and root plane, and understand both its benefits and limitations?

Whatever happened to comprehensive diagnosis and treatment planning shared by the periodontist and restorative dentist? Don’t we need to give the patient the pros and cons of all treatment options before we recommend any treatment. What has happened to trying to save teeth as a preference to dental implants?

May I suggest to you, my readers, that before advocating or instituting the quick fix therapies I have mentioned, you read their scientific references carefully, as well as references they may have selectively omitted. This might give you a better perspective as to the real value of these therapies. If you still have questions about the validity of these claims, contact experts in the field who have no financial interests in these products or therapies and see how they feel about it. Ask these questions: Why are most periodontists not buying lasers? Why are they reluctant to prescribe low-dose doxycycline? Why don’t they routinely use topical or systemic antimicrobials in their therapy? Could it be the scientists are not convinced by the science? Take your periodontist to lunch and ask these questions.

The crisis in morality that I referred to in the title of this editorial is honesty. Honesty requires one to look at all the evidence, as well as the quality of the evidence, before coming to a personal decision as to which therapies are based on good science and which are based on poor science, hearsay, or manipulated statistics. Honesty requires knowing what can be accomplished with proper periodontal therapy and being willing to refer if necessary.

Remember, a lot of people are very sincere about their beliefs (meaning that they believe what they are saying), but few people are truly honest about their beliefs (meaning they have done their homework and looked at the entire picture before coming to a conclusion). Dentistry is not just a business; more importantly it is a profession, and as such we have the public trust to be honest to ourselves and our patients regardless of the consequences, financial or otherwise.

GERALD I. DRURY is WLADS Ethics Chair; Clinical Professor and Course Director of Advanced Periodontology at USC; Editor of Periodontal Abstracts, the Journal of the Western Society of Periodontology, and former Chairman of the American Board of Periodontology. He is a past president of the California Society of Periodontists and the Western Society of Periodontology, and Chair for Periodontology Peer Review for CDA. He is a trustee of the American Academy of Periodontology.

REVIEW STUDIES

REVIEW / Basic Science

The interaction between beta-3 adrenergic receptor and peroxisome proliferator-activated receptor gamma gene polymorphism to periodontal disease in community-dwelling elderly Japanese

**Background** The aim of the study was to discuss the interactions between β-3 adrenergic receptor, and peroxisome proliferator-activated receptor gamma (PPARg) gene polymorphisms, and PD.

**Methods** 1310 females aged 55–74 in Yokogoshi, Japan, enrolled in the study and 674 agreed to participate. Mean age was 64.7 ±5.7 yr. Any medical histories that affected bone metabolism were excluded from the study. Final sample size consisted of 332 females. Bone density was measured in the frontal aspect of lumbar vertebrae. BMI was calculated for every patient; blood samples were taken ≥6 hr after a meal to determine high sensitivity c-reactive protein; HbA1c was taken; and PPARg was determined using DNA PCR. An oral exam (including a periodontal exam) was done by 2 dentists: PD, CAL, and BoP were determined at 2 sites per tooth. The number of sites with PD 4–5 mm, PD ≥6 mm, CAL 4–5 mm, and CAL ≥6 mm was calculated. Arg allele is a mutant type associated with low β-3 adrenergic activity; participants were combined with TRP/ARG and ARG/ARG for analysis and divided participants into ARG carriers and non-ARG carriers and ALA carriers and non-ALA carriers. Prevalence-rate ratios (PRRs) were calculated by multiple Poisson regression analyses to evaluate the relationship among PD markers, such as the number of sites with CAL 4 to 5 or ≥6 mm or PD 4 to 5 or ≥6 mm, and β-3 adrenergic receptor polymorphisms, PPARg polymorphisms, and the interaction term adjusted by age, hsCRP, and HbA1c.

**Results** Participants with BMI ≥25, PRRs of β-3 for PD were 0.13–0.70, and the PPARg genotype being 0.66–3.14 and interaction term for the two genotypes 1.69-12.61. BMI participants <25 did not show a constant tendency was not observed. PRRs of β-3 were 0.29–1.34, PPARg were 0.78–1.76, and the interaction term of the two were 0.36–2.93.

**Discussion** Results of this study showed a positive correlation between β-3 adrenergic receptor and PPARg genotypes and various periodontal markers. From the data it can be determined that a minor gene can have a stronger effect on PD, which is attributable to gene-gene interactions. ALA allele noncarriers have a higher risk for obesity; high BMI group had polymorphisms associated with more severe periodontal parameters. β-3 adrenergic receptor is the principal receptor mediating catecholamine-stimulated thermogenesis in brown adipose tissue. In humans, low β-3 may promote obesity through decreased function.

**Conclusion** β-3 adrenergic receptor and PPARg were not independent risk factors for PD in Japanese females, however the interaction of them showed more PD in obese females.

doi:10.1902/jop.2015.140472

Molecular aspects of the pathogenesis of periodontitis

**Background** This introductory article highlights the pertinent topics covered in this edition of Periodontology 2000. In short, it reviews the new discoveries and advances that modify or elucidate the classic model of PD pathogenesis developed by Page and Kornman in 1997.

**Discussion** The salient feature of these new discoveries is that a pathogenic biofilm is insufficient to cause disease. The host inflammatory immune response accounts for 80% of the risk of tissue destruction, and as such, the authors term periodontitis an “infectious immune condition.” Key changes to our understanding include (1) Clinical health requires a health-promoting biofilm which triggers a proportionate and resolving host response; (2) Accumulation of biofilm favors quorum-sensing species like *Fusobacterium nucleatum*, which can elicit a stronger host response and proliferation of other pathogens like *Porphyromonas gingivalis*. This is now termed “incipient dysbiosis,” which will be limited to gingivitis in nonsusceptible individuals; (3) In susceptible individuals, this can lead to an excessive host response characterized by cytokines, reactive oxygen species, and MMPs, which create a chronic inflammatory lesion. Viruses also appear to play
a role in priming immune cells and dysregulation of the host response; (4) Plasma cells and neutrophils dominate the active lesion, the latter of which is particularly destructive; and (5) The biofilm removal necessary to re-establish health promoting bacterial species varies greatly between low (or no) risk and high-risk individuals. The article then goes into further detail on each factor in the process.

Oral biofilms: In health, there is a symbiotic relationship between the biofilm species, and between the organisms and the host response. Rather than a “pathogenic species” model or “non-specific plaque” model, researchers now recognize that inborn or acquired host factors drive the development of dysbiosis and disease. Commensal bacteria protect the host by occupying the periodontal niche and create a positive environment. There is a distinct shift in the character of biofilm at diseased sites and healthy sites. Slots argues that viral coinfection (with herpesviruses like CMV, EBV, HSV-1) is an important contributor to tissue destruction by activation of neutrophils, release of cytokines and MMPs, and osteoclast activation.

Host response/local inflammation: A clinically healthy periodontium involves a leukocytic infiltrate as part of an “immune surveillance,” but inadequate or excessive migration can cause disease. Release of pro-inflammatory cytokines activate neutrophils, and the subsequent release of histamine and activation of complement leads to vasodilation and movement of neutrophils into the tissue by diapedesis. The increased tissue fluid also causes tissue swelling and increased exudation of GCF. Many pathogens like P. gingivalis extend the inflammatory reactions and neutrophil activation, a process that contributes substantially to PD. Tissue destruction is accelerated by poorly-controlled diabetes and the associated advanced glycation end-products and oxidized LDLs.

Barrier functions of oral epithelium/dendritic cells: Oral keratinocytes are not merely a physical barrier but also contribute to the immune response by the release of inflammatory cytokines and production of defensins. Defensins are powerful antimicrobial peptides and also activate immature dendritic cells. Dendritic cells are a family of antigen-presenting cells required for presentation to B and T lymphocytes. They also tolerize T cells to self-antigens, reducing the chance of autoimmune reactions.

Natural killer cells are a unique group of cytotoxic lymphocytes, part of the innate immune system that can kill target cells by direct contact or the production of cytokines, like interferon gamma. Mice lacking interferon gamma showed decreased bone loss following oral infection with P. gingivalis.

T and B cell subsets: The T helper cell population is composed of many subsets (Th1, Th2, Th17, regulatory T cells, follicular helper cells), each with different functions and gene expression patterns. MicroRNAs are small, noncoding RNA molecules that negatively regulate protein expression. Aberrant expression of microRNAs triggers the dysregulation of cellular processes involved in innate and adaptive immune responses, leading either to ineffective responses or excessive catabolic responses. MicroRNAs also regulate the pathways controlling dendritic cells functions.

Periodontally-driven systemic inflammation and pro-resolution pathways: The authors present the most plausible mechanism for a periodontal impact on the cardiovascular system and diabetes by a periodontal bacteremia triggering an acute-phase response by the liver. This includes the release of CRP, IL-6, and the activation of blood neutrophils to release oxygen radicals, creating a peripheral oxidative stress response. The authors term this “metastatic inflammation” which can lead to pancreatic beta-cell damage and vascular endothelial damage. A class of molecules known as lipoxins has recently been identified, produced during an acute inflammation response as a feedback mechanism, responsible for the resolution of the inflammation before it becomes chronic. [AGG]


■ REVIEW / Implants

The concept of platform switching to preserve peri-implant bone level: assessment of methodologic quality of systematic reviews

BACKGROUND The study purpose was to assess the methodologic quality of systematic reviews on the effect of platform switching upon peri-implant marginal bone loss.

METHODS Medline, Embase, Web of Science, Cochrane Central Register of Controlled Trials, and Cochrane Oral Health Group Trials Register databases were searched for articles from 2000 Jan. to 2013 Nov. 5 studies were included in this study.
AMSTAR and Glenny et al. checklists were used to assess the quality of systematic reviews that were included in the study.

Results Out of the 5 articles that were included in this study, 4 articles stated that platform switching (PS) is useful in limiting bone loss. One article stated that current evidence fails to provide enough evidence about the effectiveness of different implant abutment designs.

Discussion The development of the AMSTAR and Glenny et al. checklists have permitted qualitative appraisals of systematic review in implant dentistry and periodontology.

Conclusions Substantial methodologic variability was found in systematic assessment of the benefits of PS concept. Only findings of high-scoring systematic reviews, which generally favored platform switching over platform matching, can be trusted. [AGG]


International brainstorming meeting on etiologic and risk factors of peri-implantitis, Montegrotto (Padua, Italy), August 2014

Background Initial definition of the osseointegration included a molecular bond between implant and bone. Today, osseointegration is described as a close adaptation of bone to implant where molecular bond is rarely discussed. Some authors compare periimplantitis to periodontitis, but some argue it is a completely different entity due to an anatomical difference of tooth to bone and implant to bone contact. Osseo-insufficiency was proposed to demonstrate the difference between periimplantitis and PD bone loss. Due to largely different opinions, this international conference of 30 clinical experts was formed to develop an objective discussion on this topic.

Methods Participants gathered to review a large number of systematic reviews. For each of the systematic reviews, RCTs, cohort studies, and case-control studies with at least 10 patients per group and with at least 6 mo of follow-up were included.

Results Topics that were reviewed included individual susceptibility to periimplant diseases, plaque as etiologic factor for periimplant diseases, biomechanics as triggering factors for periimplant diseases, surgical procedures as triggering factors for periimplant diseases, and prosthetic procedures as triggering factors for periimplant diseases.

Discussion Basic outcome of the project was a verbal discussion of literature review coupled with clinical opinion of experts. From the etiologic standpoint, it was agreed that plaque is the etiology of periimplant inflammation. Viruses were mentioned in the discussions that have modifying properties of the host response. A table describes all possible biologic, surgical, biomechanical, and prosthetic factors that play an important role in development and progression of the disease. There was strong evidence that suggested different microbiota (then found in periodontal infection) could support periimplantitis. Moderate strength evidence showed surgical, prosthetic, and biomechanical inducing factors. [dvi]


Are periodontal diseases really silent? A systematic review of their effect on quality of life

Background The purpose of this study was to investigate the influence of periodontal diseases (PDs) (gingivitis and periodontitis) on oral health-related QoL (OHRQoL) by systematically reviewing the literature.

Methods Studies using clinical periodontal examinations and validated survey instruments were included. 37 studies were eligible and data were extracted from full texts.

Results A significant association between PDs and OHRQoL was reported in 28 studies, of which 8 reported increasing impact with greater disease severity or extent. Included studies revealed considerable heterogeneity in participant selection, clinical assessments, and OHRQoL measures.

Conclusions OHRQoL was affected by clinically assessed PDs. There was evidence for increased impairment with greater severity and extent of PDs, and the recognition of the association was increased when full-mouth recording protocols were applied. [gc]

Systemic antimicrobials adjuvant to periodontal therapy in diabetic subjects: a meta-analysis

**Background** The results of periodontal therapy has been suggested to improve with adjunctive antibiotics. The aim of this study was to systematically review randomized clinical trials assessing systemic antimicrobial use adjuvant to SRP versus SRP alone in diabetic subjects.

**Methods** The focused Pico question is: Based on RCTs examining individuals with DM and periodontitis, what are the effects of systemic antibiotic use as an adjunct to nonsurgical periodontal treatment during a follow-up period of ≥3 mo in terms of gain in CAL and reduction in PD, as compared with nonsurgical periodontal treatment alone? The PubMed, Cochrane Central Register of Controlled Trials, EMBASE, TRIP, Web of Science, and LILACS databases and the grey literature were searched through May 2015. Of 2534 potentially eligible studies, 13 were included in the systematic review. Weighted mean differences (WMDs) in PD reduction and CAL gain (primary outcomes), and PI and BoP reductions, were estimated using a random effect model.

**Results** The WMD in PD reduction [0.15 mm, n=11, p=0.001, 95% confidence interval (CI) 0.24, 0.06 favored antibiotic use. WMDs in CAL gain, PI, and BoP reductions (0.14 mm, n=9, p=0.11, 95% CI 0.32, 0.03; 4.01%, n=7, p=0.05, 95% CI 0.04, 8.07; and 1.91%, n=7, p=0.39, 95% CI 6.32, 2.51 respectively) did not favor adjunctive antibiotic use.

**Discussion** The present systematic review and meta-analysis revealed that adjunctive systemic antibiotic therapy might not improve the efficacy of SRP in terms of CAL gain, PI, and BoP reduction. Conversely, the meta-analysis showed statistically significant improvement in PD reduction favoring adjunctive therapy over SRP alone. The combined application of SRP and antibiotics may have greater potential to change the pathogenic bacterial community, thereby achieving more beneficial and stable re-colonization over time in recently scaled pockets and creating a stable biofilm community, like that observed in healthy individuals.

**Conclusion** Adjunctive therapy may improve the efficacy of SRP in reducing PD in diabetic subjects.


Outcomes of regenerative treatment with rhPDGF-BB and rhFGF-2 for periodontal intrabony defects: a systematic review and meta-analysis

**Background** The objective of this study was to examine the effects of 2 growth factors (recombinant human platelet derived growth factor-BB [rhPDGF-BB] and recombinant human fibroblast growth factor-2 [rhFGF-2]) on treating periodontal intrabony defects, compared to a carrier control.

**Methods** Studies were searched in the literature that pertained to this topic. The following parameters were evaluated through meta-analysis: linear defect fill (LDF), PD reduction, CAL gain, and gingival recession (GR).

**Results** 1018 articles were found, out of which 7 studies were included. The results that showed a statistical difference were LDF and CAL gain for PDGF, and LDF for FGF-2.

**Conclusions** rhPDGF-BB showed significantly more LDF and CAL gain; rhFGF-2 showed higher percentage of LDF.


Alcohol consumption and risk of periodontitis: a meta-analysis

**Background** A meta-analysis was conducted to quantitatively summarize the evidence from observational studies on alcohol consumption and risk of periodontitis.

**Methods** PubMed, Web of Science, and Embase databases were utilized to identify eligible studies published in English. Pooled relative risks (RRs) with 95% confidence intervals (CIs) were calculated by random-effects models. Restricted cubic splines were used to assess the dose–response relationship.

**Results** 18 studies were included. The pooled RR of periodontitis for the highest with the lowest alcohol consumption was 1.59 (95% CI: 1.37–1.85). Significant associations were also found in stratified analysis by gender (males: 1.25, 95% CI: 1.11–1.41; females: 2.15, 95% CI: 1.36–3.41) and study design (cohort studies: 1.28 [1.04–1.57] and cross-sectional studies: 1.66 [1.39–1.99]). A linear dose–response relationship was found between alcohol consumption and periodontitis risk, and the risk of periodontitis increased by 0.4% (95% CI [1.002–1.007]) (p = 0.002) for each 1 g/day increment in alcohol consumption.
Conclusion This meta-analysis posits that alcohol consumption is associated with an increased risk of periodontitis. [SHA]

Does dentifrice use help to remove plaque? A systematic review

Background The ADA states on its website that toothpaste improves mechanical brushing and cleaning power of a toothbrush. However, conflicting reports have been published concerning the added value of using a dentifrice for plaque removal (van der Weijden, Slot 2015). The purpose of this study was to appraise the literature systematically and critically concerning the additional instant effect of dentifrice uses on mechanical plaque removal.

Methods Medline-PubMed, Cochrane-Central, Embase, and other electronic databases were searched. The inclusion criteria were randomized controlled trials and controlled clinical trials with subjects ≥18 yr of age with good general health. Studies that evaluated the effect of tooth brushing with a dentifrice compared to brushing without a dentifrice were included. Data were extracted from the eligible studies and a meta-analysis was performed where feasible. The focus question was What is the efficacy of brushing with or without a dentifrice for the mechanical removal of dental plaque in healthy adults?

Results The search was conducted until June 2016 and retrieved 10 eligible publications that included 20 comparisons. On average, 49.2% of plaque was removed when brushing was performed with a dentifrice, and 50.3% of plaque was removed when tooth brushing without a dentifrice. The descriptive analysis indicated that most the comparisons did not show an additional effect of dentifrice use. Regarding the meta-analysis of post brushing scores, no significant difference was observed between tooth brushing with and without a dentifrice (DiffM 0.00, 95% CI [-0.05: 0.05], p=0.91). The meta-analysis of incremental data (as means or percentages) supported and strengthened these findings.

Discussion This review selected studies that evaluated the contribution of a dentifrice to the efficacy of dental plaque removal by assessing the pre- and post-brushing scores of single brushing exercises with and without a dentifrice. 20 brushing exercises from 10 different studies were used to calculate an overall weighted mean percentage plaque score reduction. All included studies used the Quigley and Hein plaque index (1962) and modifications by Turesky et al. (1970) or Lobene et al. (1982). An approximately 49% plaque score reduction was observed based on 1153 single brushing exercises among 442 participants. This finding is consistent with Jepsen (1998), who reported that most individuals reduce plaque scores by approximately 50% during tooth brushing. Slot et al. (2012) observed that efficacy is related to the plaque index used. The present review included studies that used the Turesky et al. (1970) modification of the Quigley and Hein plaque index (1962).

Conclusions The cumulative evidence for this systematic review demonstrates that there is moderate certainty that tooth brushing with dentifrice does not provide an added effect for the mechanical removal of dental plaque. [jw]


CLINICAL STUDIES

CLINICAL / Implants

Long-term outcomes of osteotome sinus floor elevation without bone grafts: a clinical retrospective study of 4–9 years

Background The study purpose was to evaluate the long-term results of dental implants with osteotome sinus lifts (OSL) without bone grafts and to examine potential influential factors of endo-sinus bone remodeling and bone gain.

Methods Clinical and radiographic data of 96 implants in 80 patients were collected after 4 to 9 yr follow-up. Implant failures, implant marginal bone loss (MBL), and endo-sinus bone remodeling on the radiographs were evaluated. Statistical models were used to assess the implant survival and investigate the potential influence factors.
Results 9 implants in 7 patients failed, giving the 9 yr survival rates of 90.6%. The mean MBL between implant placement and the 4–9 yr follow-up visit was 0.46 ±0.88 and 0.50 ±1.69 mm, respectively. The average ESBG on radiographs was 2.95 ±1.25 and 2.16 ±1.13 mm at the 4 and 9 yr follow-up. The final ESBG was found to be positively correlated to implant protrusion length after surgery without any other factors related. The implant survival rate was significantly lower in severe atrophic sites with residual crestal bone height <5 mm.

Conclusions Sinus lifts without bone grafting can be considered a predictable treatment modality in the long run as per this study's suggestion. However, there must be caution when the initial bone height of the edentulous site is lower than 5 mm. Final endo-sinus bone height was found to be positively correlated to implant protrusion length measured on radiographs immediately after implant installation. [DL]


Assessment of marginal peri-implant bone-level short-length implants compared with standard implants supporting single crowns in a controlled clinical trial: 12 month follow-up

Background The study purpose was to compare marginal bone level alteration through radiographic evaluation and clinical parameters between short and standard implants supporting single crowns.

Methods 82 healthy and nonsmoking patients (42 male, 40 female, 30–60 yr) were included in this study and were divided into 2 groups. Group 1 had implants placed ranging from 5.5 to 7 mm and group 2 was for standard length implants, 10 to 12 mm. Periapical analysis was performed using Image J computer software for establishing initial bone measurement and periapical bone loss. All radiographs were taken using standard radiographic protocols, and measurements were taken at 6 and 12 mo.

Results No implants were lost in either group during the observation period. Standard length implants had statistically significant less bone loss. Bone loss did not exceed 0.53 mm in the short implant group. A statistically significant difference was found in the standard implant group showing greater gingival recession.

Conclusions Short implants are as reliable as standard length implants. Short implants experience minimal peri-implant bone loss, and therefore you do not need to treat partially edentulous patients with splinted crowns. [ES]


Comparison of peri-implant soft tissue parameters and crestal bone loss around immediately loaded and delayed loaded implants in smokers and non-smokers: 5-year follow-up results

Background The study purpose was to compare peri-implant soft tissue parameters and crestal bone loss (CBL) around immediately loaded (IL) and delayed loaded (DL) implants in smokers and nonsmokers.

Methods 61 partially edentulous patients (51 male, 10 female, aged 30–53 yr) were included. There were 33 smokers (defined as 1 or more cigarettes a day for 12+ mo) and 28 nonsmokers. 31 patients were treated with IL bone level implants in the posterior mandible (16 smokers, 15 nonsmokers), while 30 patients (17 smokers, 13 nonsmokers) were treated with DL bone level implants. Both groups received dental implants that ranged from 12 to 14 mm in length, and 3.3 to 4.1 mm in diameter. Loading was performed 2 d after surgery in the IL group and 3 mo in the DL group. Standardized radiographs were taken to assess crestal bone loss. Peri-implant PI, BoP, and PD >4 mm were recorded.

Results Mean scores of PI and PD >4 mm were statistically significantly higher in smokers compared with nonsmokers in patients with IL and DL dental implants. The mean score of BoP was statistically significantly higher in nonsmokers compared with smokers in both groups. Total CBL was statistically significantly higher in smokers compared with nonsmokers. There was no statistically significant difference in PI, BoP, PD >4 mm, and total CBL among smokers with IL and DL implants. At 5 yr, the survival and success rates of all IL and DL implants were 100%.

Discussion This is the first study to report peri-implant soft-tissue parameters and CBL around IL and DL implants in smokers compared with nonsmokers. All participants received cleanings 2 times yearly for the duration of the study,
which could help to minimize the oral soft-tissue inflammation. Some limitations of this study include the fact that smokers weren't classified by quantity and frequency of smoking. Heavy smokers may demonstrate different results from the light smokers. This study concluded that tobacco smoking enhances peri-implant soft-tissue inflammation and CBL around IL and DL implants. Loading protocol did not show a statistically significantly effect on the peri-implant hard-and soft-tissue status in healthy smokers and nonsmokers. [PC]


Early loading of splinted implants in the posterior mandible: a prospective multicenter case series

BACKGROUND The study aim was to evaluate the 12 mo clinical and radiological outcomes with the OsseoSpeed TX implant using an early loading protocol in patients with missing teeth in the posterior mandible.

METHODS 45 subjects, with Kennedy class I or II edentulism in the mandible, were enrolled at 3 centers in China. 2 or 3 implants were placed in one edentulous region using a 1-stage procedure. Patients received a screw-retained splinted fixed permanent restoration in one edentulous region 6–8 wk after surgery. Follow-up took place at 6 and 12 mo after loading. Marginal bone level alteration, implant survival, and clinical findings were assessed using descriptive statistics. The data were analyzed on a patient level, implying that the mean overall implants by patient was used as the statistical unit. The data from the 3 centers were pooled in the statistical analyses.

RESULTS 107 implants were inserted in 45 patients (5 study implants in 2 patients were excluded from the 107 implants due to prolonged healing time). 12 mo after loading, the implant survival rate was 100%, with a mean marginal bone gain of 0.08 ±0.411 mm and healthy soft-tissue status. The results among the 3 centers were pooled because there was no difference of the mean marginal bone level alteration among each center.

DISCUSSION In our patients, we observed a mean marginal bone gain (our primary outcome measure) of 0.08 ±0.411 mm. In terms of our secondary outcomes, the implant survival rate was 100%, and positive clinical assessments, such as healthy soft tissue, were obtained 12 mo after loading. In addition, no safety issues related to the dental implants were reported and only 2 subjects experienced loose bridge screws. The results of this study using an early loading protocol are comparable with, or even better than, the results in many previously reported studies obtained using conventional loading protocols in the posterior mandible (Barewal et al. 2012, Palarie et al. 2012, Gulje et al. 2013, Gulje et al. 2015).

CONCLUSIONS Early loading of splinted OsseoSpeed TX implants was an effective and safe treatment for partial edentulism of the posterior mandible.


The association between shallow vestibular depth and peri-implant parameters: a retrospective 6 years longitudinal study

BACKGROUND The aim of this study was to retrospectively evaluate the association between shallow vestibular depth (VD) and peri-implant parameters.

METHODS Peri-implant parameters were evaluated in 61 periodontal patients under regular supportive periodontal therapy. Clinical parameters included GI, PI, BoP, peri-implant pocket depths (PPD), mucosal recession (MR), relative attachment level (RAL), width and thickness of keratinized mucosa (KMW, KMT), and VD. Radiographic bone level (RBL) was measured on peri-apical radiographs.

RESULTS Sites with shallow VD (≤4 mm) were associated with higher MR (0.91 mm vs 0.47 mm, \( p \leq 0.009 \)), higher RAL (4.23 mm vs 3.59 mm, \( p \leq 0.0001 \)), and higher RBL (2.18 mm vs 1.7 mm, \( p \leq 0.05 \)) when compared with adequate vestibular depth sites (VD >4 mm). Moreover, sites with shallow VD presented lower KMW compared with sites with adequate VD (1.24 mm vs 2.38 mm, respectively, \( p \leq 0.0001 \)). Slightly greater BoP and GI were recorded for the shallow VD compared with adequate sites. According to multivariate analysis, factors that could predict RAL include: VD, GI, age, supporting periodontal therapy, implant type, and design.

DISCUSSION This clinical trial is the first attempt to evaluate the association between shallow vestibular depth and peri-implant health. Shallow vestibule was found to be associated with higher
mucosal recession and increased peri-implant bone loss. The width of keratinized mucosa was approximately 1 mm narrower in sites with shallow vestibular depth compared with sites with adequate vestibular depth.

**Conclusions** Based on this study, inadequate vestibular depth around dental implants may be associated with increased peri-implant bone loss and mucosal recession. Further prospective and intervention studies will be required to fully understand this phenomenon.

**Methods/Results** 470 patients underwent mandibular implant placement. Failure in men was 67 out of 837 (92% cumulative survival rate) and in females 109 out of 1557 (94.5%) failures have occurred. Statistically significant difference in CSR was found between different age groups: 60 to 69 (94.6%), and both 40 to 49 (91.2%) and 50 to 59 (91.9%) were 57.9 to 1358 (57.9%) total implants supported a full arch acrylic prosthesis with a cumulative success rate of 96.6% comparing it to full fixed prosthesis, which had CSR of 81.5%. Comparing single unit implant crowns or FPD or other implant supported dentures didn't differ significantly between each other.

**Discussion** Brånemark system implant CSR or 94.1% after 5 yr and 93.5% after 10 yr observed in this report which was like previous retrospective studies. Implant location showed significance on implant survival. Present study showed about 4% difference of survival in the anterior vs. posterior mandible. Statistically significant differences were also found in CSRs of type 3 and type 1 bone, as well as type 3 and type 4 bone.

**Conclusion** Success of implants is overall high as a long-term treatment options for the rehabilitation of the edentulous and partially edentulous mandible.

**Effectiveness of enamel matrix derivative on the clinical and microbiological outcomes following surgical regenerative treatment of peri-implantitis. A randomized controlled trial**

**Background** This randomized clinical trial aimed at comparing radiological, clinical, and microbial effects of surgical treatment of peri-implantitis alone or in combination with enamel matrix derivative (EMD).

**Methods** 26 subjects were treated with open flap debridement and decontamination of the implant surfaces with gauze and saline followed by adjunctive EMD or no EMD. Bone level (BL)
change was primary outcome, and secondary outcomes were changes in PD, plaque, suppuration, BoP, and the microbiota of the peri-implant biofilm analyzed by the Human Oral Microbe Identification Microarray over a time period of 12 mo.

Results In a multivariate modelling, increased marginal BL at implant site was significantly associated with EMD use, the number of osseous walls in the peri-implant bone defect, and a gram+/aerobic microbial flora. Moreover, reduced BL was associated with gram/anaerobic microbial flora and presence of bleeding and suppuration, with a cross-validated predictive capacity (Q2) of 36.4%. Similar, but not statistically significant, trends were seen for BL, PD, plaque, suppuration, and bleeding in univariate analysis.

Conclusion Adjunctive use of EMD to surgical treatment of peri-implantitis was associated with prevalence of gram+/aerobic bacteria during the follow-up period and increased marginal BL 12 mo after treatment.


Randomized controlled clinical study evaluating effectiveness and safety of a volume-stable collagen matrix compared to autogenous connective tissue grafts for soft tissue augmentation at implant sites

Background The study purpose was to test if the use of a collagen matrix (VCMX) results in short-term soft-tissue volume increase at implant sites in comparison to an autogenous subepithelial connective tissue graft (SCTG), and to evaluate safety and tissue integration of VCMX and SCTG.

Methods Soft-tissue volume augmentation was performed in 20 patients with a volume deficiency at single-tooth implant sites. Patients were randomly allocated to VCMX or SCTG. Soft-tissue thickness, patient-reported outcome measures (PROMs), and safety were assessed up to 90 d (FU-90). At FU-90 (abutment connection), tissue samples were obtained for histological analysis. Descriptive analysis was computed for both groups. Nonparametric tests were applied to test noninferiority for the gain in soft-tissue thickness at the occlusal site.

Results Median soft-tissue thickness increased between BL and FU-90 by 1.8 mm (Q1:0.5; Q3:2.0) (VCMX) (p = 0.018) and 0.5 mm (□1.0; 2.0) (SCTG) (p = 0.395) (occlusal) and by 1.0 mm (0.5; 2.0) (VCMX) (p = 0.074), and 1.5 mm (□2.0; 2.0) (SCTG) (p = 0.563) (buccal). Noninferiority with a noninferiority margin of 1 mm could be demonstrated (p = 0.020); the difference between the 2, group medians (1.3 mm) for occlusal sites indicated no relevant, but not significant superiority of VCMX vs SCTG (primary endpoint). Pain medication consumption and pain perceived were nonsignificantly higher in group SCTG up to d 3.


Immediate implant placement and provisionalization in the aesthetic zone using a flapless or a flap-involving approach: a randomized controlled trial

Background We conducted a randomized clinical controlled trial to compare the effect of flapless (FLS) or flap-involving (F) immediate placement and provisionalization of single-tooth implants in the aesthetic zone.

Methods 39 patients were randomized following extraction of a nonrestorable tooth to a FLS or F group. All implants were immediately placed and provisionalized. We monitored prospectively changes in the peri-implant mucosal margin, the interproximal bone, and buccal horizontal ridge at 3, 5, and 12 mo.

Results At 3 mo postsurgery, the mean SD (median [interquartile range]) mesiobuccal peri-implant gingival margin recession from the presurgical soft tissue position amounted to 0.11 ±0.32 mm (0 [0, 0.5]) in the FLS treatment arm vs. 0.43 ±37 mm (0.5 [0, 0.5]) in the F treatment arm (p=0.02); corresponding values at the distobuccal surface were 0.11 ±32 mm (0 [0, 0]) in the FLS arm vs. 0.48 ±0.44 mm (0.5 [0, 1]) in the F arm (p=0.01). No other significant differences in soft- or hard-tissue remodeling between the treatment arms were observed at 3, 6 or 12 mo.

Discussion In this randomized controlled trial, we assessed longitudinally over 12 mo the impact of flap elevation on the soft- and hard-tissue remodeling around immediately placed and provisionalized single tooth implants in the aesthetic zone. At 3 mo postextraction, a 0.5 mm recession of the interproximal GM compared with the presurgical position was observed in the F arm,
while largely unchanged GM levels were observed in implants placed using a FLS approach. However, the difference between the 2 treatment arms was no longer discernible at 6 or 12 mo, mostly due to a coronal shift of the interproximal tissue in the F arm. Postoperative coronal proliferation of the interproximal papilla has been reported in retrospective (Jemt 1997, Chang et al. 1999, Belser et al. 2004), as well as in 12 mo prospective studies (Cooper et al. 2010). A delay in papillary regeneration following F vs. FLS implant placement has been previously reported (Bashutski et al. 2013), extending to 15 mo postsurgically in delayed implant placement.

Although the apex of the buccal mucosa exhibited a trend for greater recession in the F arm during the first 3 mo., it remained virtually stable in both treatment arms between 3 and 12 mo. This finding agrees with a prospective multicenter clinical trial (Cooper et al. 2010) that demonstrated no change in the most apical aspect of the buccal periimplant mucosal margin between 3 and 12 mo. Similarly, a randomized clinical trial of immediately placed and provisionalized implants (De Rouck et al. 2009) showed longitudinal buccal recession after flap elevation amounting to 0.47 ±0.78 mm at 3 mo and 0.41 ±0.75 mm at 12 mo. Importantly, the statistically significant difference between the groups, when compared to the postsurgical position of the GM, was mainly due to coronal migration of approximately 0.25–0.5 mm in the flapless group, seemingly compensating for the tissue collapse during surgery, to almost the presurgical tissue level. Although we did not assess in our study the preoperative to postoperative GM change, Kan et al. 2003, demonstrated a significant recession between the presurgical and immediately postsurgical GM position ranging between 0.21 and 0.36 mm, following immediate flapless implant placement and provisionalization.

At 12 mo, buccal recession amounting to 1 mm was observed in 1 of 16 and 4 of 18 patients in the FLS and F treatment arms, respectively. These recessions were detected at the 3 mo follow-up and remained mostly unchanged thereafter. Two of the 18 patients in the F group showed interproximal longitudinal recession of 1 mm both mesially and distally, while 1 of 18 patients showed the same level of recession at the mesial surface. No advanced recession exceeding 1 mm (Cosyn et al. 2012) was observed at 12 mo, although a single site in the flap group exhibited 1.5 mm buccal recession at 6 mo, which reverted to 1 mm at 12 mo. The level of recession observed in our study are comparable to those reported by Chu et al. (2015), in grafted and nongrafted immediate implants, although no bone grafts were used in our study. Few recent studies of flapless immediate implant placement and provisionalization reported greater recessions, approximately 1 mm (Slagter et al. 2015) at 12 mo or 2 mm (Chu et al. 2015) at ≥8 mo. This may be due to the methodological or reference-point differences, such as mid-buccal versus most apical presurgical buccal GM location. The latter point is of importance with tooth extractions due to acute infection or fractures, rendering the most apical position of GM off-center. The interproximal soft-tissue response may be influenced by missing tooth contacts due to the fractured crowns of teeth scheduled for extraction.

With respect to interproximal bone crest level change, one of the secondary outcomes investigated, a trend for greater bone loss was noted in the F group, although the difference was not statistically significant. Recent reviews (Lin et al. 2014, Vohra et al. 2015) reported comparable bone level changes following either technique. Sanz et al. (2010) reported buccal 1 mm bone crest loss 4 mo following flap-involving immediate implant placement, which exceeds the one observed in our study at 6 mo, possibly due to different buccal versus interproximal bone remodeling. Gomez-Roman (2001) reported significantly greater bone loss following interproximal flap elevation than papilla-sparing technique in a study utilizing mostly delayed surgical protocol, though additional flap elevation was used in some of their second-stage surgeries.

Buccal ridge change, another secondary outcome investigated, was not significantly different between the treatment arms at any of the examined time-points. Greater combined ridge loss of 2 mm was reported (Koh et al. 2011) 4 mo following flap-involving immediate implantation, despite grafting of the periimplant gap. This difference could be attributed to the delayed restorative therapy and the nonfixed reference point in the latter study. In our study, both groups exhibited ≤1 mm thickness of the buccal bone, which has been associated with greater risk of vertical crest reduction (Ferrus et al. 2010). On the other hand, the latter study demonstrated that presence of a ≥2 mm horizontal gap, which occurred in both groups in our study, was associated with greater bone fill. Immediate provisionalization may have played a decisive
role in the relative preservation of the buccal ridge, supporting similar recent observations (Tarnow et al. 2014, Chu et al. 2015). At 12 mo, 1 incisor and 1 canine site in the F group exhibited 3 mm horizontal ridge reduction (both associated with a narrow dehiscence), while a 2.5 mm ridge reduction occurred at 1 premolar site in the FLS group.

Although all 4 sites with initial periapical radiolucency in our study healed uneventfully, Hita-Iglesias et al. (2015) reported higher complication rates in sites with larger than 4 mm periapical lesions.

**Conclusions** Flapless and flap-involving immediate single implant placement and provisionalization resulted in largely comparable recession, interproximal bone loss, and buccal ridge reduction at 6 and 12 mo. The longer-term outcome of these approaches must be evaluated in future studies. [Jw]


**Indications and frequency for the use of cone beam computed tomography for implant treatment planning in a specialty clinic**

**Background** In 1998, Mozzo and coworkers first described the use of CBCT for various dental applications, including implant surgery. Since then, it has become the modality of choice when conventional 2D imaging fails to adequately show the necessary anatomy. However, it is not known how often, for which indications and what types of surgical treatment CBCT is used. The study aims to gauge the prevalence of CBCT as a modality for implant treatment planning in addition to 2D imaging, with respect to patient variables, location in the mouth, and kind of surgical intervention.

**Methods** All patients who received implants from the Dept. of Oral Surgery at the Univ. of Bern from 2008 to 2010 were included in the study. Patients with severe systemic medical conditions were excluded. Evaluations and procedures were performed by 25 different surgeons. All patients received initial 2D radiographs, and the evaluating surgeon determined the need for additional 3D imaging with small or medium field of view. The variables collected included patient age and gender, location of implants, indication for implants, type of radiographic assessment, and surgical procedures performed. The authors then analyzed the impact of the variables on the frequency of use of 2D radiographic analysis alone or in combination with 3D CBCT.

**Results** In this time period, there were 1568 patients receiving 2279 implants. Overall, 40.4% of patients were assessed with 2D imaging alone, while 59.6% also had 3D imaging performed. Medium field of view (6×6 cm) was most common. There was a statistically significant increase in the use of CBCT in the time period (52.4% to 65.9%). Patients over the age of 55 received a CBCT more often than those under 55. There was no significant difference between sexes. CBCT was used more often in patients with extended and distal edentulous gaps in both jaws. Also, the use of CBCT was highest in the posterior maxilla and lowest in the mandible. The need for bone augmentation or sinus floor elevation also increased the prevalence of 3D imaging.

**Discussion** The study confirms the prevalent opinion amongst practitioners that 2D imaging alone may be sufficient for sites in the posterior mandible, as 50% of mandibular implants were placed using only 2D imaging. However, the prevalence of CBCT increased to 70% in the maxilla. Increasing surgical complexity also increased the prevalence of CBCT, as more than 90% of implants placed with GBR or sinus elevation made use of 3D imaging. Patients over the age of 55 were more likely to receive a CBCT image, possibly due to the association with extended edentulous spaces and distal extensions. This is only one center, from one country, which no doubt has its own prevailing opinions regarding the indications for CBCT. However, it does seem to reflect the overall trend seen in this country, as well as supported by the AAOMR position on imaging for dental implants.

**Conclusions** The use of CBCT for dental implant planning is increasing in prevalence, particularly for older patients, sites with more difficult anatomy (posterior maxilla), and sites which require grafting procedures. [AGP]


**Characterization of cement particles found in periimplantitis-affected human biopsy specimens**

**Background** The study aim was to evaluate the composition of foreign particles from 36 human biopsy specimens with 19 specimens selected for analysis.

**Methods** 36 biopsy samples were taken from patients who had peri-implantitis around implants that were cement retained. Out of the 36, 19 samples were used because they had cements included in them. Cements that were analyzed were Tello CS Cem Implant (Tello), TempBond Clear with triclosan (TB), Premier Implant Cement (PIC),
RelyX Unicem 2 (Relyx1 and Relyx2), and Intermediate Restorative Material (IRM).

**RESULTS** Relyx1 was in 3 samples, PIC and IRM in 4 samples each, TB in 1 sample, and Telio in 7 samples. No sample was predicted to contain Relyx2.

**DISCUSSION** Zn, Si, Al, and Zr were the elements detected in foreign particles embedded in the tissue biopsies related to dental cements.

**CONCLUSION** Excess cement left after implant placement can remain embedded in peri-implant tissues, possibly triggering the development of the inflammatory processes.


---

**CLINICAL / Nonsurgical**

**Increased autophagy is required to protect periodontal ligament stem cells from apoptosis in inflammatory microenvironment**

**BACKGROUND** Autophagy, a mechanism cellular organelles and proteins turnover through a lysosome-dependent degradation pathway, has been correlated to the pathogenesis of inflammatory disorders and other diseases. The aim of the current study was to examine the role of autophagy in periodontal ligament stem cells (PDLSCs) and shed the light on a new strategy for treatment or prevention of periodontitis.

**METHODS** Immunohistochemistry to detect the LC3 expression in periodontal ligament (PDL) tissues from patients with (n = 20) or without (n = 20) periodontitis was utilized. To investigate the mechanism of autophagy, PDLSCs were divided into 3 groups: H-PDLSCs, P-PDLSCs, and I-PDLSCs. The level of autophagy in PDLSCs was evaluated by qRT-PCR and Western blot. LC3-positive points were examined by immunofluorescence, and the autophagic vacuoles (AVs) were detected by transmission electron microscope.

**RESULTS** A higher level of autophagy in gene expression and autophagosome production of PDL tissues from periodontitis patients was found. Additionally, higher protein levels of LC3, Beclin-1, Atg7, and Atg12 in P-PDLSCs and I-PDLSCs was observed. LC3-positive points were also detected and AVs in P-PDLSCs and I-PDLSCs. The activation of autophagy could protect PDLSCs from apoptosis.

**CONCLUSION** Results indicate that the utilization of autophagy in P-PDLSCs may provide a novel therapeutic strategy to improve periodontal therapy. [SHA]


---

**Effect of obesity on periodontal attachment loss progression: a 5-year population-based prospective study**

**BACKGROUND** The purpose the present study was to evaluate the effect of obesity on periodontal attachment loss (PAL) advancement in an urban population from south Brazil.

**METHODS** In 2001, a population-based oral health survey entitled “Epidemiology of periodontal diseases: the Porto Alegre Study,” was conducted by drawing a probabilistic sample of 1586 individuals. 755 (participation rate: 47.6%) participants were evaluated and re-examined after 5 yr. Exclusion criteria included any self-reported diabetics, underweight individuals, and individuals with <6 teeth. Poisson regressions were used to calculate relative risks (RR) and 95% confidence intervals (CI), adjusted for sex, age, skin color, education, socio-economic status, smoking and dental care.

**RESULTS** Of the 755 initially participating, only 582 (333 males, 249 females, 36.02 ±14.97 yr) were included. The results depicted that obese individuals had significantly higher risk of PAL advancement than individuals with normal weight after adjusting for important cofactors (RR = 1.36, 95% CI = 1.04–1.78). In a stratified analysis, no statistically significant associations were found between PAL progression and obesity for males (RR = 1.13, 95% CI = 0.75–1.69), however, obese females were at statistically significant higher risk than normal weight females (RR = 1.64, 95% CI = 1.11–2.43).

**CONCLUSION** Obesity seems to be a risk factor for PAL advancement for females but not males in this developing country population. [SHA]


---

**Aggressive and chronic periodontitis in a population of Moroccan school students**

**BACKGROUND** This study was conducted to assess the prevalence, clinical characteristics, and demographics of agP and chP in a population sample of Moroccan school students.
METHODS Students older than 12 yr old from schools of Benslimane Province participated in this study. The age of the patients included were 12–25 yr (mean: 16.1 yr with a 1:1 distribution between males and females). Classification of periodontitis was determined clinically.

RESULTS 31% of the participants had ≥4 mm and 10.1% had ≥6 mm of attachment loss; agP was diagnosed for 4.9% of the subjects, and 6.4% were diagnosed with chP. The amount of attachment loss for subjects with chP was 4–5 mm, affecting a few molars or premolars. Subjects with agP had ≥5 mm attachment loss affecting multiple teeth, and 68% and 73% of these subjects had ≥6 mm attachment loss affecting maxillary and mandibular molars respectively. Attachment loss and periodontitis were significantly more prevalent in the 19–25 yr group than the 12–18 yr group. Gender or ethnic groups had no significant differences in disease prevalence.

CONCLUSIONS There is a high risk of destructive PD in the population in this study, and further studies are indicated to investigate the biological and environmental factors that may contribute to the increased risk of disease. [rcg]

Cost-effectiveness of regular versus irregular supportive periodontal therapy or tooth removal

BACKGROUND For patients diagnosed with periodontitis, regular supportive periodontal therapy (SPT) decreases the need teeth extraction, with savings for tooth replacement possibly compensating SPT costs. The aim of the study was to assess the cost-effectiveness of regular versus irregular SPT, and to compare both strategies with immediate tooth removal.

METHODS We constructed a tooth-level Markov Model. Replacement of 50% of removed teeth via implant-supported crowns was modelled in the base case. We estimated cost-effectiveness as Euro per tooth retention year using Monte Carlo microsimulations. We also performed Scenario analyses.

RESULTS Regular SPT saved more teeth (tooth retention 28.7 vs. 26.1 yr), but was costlier (€806 vs. €731 per tooth), with an incremental cost-effectiveness ratio (additional costs per tooth retention year) of €29/year. Regular SPT was less costly if costs for SPT per tooth and visit were <€5.03, patients had high risk of tooth loss, or teeth were regularly replaced. Immediately removing and replacing teeth was usually most costly.

CONCLUSIONS Based in this study, regular SPT helps to retains teeth longer than irregular SPT, but does not necessarily reduce expenses. Decision-making should consider the value placed on retaining teeth, the technical feasibility of replacement, and the impact of periodontal on general health. [rcg]

Regular consumption of Lactobacillus reuteri-containing lozenges reduces pregnancy gingivitis: an RCT

BACKGROUND This study assessed the impact of Lactobacillus reuteri on pregnancy gingivitis in women in good health condition.

METHODS 45 women (24 test/21 placebo) with pregnancy gingivitis in the third trimester of pregnancy participated in this study. At baseline, gingival index (GI) and plaque index (PI) were documented at the Ramfjord teeth and venous blood taken for TNF-α analysis. Then participants were randomly given lozenges to be taken twice daily until birth (approx. 7 wk) containing ≥108 CFU L. reuteri ATCC PTA 5289 and ≥108 CFU L. reuteri DSM 17938 (test) or being devoid of L. reuteri (placebo). During the subsequent days after birth, recording of GI, PI, and blood sampling were done again.

RESULTS At baseline, mean GI and mean PI were not significantly different between both groups. In the test group mean TNF-α serum level was significantly (p <0.02) lower than in the control group. At reevaluation, mean GI and mean PI of the test group had both significantly (p <0.0001) decreased than in the control group. Mean TNF-α serum level stayed at comparable levels between the groups.

CONCLUSIONS The consumption of L. reuteri lozenges by pregnant women may be a useful adjunct in the control of pregnancy gingivitis. [rcg]

The effect of periodontal therapy on intra-oral halitosis: a case series

BACKGROUND The aim of this study was to evaluate the effects of nonsurgical periodontal therapy on intraoral halitosis 3 mo after therapy.
Methods 68 adults with intraoral halitosis were included in a case series. Intraoral halitosis was evaluated at baseline and at 3 mo after treatment using the organoleptic scores (OLS), Halimeter, and a gas chromatograph.

Results Significant reductions for OLS ($p<0.01$), total sum of volatile sulphur compounds (T-VSC) ($p<0.01$) and methyl mercaptan (MM) ($p<0.05$) values were found after treatment. Hydrogen sulfide ($H_2S$) levels were not significantly reduced. The numbers of probing pockets 4 mm, 5 mm, and 6 mm were significantly reduced because of therapy ($p<0.001$). BoP and plaque indices were also significantly reduced ($p<0.001$). For the 34 individuals with successful periodontal treatment (BoP <20% and a ≥50% reduction of total PD reductions in OLS ($p<0.01$) and T-VSC scores ($p<0.01$) were found. 11 individuals were considered effectively treated for intraoral halitosis presenting with a T-VSC value <160 ppb, a $H_2S$ value <112 ppb and a MM value <26 ppb.

Conclusions Nonsurgical periodontal therapy resulted in reduction of OLS, MM, and T-VSC values 3 mo after therapy. Few individuals were considered as effectively treated for intraoral halitosis. [ske]

Maxillary overdentures supported by four or six implants in the anterior region: 5-year results from a randomized controlled trial

Background There is a need for comparative studies on 4 vs. 6 implants in the anterior region of the maxilla with a longer follow-up period. Therefore, the purpose of this 5 yr randomized controlled trial was to assess the treatment outcome (implant survival, overdenture survival, peri-implant health, radiographic bone height changes, patients' satisfaction, and biological/technical complications) of maxillary overdentures supported by 4 or 6 dental implants in the anterior maxillary anterior region.

Methods 50 subjects with functional problems concerning their maxillary denture who had ample bone volume in the anterior region to place 4 or 6 implants, were included and randomly assigned to either group. Implant and overdenture survival, clinical performance, marginal bone loss, and patient satisfaction were assessed.

Results 46 patients completed the 5 yr follow-up. One implant failed in the 6-implant group (99.2% survival) and none in the 4-implant group (100% survival). No overdentures had to be replaced during the observation period and the number of complications was limited. Clinical function was good, with no difference in clinical parameters between the groups. Mean marginal bone resorption was $0.50 \pm 0.37$ mm and $0.52 \pm 0.43$ mm in the 4- and 6-implant group respectively.

Discussion In patients with functional complaints of their maxillary denture, bar-supported overdentures on 4 implants in the anterior maxillary region were not inferior to overdentures supported by 6 implants after 5 yr of function. Implant survival and patient satisfaction were high, clinical parameters favorable, and bone loss and complications to the denture were minor in both groups.

Cross-sectional association between physical strength, obesity, periodontitis and number of teeth in a general population

Background Muscle strength declines and gums recede with increasing age across the life course. Possible associations exist between handgrip strength as an indicator of physical fitness, periodontitis, and number of teeth.

Methods Handgrip strength (GS), anthropometric measures, CAL, number of teeth, C-reactive protein and glycated hemoglobin were assessed in 2089 participants of the Study of Health in Pomerania (SHIP-2). Linear regression, including interaction with age, was used to estimate the association between clinical attachment level, number of teeth, and GS.

Results In multiple regression adjusted for age, body mass index (BMI), and waist-to-hip ratio (WHR), each mm of diminished periodontal attachment was associated with reduction in GS by 1.47 kg (95% CI, −2.29 to −0.65) and 0.38 kg (−0.89 to 0.14) in men and women, respectively. Correspondingly, each additional remaining tooth was significantly associated with higher GS. Using handgrip strength relative to BMI as outcome, these relationships become even more apparent. Indicators of obesity, such as BMI and WHR, associated with both GS and periodontitis modulate the relationship between GS and periodontitis with a different impact between the sexes.

Conclusions Periodontitis is associated with
Microbiologic observations after four treatment strategies among patients with periodontitis maintaining a high standard of oral hygiene: secondary analysis of a randomized controlled clinical trial

**Background**  The investigation aimed to report on a secondary analysis of the microbiologic outcomes of the treatment modalities comparing adjunctive metronidazole (MET) therapy versus placebo and traditional SRP versus SRP within a single workday (full-mouth disinfection [FDIS]), and to examine the relationship of the microbiologic outcomes with the clinical outcomes of treatment.

**Methods**  This study represents the secondary analysis of patients treated in Norway for severe periodontitis who underwent different treatment modalities: full-mouth disinfection (FDIS), with metronidazole, full-mouth disinfection with placebo, SRP with metronidazole, and SRP with placebo. FDIS was done in 65 min, 2 sessions 2 h apart, and SRP was done in 65 min sessions, 21 d apart. Metronidazole was given 400 mg ×3 for 10 d starting the day before treatment. 4 patients left the study and 3 died (2 from cancer and 1 from diabetes). At baseline sampling was collected from the 4 deepest pockets of each patient and obtained at 3 and 12 mo using paper points. Genomic DNA probes were constructed for Porphyromonas gingivalis, Prevotella intermedia, Campylobacter rectus, Tannerella forsythia, Aggregatibacter actinomycetemcomitans, Fusobacterium nucleatum, Treponema denticola, and Haemophilus parainfluenzae. Also, Enterococcus faecalis, Staphylococcus aureus, Enterobacter cloacae, and Candida albicans were included because these bacteria are known to cause opportunistic infections.

**Results**  Periodontal treatment resulted in reductions of P. gingivalis, P. intermedia, C. rectus, F. nucleatum, T. denticola, and T. forsythia and no changes were seen for A. actinomycetemcomitans, and H. parainfluenzae. Reductions seen were greater at 3 mo versus 12 mo for 3 out of the 4 treatment groups; the exception was FDIS only, which were greater or like the 3 mo results. Relative insignificant influence of FDIS versus SRP and MET versus placebo were seen for bacterial log counts at 3 mo or 12 mo the exception: C. rectus (12 mo) and T. forsythia (3 mo) after MET treatment showing that FDIS with MET had the greatest effect. T. forsythia was free of PD ≥5 mm at 12 mo.

**Discussion**  FDIS versus SRP had no influence on clinical outcomes of treatment. MET treatment resulted in PD reductions and CAL gains compared with placebo, especially with T. forsythia counts being free in PD ≥5 mm at 12 mo. The findings with this study are in concert with Haffajee et al. who showed decrease in T. forsythia with SRP + Met, with their study also showing reductions in P. gingivalis. This study included patients only after a long oral hygiene phase, which may be selecting patients biased towards gingivitis versus periodontitis.

**Conclusions**  After 4 treatment modalities among patients with periodontitis maintaining a high standard of oral hygiene, only T. forsythia was shown to be significantly decreased after treatment of FDIS and MET. [vss]


| CLINICAL / Surgical |

Retention costs of periodontally compromised molars in a German population

**Background**  This study assessed the long-term costs per retention year for periodontally affected molars.

**Methods**  A cohort of 379 compliant subjects was retrospectively evaluated. Periodontal, restorative, endodontic, prosthetic, and surgical treatment costs were estimated based on fee items of private German health insurance. Costs per year were calculated, and the impact of tooth- and subject-related factors on this cost effectiveness ratio was assessed using generalized linear-mixed modelling.

**Results**  2306 molars received nonregenerative initial and supportive therapy and were followed until extraction or censoring (in mean [SD]: 16.5 [6.8] yr). Per year, 0.07 (SD: 0.12) deep scalings, 0.04 (0.11) open flap debridements, 0.01 (0.04) resective therapies, and 2.49 (0.12) SPTs had been provided. Few teeth received nonperiodontal treatments. Costs per year decreased significantly with each tooth a patient had at baseline (mean

GS modified mainly by anthropometric measures related to adiposity and inflammation. Putative mechanisms encompass interactions of factors declining with increasing age. [jw]

difference: 0.01, 95% CI: 0.02/0.01 Euro/year), and increased with each mm of PPD (0.04 [0.03/0.06] Euro/year), in upper (0.07 [0.11/0.31] Euro/year), or mobile molars (up to 0.33 [0.18/0.48] Euro/year), those with bone loss (up to 0.11 [0.04/0.17] Euro/year), endodontic treatment (0.24 [0.15/0.33] Euro/year), peri-apical lesions (0.24 [0.11/0.38]), and prosthetic treatment (0.54 [0.49/0.59] Euro/year).

**Discussion** If compared with total costs, periodontal treatment costs made up around two-thirds of the total long-term costs, i.e. most teeth did not generate significant costs for endodontic or restorative treatment. We identified further relevant factors associated with higher treatment costs, like having fewer teeth present (previous tooth loss as an indicator of high needs), high PPD (which was found to predict tooth survival and was a measure to decide follow-up treatments), endodontic status (which is possibly associated with more decisions towards resective therapy), peri-apical lesions (demanding endodontic treatment or resective therapy), and prosthetic status.

**Conclusions** Annual costs for retaining periodontally affected molars were limited and associated mainly with tooth-level factors.


**Clinical efficacy of coronally advanced flap with or without connective tissue graft for the treatment of multiple adjacent gingival recessions in the aesthetic area: a randomized controlled clinical trial**

**Background** The aim of this study was to compare the clinical success of coronally advanced flap (CAF) with or without connective tissue graft (CTG) for the treatment of multiple adjacent gingival recessions in the maxillary archs.

**Methods** 32 patients with a total of 74 gingival recessions were randomly allocated to the 2 treatment groups (CAF, CAF+CTG). Study parameters included complete root coverage (CRC), recession reduction (RecRed), keratinized tissue (KT) gain, increase in gingival thickness (GT), patient satisfaction, and root coverage aesthetic score (RES); they were collected by a blind examiner.

**Results** An interaction between treatment and baseline GT was detected. At 1 yr, CAF+CTG resulted in better outcomes in terms of CRC ($p = 0.0016$) and RecRed ($p < 0.0001$) than CAF alone at sites with thin gingiva (thickness ≤0.8 mm). No difference was found between CAF alone and CAF+CTG at sites with thick gingiva (>0.8 mm). CAF resulted in higher aesthetic scores (RES) than CAF+CTG at sites with thick gingiva. CAF+CTG was associated with greater KT gain ($p < 0.0001$) and greater postoperative morbidity ($p < 0.0001$).

**Conclusion** Coronally advanced flap with the use of a CTG results in increased probability of CRC only at sites with thin baseline gingiva. CAF alone is associated with similar clinical outcomes and better aesthetics at sites with thick baseline gingiva compared to that of thin gingival biotype.


**Quantitative changes in palatal donor site thickness after free gingival graft harvesting: a pilot study**

**Background** The aim of this study was to observe how the thickness of donor sites quantitatively change over time in spontaneous palatal wound healing after free gingival graft (FGG) harvesting.

**Methods** 40 participants were enrolled and separated into 2 groups based on the residual tissue thickness (RTT) after harvesting: group 1, less than 2 mm; and group 2, more or equal to 2 mm. FGGs were standardized. Tissue filling was measured at 3 different points of the defect area (mesial, central, and distal) at baseline, after harvesting, and at 1, 3 and 6 mo.

**Results** The palatal thickness of the tissue from the baseline to 1 mo after harvesting was greater in group 2 compared to group 1, however the thickness from 1 to 3 mo and from 3 to 6 mo after harvesting was greater in group 1 than in group 2 ($p < 0.005$). RTT was positively correlated with tissue filling in all the groups at all time points ($p 0.05$).

**Conclusions** The palatal mucosal thickness after FGG harvesting can affect the filling of the defect. Within the study period, the periphery of the palatal wounds filled earlier and compared with the center of the wounds.

Tooth loss and alveolar bone crest loss during supportive periodontal therapy in patients with generalized aggressive periodontitis: retrospective study with follow-up of 8 to 15 years

**BACKGROUND** The aim of this study was to determine the incidence of tooth loss in patients with generalized aggressive periodontitis (GAgP) during supportive periodontal therapy (SPT), identify tooth loss risk factors, and quantify alveolar crest height changes on periapical X-ray during follow-up.

**METHODS** This retrospective study included 25 GAgP patients with 656 teeth after periodontal treatment (baseline). Data were gathered on sociodemographic, periodontal, and radiological variables at baseline and at the end of follow-up. Linear regression models were used to assess the association of risk factors with tooth loss.

**RESULTS** 28 teeth were extracted during SPT. The mean tooth loss per patient was 1.12 ±2.01 for all causes and 0.9 ±2.0 for PD after a mean follow-up of 10.9 ±2 yr. Clinical variables were improved at the end of follow-up with a mean reduction of −1 ±0.8 mm in probing depth (−0.7 to −1.3, 95% CI) and −0.6 ±0.9 mm in clinical attachment loss (−0.9 to −0.2, 95% CI). Mean alveolar bone crest loss at the end of follow-up was 0.36 ±0.56 mm (0.10–0.61, 95% CI). Smoking was associated tooth loss.

**DISCUSSION** In this series of GAgP patients undergoing SPT, the mean tooth loss was 1.12 ±2.01 per patient for total causes and 0.9 ±2.0 for periodontal causes after a mean follow-up of 10.9 yr. The annual tooth loss per patient, assuming a constant loss rate, was 0.10 ±0.18, similar to the annual losses published by Nibali et al. (2013) in their meta-analysis (0.14), and by Albandar et al. (1996) (0.08); Kamma and Baehni (2003) (0.21), and Baumer et al. (2011) (0.15). Waerhaug (1977), Saxen et al. (1986), and Graetz et al. (2011), who did not differentiate between generalized and localized AgP, also observed comparable losses of 0.14, 0.11, and 0.13, respectively. However, Dopico et al. (2016) recently described a higher loss rate for AgP patients not under strict SPT of 0.27 teeth per patient/year after a mean follow-up of 6.97 yr. The main cause of tooth loss in the present study was periodontal, although 72% of the participants lost no teeth due to periodontal causes. As in previous studies, a small proportion of the participants were responsible for most tooth losses (Baumer et al. 2011). Among the teeth lost during the follow-up, 82% were multirooted (12 molar and 6 maxillary premolars), consistent with previous reports in both AgP and ChP (Ng et al. 2011, Salvi et al. 2014). Thus, Ng et al. (2011) found an OR of 4.7 for the loss of multi-rooted versus single-rooted teeth in patients receiving SPT. Danewitz et al. (2006) attributed the greater loss of maxillary molars during SPT to their complex anatomy and higher prevalence of furcation defects.

**CONCLUSIONS** This retrospective study, along with the one by Graetz et al. (2011), is the longest follow-up of GAgP patients published to date. A low tooth loss rate was obtained in the patients who were on a regular supportive care program for a mean of almost 11 yr, while clinical periodontal variables improved and alveolar crest loss was minimal. Smoking was associated with tooth loss.

**Surgical removal of third molars and periodontal tissues of adjacent second molars**

**BACKGROUND** The aim of this study was to investigate the effect of mandibular 3rd molar (M3) removal on periodontal health of adjacent 2nd molars (M2). PPD and PAL have been described for primary outcome. As co-factors involved, gender, complications, two suture materials and two types of impaction were chosen as secondary outcomes.

**METHODS** 78 patients (49 female; mean age 16.0 ±2.0 yr) with 78 asymptomatic impacted mandibular M3 were included in this study. Plaque and gingival indices, PPD, and PAL were recorded prior and 6 mo after surgery. Impacted teeth were classified as either fully impacted (completely within the bone) or submucosal (fully covered by oral mucosa).

**RESULTS** Average baseline PPD was reduced from 3.3 mm to 2.6 mm after 6 mo (p <0.05). Average PAL was reduced from 3.0 to 2.6 mm (p <0.05). Preoperative PPD ≥4 mm at the distolingual and distobuccal sites was positively correlated with clinical improvement (PPD: p <0.05; PAL: p <0.05). The impaction class was also identified as positive cofactor for PPD (p 0.039), but not for PAL.

**CONCLUSIONS** Young patients may benefit from an early removal of mandibular M3, especially in the presence of certain cofactors.
Resin composite plus connective tissue graft to treat single maxillary gingival recession associated with non-carious cervical lesion: randomized clinical trial

Background The study aim was to evaluate clinically, the aesthetics and the patient-centered parameters after the treatment of gingival recession associated with noncarious cervical lesion by connective tissue graft alone or combined with a nano-filled resin composite restoration.

Methods 36 patients presenting one Miller Class I or II gingival recessions and B+ tooth cervical defect were included. The defects were treated by either connective tissue graft (CTG: control group; n = 18) or connective tissue graft plus resin composite restoration (CTG+RC: test group; n = 18).

Results The mean percentage of defect coverage was 82.16 ±16.1% for CTG and 73.84 ±19.2% for CTG+RC after 1 yr (p >0.05). Both groups presented statistically significant improvements in two aesthetic evaluations. The professional evaluation (MRES) was 7.44 ±2.3 for the CTG group and 7.52 ±2.27 for CTG+RC after 1 yr, with no significant difference between the groups. The 2 groups presented significant reduction of dentin sensitivity (DS); it decreased from 94.4% of the sites to 44.4% in the CTG group and from 88.8% to 5.5% in the CTG+RC group.

Conclusions CTG or CTG+RC can successfully treat gingival recession associated with B+ noncarious cervical lesion; but less sensitivity may be expected with the combined approach (NCT02423473). [Jw] Santamaria MP, Queiroz LA, Mathias IF, et al. J Clin Periodontol 2016;43(5):461–68

LABORATORY STUDIES

Laboratory / Implants

Peri-implantitis – onset and pattern of progression

Background The prevalence of peri-implantitis describing onset and progression of the disease are limited.

Methods Longitudinal assessments of peri-implant marginal bone levels were used to construct a statistical model with bone loss as the dependent variable. Onset of peri-implantitis was determined by evaluating the cumulative percentage of implants/patients presenting with estimated bone loss at each year following prosthesis delivery.

Results The analysis showed a nonlinear, accelerating pattern of bone loss at the affected implants. The onset of peri-implantitis occurred early, and 52% and 66% of implants presented with bone loss of >0.5 mm at yr 2 and 3 respectively. A total of 70% and 81% of subjects presented with ≥1 implants with bone loss of >0.5 mm at yr 2 and 3 respectively.

Conclusions Peri-implantitis progresses in a nonlinear, accelerating pattern, and for the majority of cases the onset occurs within 3 yr of function. [Gc]


Laboratory / Nonsurgical

Osteocytic sclerostin expression in alveolar bone in rats with diabetes mellitus and ligature-induced periodontitis

Background The study aim was to study sclerostin and TNF-α expression in rats with DM and periodontitis.

Methods 6–8 rats were divided into 3 groups in Seoul, Korea: control (C), periodontitis (P), and diabetes with periodontitis (DP). Diabetes was induced using streptozotocin 50 mg/kg. One wk later periodontitis was initialed using ligatures on the first molars. Control rats were sacrificed before ligature, P, and DP rats were sacrificed at d 3 and d 20 after ligature. Body weight and fasting glucose was measured daily. Mandibles were removed to examine at d 0, 3, and 20 and fixed to determine distance between CEJ and alveolar bone crest. Osteoid area distal to the first molar was evaluated for new bone formation. Osteoclasts were evaluated using TRAP assay and calculated per millimeter length of alveolar bone. Sclerostin, TNF-α, and IL-1β were evaluated using immunochemistry.

Results In P and DP groups, increased distance at d 3 and 20 after periodontitis compared to C. DP had increased distance at d 20 compared to group P. Osteoclasts in P and DP groups were significantly higher at d 3 and 20 compared to C. Reduced osteoid area was seen in both P and DP at d 3, however, DP maintained a decreased osteoid area at d 20 compared to group P which
increased 3.3-fold. Sclerostin increased in P and DP groups after d 3, however, in group P those levels decreased to control levels while DP group maintained those initial levels from d 3. TNF-α cells increased in both P and DP groups at d 3 and 20 with TNF-α levels being more in DP group.

**Discussion** DP group showed increased destruction at d 20 compared to P group, which may indicated that diabetes exacerbates bone loss and can contain sustained bone remodeling in periodontitis. Both P and DP groups had increased osteoclastic numbers after d 3, which gradually decreased. DM was shown to increase bone formation and resorption in the DP group, especially at d 20. Increased sclerostin expression with diabetes may also contribute to diminished bone formation. This study also showed that increased TNF-α and IL-1β levels are associated with decreased bone formation.

**Conclusions** Alveolar bone loss can be prolonged with suppressed bone formation with increased levels of IL-1β and TNF-α in rats with diabetes and periodontitis. Upregulated osteocytic sclerostin expression may play a role in suppressed bone formation.

---

**High glucose concentrations suppress the proliferation of human periodontal ligament stem cells and their differentiation into osteoblasts**

**Background** The study purpose was to investigate whether hyperglycemia affects periodontal tissue regeneration using human PDLSCs and high-glucose medium as a model of DM.

**Methods** PDLSCs were cultured from 3 females after extraction from the midroot and cultured for 5 to 10 d. After 24 hr, the medium was replaced with high-glucose medium (5.5, 8.0, 12.0, or 24.0 mM), and the cells were incubated for 1, 3, 5, and 7 d. Cell proliferation, osteoblastic differentiation, and pro-inflammatory cytokine expression were investigated. Statistical analysis was completed.

**Results** PDLSC proliferation was significantly decreased in high-glucose media. Cell viability was also decreased in high-glucose media; however, cell morphology was not markedly different in PDLSCs after culture in media containing 5.5 to 24.0 mM glucose. Calcium deposition significantly decreased with increasing glucose concentration. IL-6 mRNA levels were significantly increased after 3 d in 12.0 and 24.0 mM glucose. IL-8 mRNA expression was significantly increased after 3 and 7 d in 8.0, 12.0, and 24.0 mM glucose.

**Discussion** High glucose concentrations inhibit the proliferation, osteoblastic differentiation, and mineralization of human PDLSCs. They also inhibit PDL stem cells and bone marrow cells. This study had levels of glucose similar to that of a patient with uncontrolled diabetes. During periodontal tissue regeneration, the potential of PDLSCs to differentiate into osteoblasts is an essential factor in the success or failure of periodontal regenerative therapy. OCN is a protein marker of late osteoblastic differentiation. In this study, high levels of glucose inhibited OCN production. High levels of glucose also produced pro-inflammatory cytokines associated with periodontal breakdown.

**Conclusions** Hyperlipidemia inhibits proliferation and osteoblastic differentiation of PDLSCs that are intimately involved in periodontal tissue regeneration. [vss]

---

**Salivary antimicrobial defensins in pregnancy**

**Background** Susceptibility to and severity of gingival inflammation are increased during pregnancy. However, regulation of oral innate immune response, including antimicrobial peptides during pregnancy, is still unknown. In this study we have analysed salivary levels of human beta-defensin (hBD)-1, -2, -3, and human neutrophil peptide (HNP)-1 in pregnant women, and related those to their periodontal status.

**Methods** In this cohort study, 30 generally healthy, nonsmoking Caucasian women without periodontitis were followed at three time points during pregnancy and twice post-partum. The nonpregnant group consisted of 24 women who were examined three times in the following months. At each visit, periodontal status was recorded, and stimulated saliva samples were collected. Salivary estradiol, progesterone, and defensin concentrations were measured by ELISA assays.

**Results** After adjusting for visible plaque and gingival bleeding, reduced salivary concentrations of hBD-1, hBD-2, and HNP-1 were found especially during the third trimester; whereas hBD-3
Novel coating of surgical suture confers antimicrobial activity against *Porphyromonas gingivalis* and *Enterococcus faecalis*

**Background** The study aim was to show that K21, a quaternary ammonium compound coated on surgical sutures and dental floss, has dose-dependent antimicrobial activity for *Porphyromonas gingivalis* and *Enterococcus faecalis* in vitro.

**Methods** Chromic gut, polyester sutures, silk sutures, and nylon sutures, and the control of unwaxed dental floss were cut and placed on glass slides. *P. gingivalis* and *E. faecalis* were grown on blood agar, and sutures were placed with identical lengths and inoculated for 12 d to allow formation of colonies. The concentrations of K21 were 5%, 10%, 20%, and 25% for 30 min in the sutures. A figure shows a control that was the untreated silk with no zone of inhibition and a figure shows K21 treated silk with zones of bacterial inhibition.

**Results** K21 impregnated surgical sutures placed on blood agar showed significant inhibition of colony growth. Zones of inhibition were measured at 5 selected sites in millimeters. Nylon coated with K21 at 5%, 10%, 20%, and 25% concentrations resulted from 3–11 mm of inhibition. Polyester coated was most effective at low concentrations of 5%, 10%, and 20%, yielding 7.5, 8.3, and 10.5 mm zone of inhibition; however, 25% showed a drop-in inhibition. Silk showed significant reduction at 25% and chromic showed inhibition at 5% and 25% relative to the control. Unwaxed dental floss was the highest at 25% with >12 mm of inhibition. *E. faecalis* was susceptible to K21 on silk, chromic gut, and polyester sutures, and unwaxed dental floss, however, these zones were lower than *P. gingivalis*.

**Discussion** K21 is made of positively charged cationic ions. Bacteria are negatively charged and will attract K21 compound. This will attach to bacteria and cause the cytoplasmic membrane to leak killing bacteria. Although this is a laboratory strain, *P. gingivalis* can develop resistance to many antibiotics and can also transfer chromosomal and plasmid DNA and would provide an important route for transfer of resistance genes. *E. faecalis* behaves as both a commensal and opportunistic pathogen and in 15% of cases is involved in endocarditis. K21 at 5% to 25% could inhibit growth of both bacteria in this study. Antibiotics have a disadvantage of higher cost and insufficient bacterial spectrum.

**Conclusions** In vitro studies show that suture materials can be made to have antimicrobial effects when coated with K21. Polyester sutures were most effective due to increased absorbance of K21. More testing is needed in the future to confirm long-term efficacy.
significantly, displaying a 50% lower resistance to tearing in the CM compared to the CTG group.  

CONCLUSION Application of a CTG, sutured to a nonshedding hard surface, significantly increased flap resistance to tearing. [GC]


Soft tissue volume alterations after connective tissue grafting at teeth: the subepithelial autologous connective tissue graft versus a porcine collagen matrix – a pre-clinical volumetric analysis

BACKGROUND The aim of the study was to compare the usage of porcine collagen matrix (CM) for soft tissue thickening to subepithelial connective tissue graft (SCTG).

METHODS Soft tissue thickening was performed at the buccal aspects of the upper canines (SCTG and CM) in 8 beagle dogs. Impressions were taken and casts were optically scanned with a 3D scanner before augmentation (i1), after surgery (i2), after 1- (i3), 3- (i4), and 10-mo (i5). Aspects and measurements evaluated were the primary outcome variable: volume increase in mm³; secondary outcome variables were volume increase in percent and mean and maximum thickness increases in mm.

RESULTS 3D tissue measurements 10 mo after surgery revealed a nonsignificant difference between groups (SCTG: 11.36 mm³ _ 9.26 mm³; CM: 8.67 mm³ _ 13.67 mm³). Maximum soft tissue thickness increase (i1–i5) was 0.66 mm _ 0.29 mm (SCTG), and 0.79 mm _ 0.37 mm (CM) with no significant difference.

DISCUSSION This study had a randomized split mouth design that eliminated the influence of inter-individual differences between the test animals. In addition, the applied standardized surgical procedure and the randomized placement of the grafts ensured the greatest possible comparability between the experimental groups.

CONCLUSIONS 10 mo after soft tissue thickening, there was no statistical significant difference between CM and SCTG. CM is not inferior to the SCTG in terms of soft tissue volume and thickness increase. [SHA]


Ridge preservation after tooth extraction with buccal bone plate deficiency using tunnel structured β-tricalcium phosphate blocks: a 2-month histologic pilot study in beagle dog

BACKGROUND The purpose of the study was to evaluate and compare the efficacy of Tunnel β-tricalcium phosphate blocks for alveolar ridge preservation after tooth extraction with buccal bone deficiency.

METHODS Blocks were created with an inner diameter of 300 microns, an outer diameter of 500 microns, and a length of 1 mm. 6 male beagle dogs were premedicated with 0.5 mg/kg medetomidine hydrochloride. Buccal bone covering the root surface of the first premolar was removed using burs, and a 5× 5 mm defect was created with a bur. Then the premolar was extracted. Bilateral defects were designated randomly. Block was filled to the level of the adjacent bone in the test group. No bone grafts were placed on the control site. After 2 mo, dogs were euthanized and maxillae were removed. Histologic analysis was completed afterwards along with a statistical analysis.

RESULTS New bone formation was evident inside the block group while the control group showed larger amount of connective tissue. Also, the amount of bone marrow was greater at the control site.

DISCUSSION In the present study alveolar ridge preservation was accomplished using blocks, and immature new bone was observed in the buccal bone area even though no membrane was used. The material had a potential like that of conventional β-TCP and was replaced equally by newly formed bone. A 2 mo study was chosen because previous studies using similar models investigated the healing potential of biomaterials at 2 mo so that there could be a direct comparison with the other studies. But the histologic studies suggest that a longer healing period is necessary to regenerate mature bone.

CONCLUSIONS Tunnel β-TCP blocks significantly limited the absorption of the alveolar ridge after tooth extraction with deficient buccal bone compared to no graft procedures. [VSS]

Downregulation of proteinase-activated receptor-2, interleukin-17, and other proinflammatory genes by subantimicrobial doxycycline dose in a rat periodontitis model

**Background** Proteases, such as gingipains produced by *P. gingivalis*, can also activate the proteinase-activated receptor-2 (PAR2) expressed in oral epithelial and non-epithelial cells (neutrophils, gingival fibroblasts, osteoblasts). Studies have demonstrated that PAR2 is overexpressed in patients with PD and is associated with local production of pro-inflammatory mediators (tumor necrosis factor-α, TNF-α, IL-1β, and IL-17). Systemic therapies involving the modulation of the immune inflammatory host response (MHR) were suggested as complementary to conventional mechanical/chemical procedures in the treatment of periodontitis. Doxycycline is part of the tetracycline group that, in a subantimicrobial dose, can inhibit the activity of MMPs and thus reduce the degradation of macromolecules, such as collagen, fibronectin, and elastin in the periodontal tissue. The purpose of this study was to investigate for the first time the effect of subantimicrobial doxycycline dose (SDD) on PAR2 and IL-17 gene expression, in addition to IL-1β and TNF-α.

**Methods** Experimental periodontitis was induced by placing cotton ligatures around the cervix of the mandibular first molars in rats. Three groups included: (1) control group: no ligature-induced periodontitis and no treatment; (2) ligature group: ligature-induced periodontitis and placebo treatment (daily gavage administration of 0.9% NaCl solution); and (3) ligature + doxycycline group: ligature-induced periodontitis and SDD treatment (daily gavage administration of 5 mg/kg/d. At d 3, 10 animals were sacrificed and gingival tissue samples around the mandibular first molar were removed for gene expression analysis by reverse transcription-PCR. At d 15, 10 animals were sacrificed, and hemi mandibles were removed and used to evaluate the histologic and morphometric changes in the tissue. IL-1β, TNF-α, PAR2, and IL-17 was evaluated by the RT-PCR technique.

**Results** Day 3: experimental periodontitis group had higher expression of pro-inflammatory genes. The genes PAR2, IL-17, IL-1β, TNF-α, and IL-17 showed an upregulation in the ligature group when compared to the control group. Systemic administration of SDD reduced the levels of mRNA expression of PAR2, IL-17, TNF-α, and IL-1β in the gingival tissue compared to the ligature group, reaching values very close to those of the control group. SDD therapy reduced the total area of bone loss in the furcation region of first molars when compared to the control group. The SDD group also showed a lower amount of collagen degradation compared to the ligature group, indicating a protective effect of doxycycline.

**Conclusions** A positive effect of SDD was demonstrated that could downregulate the expression of proinflammatory genes related to development of periodontitis. As an effect of this regulation, bone resorption and collagen degradation in gingival tissues was reduced.

WSP Meeting Schedule

Saturday, December 2, 2017
OSP/WSP TEAM SESSION
Portland, OR

Saturday, December 2, 2017
WSP/CDHA SAN DIEGO TEAM SESSION
San Diego, CA

Friday - Sunday, April 6-8, 2018
66th ANNUAL SCIENTIFIC SESSION
San Diego, CA

To register for these, call 877-864-0263 or go to www.wsperio.org

Meetings of Interest

Thursday - Sunday, October 19-22, 2017
AMERICAN DENTAL ASSOCIATION ANNUAL MEETING
Atlanta, GA

Friday - Wednesday, November 24-29, 2017
GREATER NEW YORK DENTAL MEETING
New York, New York

Sunday, December 3, 2017
UCLA CONTINUING EDUCATION, PERIODONTAL THERAPY
Los Angeles, CA

Friday - Monday, January 19-22, 2018
LSU REVIEW OF PERIODONTOLOGY AND MOCK BOARD EXAM
New Orleans, LA

Friday - Saturday, January 26-27, 2018
USC INTERNATIONAL PERIODONTAL AND IMPLANT SYMPOSIUM
Los Angeles, CA

Wednesday - Saturday, February 28-March 3, 2018
ACADEMY OF OSSEOINTEGRATION ANNUAL MEETING
Los Angeles, CA

Friday - Sunday, May 18-20 2018
CALIFORNIA SOCIETY OF PERIODONTISTS ANNUAL MEETING
Yosemite, CA

Wednesday - Saturday, June 20-23, 2018
EUROPERIO 9
Amsterdam, The Netherlands