# BACTERIOPHAGES AS AN ALTERNATIVE TO ANTIBIOTICS IN PERIODONTOLOGY

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High frequency and the crescent of resistance of microorganisms to antibiotics and multiple complications in their use dictate the necessity of searching for alternative tools against periodontal infection.
By microbiological data studied the impact of bacteriophages on microflora of periodontal pockets in patients with periodontitis for justify their use as alternatives to antibiotics.
The sensitivity of microflora of 36 patients to the mix bacteriophages to 19 parodontopathogens determined by spot-testing and to antibiotics - by disk diffusion method. To identify parodontopatogens used PCR and spectrometry. ANOVA was used for statistical analysis.
Antimicrobial sensitivity to the bacteriophages was found in 26 patients out of 36. At the remaining 10 ($P \leq 0{,}001$) have a negative results, due to the lack parodontopatogens. Antimicrobial effectivity of antibiotics in 24 of 36 patients ranged from 8 to 50% ($P \leq 0{,}05$); at remaining 12 people ($p \leq 0.001$) there was identified a polyvalent resistance to all antibiotics.
Results showed a high frequency of resistance of the periodontal microflora to antibiotics whereas bacteriophages were 100% effective. Those facts permit consider the use of bacteriophages in Periodontology as an alternative to antibiotics. The results demonstrates high effectiveness against parodontopathogenic.

**ARE PERIODONTITIS AND CATARACT INDEPENDENTLY ASSOCIATED? A CROSS-SECTIONAL STUDY BASED ON A NATIONWIDE REPRESENTATIVE SAMPLE**

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Periodontitis and cataract have some common aspects, such as the majority of their established and putative risk factors (e.g. smoking, diabetes mellitus, alcohol, age, obesity) and, first and foremost, the key role of the oxidative damage in their pathogenesis. Furthermore, they are both associated with an increased systemic oxidative stress, which could represent a potential link between these two common diseases.
However, to the best of our knowledge, there are no currently available studies which examine the association between periodontitis and cataract.
The aim of this cross-sectional study is to evaluate, using KNHANES data, if there was in 2012 an association between periodontitis and cataract in a representative sample of the South Korean population.
All the statistical analyses considered the complex sampling design. Cataract was assessed by an ophthalmologist during a slit-lamp examination, while the periodontal status was assessed by a dentist using the Community Periodontal Index (CPI).
The preliminary odds ratio with 95% confidence interval (CI) was firstly obtained from a 2x2 contingency table, in order to evaluate the "crude" (unadjusted) association between periodontitis and cataract. Potential confounders, selected basing on external knowledge, were then separately tested for confounding according to the "change-in-estimate" strategy (cut-off: 10%). A multivariate logistic regression analysis was finally performed to examine the association between periodontitis and cataract allowing for the so identified multiple confounders. The odds ratio with 95% confidence intervals (CI) obtained from the multivariate logistic regression was reported.
A total of 5284 subjects over 19 years of age were examined. Participants affected by periodontitis were 1354 (25.62% of the total), whereas cataract patients were 2144 (40%).
In the unadjusted logistic regression, cataract and periodontitis resulted associated (OR= 3.02 - 95% CI: 2.47 - 3.70). Age, income, education, marital status, hypertension, diabetes, waist circumference and serum Vitamin D, lead and cadmium levels were identified to confound the association. The multivariate logistic regression analysis adjusted for all these confounders revealed no significant association between cataract and periodontitis (OR= 0.81 - 95% CI: 0.55 - 1.20).
Cataract is not independently associated to periodontitis. However the presence of a crude association has a clinical significance: patients affected by cataract (or periodontitis) have 3 times more the probability to be affected by periodontitis (or cataract) compared to the other patients.

# SHORT SLEEP DURATION IS INDIPENDETELY ASSOCIATED WITH PERIODONTITIS. A CROSS-SECTIONAL STUDY BASED ON A NATIONWIDE REPRESENTATIVE SAMPLE

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Short sleep duration has been independently linked to obesity, diabetes mellitus, hypertension, myocardial infarction, stroke and coronary artery disease. Both systemic inflammatory status and oxidative stress were found to lie on the causal pathway between the sleep duration and the relationship with these pathologies.
Due to the central role of the inflammation and of the oxidative damage in the pathogenesis of periodontitis and the capability of sleep duration of inducing them, a short sleep duration could be potentially associated with periodontitis.
Our hypothesis is that periodontitis and sleep duration are independently associated. However, to the best of our knowledge, there are no currently available studies which examine the association between periodontitis and sleep duration.
The aim of this cross-sectional study is to evaluate, using KNHANES data, if there was in 2012 an association between periodontitis and sleep duration in a representative sample of the South Korean population.
We performed all the statistical analyses considering the complex sampling design. Sleep duration was self-reported by participants while the periodontal status was assessed by a dentist using the Community Periodontal Index (CPI).
With the aim of evaluating the "crude" (unadjusted) association between periodontitis and sleep duration, we obtained the preliminary odds ratio with 95% confidence interval (CI) using a 2x2 contingency table.
We separately tested for confounding, according to the "change-in-estimate" strategy (cut-off: 10%), every potential confounder we selected basing on external knowledge. A multivariate logistic regression analysis was finally applied to examine the association between periodontitis and sleep duration, allowing for the so identified multiple confounders. The odds ratio with 95% confidence intervals (CI) obtained from the multivariate logistic regression was reported.
A total of 5944 subjects over 19 years of age were examined. Participants affected by periodontitis were 1380 (23.22% of the total).
In the unadjusted logistic regression, sleep duration and periodontitis resulted not associated (OR= 1.03 - 95% CI: 0.97 - 1.09). Age and Vitamin B2 intake were identified to confound the association. The multivariate logistic regression analysis adjusted for these confounders revealed a statistically significant inverse association between sleep duration and periodontitis (OR= 0.91 - 95% CI: 0.85 - 0.97).
In this nationally representative study a shorter sleep duration is independently associated with periodontitis. No other study investigating this relationship is available to compare our results.

# HIGH RISK POPULATION FOR MRONJ ONSET: PERIODONTAL CONDITION OF ONCOLOGIC AND HEMATOLOGIC PATIENTS UNDERGOING AN ORAL PREVENTIVE PROGRAM

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Antiresorptive agents such as bisphosphonates (BPs) effectively reduce skeletal-related events incidence in patients with metastatic bone cancer and multiple myeloma, thereby placing them at potential risk for developing Medication-Related Osteonecrosis of the Jaw (MRONJ). MRONJ onset and progression is due to BPs and many local risk factors, such as periodontal conditions. It is reported that 84% of MRONJ patients had periodontal disease, including 29% with advanced disease. Prevention of BPs side effects and MRONJ onset and progression is a challenge for medical team, considering Dentist, Dental Hygienists and Physician's involved in BPs prescription.
To evaluate the association between periodontal disease and MRONJ and to assess the impact of non surgical periodontal treatment on oral health in a population at risk for MRONJ onset.
In collaboration with the Hematology and Oncology Unit of the University Hospital of Ferrara, Dental Unit developed a preventive program focused on primary prevention of MRONJ onset and developed minimally invasive protocol to manage signs and symptoms in all cases of MRONJ. All participants underwent complete oral and radiographical examination and clinical parameters records (PD, BoP, PlI, mobile dentures examination). Then all parameters were merged to assign each patient a comprehensive risk evaluation score for MRONJ, "HIGH" or "LOW" score.
During 24 months observation time, 184 patients underwent to complete oral examination and treatment at Dental Unit. On average, patients received 9.7 drug treatment cycles (range 1–48). 115 patients, eligible for BPs and denosumab therapy (cohort 1), mean age of 67 years (range 33-92), received complete dental preventive treatments, including dental extraction. 69 patients, previously exposed to BPs and denosumab (cohort 2), mean age of 67 years (range 44-87), received only non surgical treatments. Both population showed same demographical and medical baseline characteristics. Individual risk for MRONJ was checked for each patients during first visit and after 3 months at least. For cohort 1, after 3 months 38.1% of the patients reduced their risk for MRONJ from "HIGH" to "LOW". For cohort 2, after 3 months only 12.2% of the patients reduced their risk for MRONJ from "HIGH" to "LOW". None patient changed his risk for MRONJ from "LOW" to "HIGH" during observation time. 24 patients developed MRONJ (3 cohort 1, 21 cohort 2).
It was observed a correlation between HIGH risk and estabilished MRONJ. The construction of the ROC Curve showed the test sensibility (96%).

MRONJ is a clinically significant adverse effect of antiresorptive agents. A mandatory preventive program for oral health, involving a multidisciplinary team, should be developed for all patients eligible for antiresorptive agents treatment. Although several studies did not found an association between periodontal parameters record and MRONJ onset, some evidence suggest that presence of oral infection could affect MRONJ risk. The proposed risk assessment method seems to be sensible and effective.

# IS IT POSSIBLE TO CONSIDER PERIODONTITIS AS ONE OF THE ADDITIONAL CARDIOVASCULAR RISK FACTORS?

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In the light of the Green Paper is relevant to examine whether chronic periodontitis influences, the cardiovascular system.
By indicators of systemic inflammation to determine the relationship between periodontitis and overall health.
4 groups patients: mild(MP)-25, moderate -34(Mod.P), severe periodontitis-30(SP), control(CG)-20. Alike markers of systemic inflammation determed: the levels of hs-CRP (immunoturbidimetric), IL-6(immunoassay) and lipid profile(using enzymatic kits). ANOVA was used for statistical analysis.
With increasing severity of periodontitis increased level of hs-CRP and IL-6. Compared with CG, at MP, Mod.P and SP, the level of hs-CRP increased by 66.7%,($p<0.05$), 95,2% ($p<0.01$) and 2.8 times($p<0.001$). Total cholesterol elevated at patients with SP vs. the CG 5,8±0,16mmol/l vs. 5,3±0,2mmol/l, ($p=0.04$), increased LDL at patients with SP 4,1±0,17 mmol/l vs. patients with Mod.P 3,7±0,17mmol/l,($p=0.05$) and CG 3,6±0,2mmol/l, ($p=0.03$). At patients with Mod.P level of APO A1 was decreased (166,0±5.33mg/dl) vs. the CG (185,2±5.83mg/dl).
Markers of systemic inflammation were increased at patients with periodontitis. The results allow to regard periodontitis as one of additional risk factors for cardiovascular disease. Elimination of infection in the periodontium - as a possible preventive measure obsessed with violations.

# DYNAMIC EVALUATION OF THE OPPORTUNITY TO TREAT PATIENTS AFFECTED BY ADVANCED PERIODONTITIS WITH IMPLANT THERAPY COMBINED TO THE USE OF AN ORAL PROBIOTIC (REUTERIN OS®) AND WITH A FOLLOW-UP OF MORE THAN 10 YEARS

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Evidence shows that osseointegrated implants have a higher prevalence of complications when placed in patients with signs and symptoms of advanced and complicated periodontal disease.
The maintenance of teeth with probing and bleeding in the presence of implants is an obvious risk for implants themselves, since the dental elements are natural reserves of periodontal bacteria.
In these situations, a possible approach could be the extraction of all the teeth and the subsequent placement of the implants.
In our clinical experience, however, we observed that in the presence of well-cooperative patients, who improved their oral hygiene, although their genetic predisposition, the implant positioning improves the concomitant clinical situation of natural teeth. These patients, having probing and mobility values that make uncertain the prognosis of several dental elements, are cleaned with an appropriate non-surgical therapy (phase-1 therapy) and then, if indicated, surgically operated to regenerate the attachment loss. After that, considering both the patient collaboration and the healing level of the treated defects, we proceed to gradually replace missing teeth with osseointegrated implants. This “slow approach” allowed us to observe how in these well-selected patients the implants are really valuable aids and they are able to gradually reduce the stabilized mobility.
Over time the implants deterioration is not different to that of patients not suffering from periodontal disease, also because the patients undergo programmed periodic checks and, in case of localized probing, they follow individualized maintenance therapies.
To assess the way to carry out complex implant-prosthetic rehabilitations in patients predisposed to suffer from periodontal disease, identifying positive and negative prognostic factors and identifying individualized maintenance strategies, such as the administration of probiotics.
It was presented to our attention a 39 years old patient with evident signs and symptoms of periodontal disease classified as advanced and complicated. In particular, the patient presented multiple periodontal defects, posterior mandibular edentulous, distal to the right, interleaved to the left. After a preliminary periodontal therapy, the patient was re-evaluated for all the time needed to obtain a collaboration in terms of oral hygiene and adhesion to an optimal retrieval system. Only after that, gradually and in a personalized manner, we proceeded to replace missing teeth with implants. Moreover, during the years after implants placement, we evaluated methods able to ensuring a long-term maintenance, higher than 10 years, of the performed therapies, such as the use of laser therapy (diode laser or photodynamic therapy), and especially the introduction of an innovative specific probiotic therapy consisting of an association of two strains of Lactobacillus reuteri DSM 17938 and ATCC PTA 5289 (Reuterin OS®), which were put as drops directly into the periodontal pockets during the periodontal therapy and then administered at home (2 tablets/die for 3 months).
Patient cooperation, adherence to a system of individualized reminders, the application of professional hygiene protocols combined with a specific probiotic therapy has allowed to monitor the progression of the disease.
In particular, the three-month treatment with the probiotic Reuterin OS® resulted in an average improvement of 1.34 mm in the periodontal pocket depth (PPD) and 1.53 mm in the clinical attachment level (CAL). The gingival bleeding (GBI) was improved by 2.8% and the plaque index (PI) by 20.8%.
The administration of an oral probiotic (Reuterin OS® drops and tablets) appears to be a safe, simple and effective clinical therapy for the treatment of periodontitis and peri-implantitis, which could be a useful adjunct to conventional non-surgical methods.

# C-REACTIVE PROTEIN SERUM CONCENTRATIONS BEFORE AND 3 MONTHS AFTER NON-SURGICAL PERIODONTAL TREATMENT

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Periodontitis (P) is a destructive inflammatory disease of the tooth supporting tissues that if left untreated leads to tooth loss. The C-reactive protein (CRP) is an acute phase reactant and a marker associated with cardiovascular risk. Several studies have shown that there are high concentrations of CRP in patients with P.
To assess and compare the serological profiles of patients affected by P before and 3 months after non-surgical periodontal treatment.
Patients affected by P from the Unit of Periodontology, Halitosis and Periodontal Medicine of the University Hospital of Pisa were screened for inclusion and subjects were invited to participate and sign the informed consent. Included subjects had a full-mouth periodontal examination including probing depth, gingival recession, plaque index and bleeding on probing. Successively all subjects underwent non-surgical periodontal treatment. Serum analyses, performed before and 3 months after the treatment, investigated the levels of CRP, IL-10, total cholesterol, HDL, triglycerides and fibrinogen. Information concerning smoking was also collected.
Ninety seven subjects were finally included and accepted to sign the informed consent; 58 females and 39 males, mean age 55 years (range 24-86, SD= 10). The study population consisted of 34.5% smokers, 47.9% nonsmokers and 17.6% former smokers. Three months after non-surgical periodontal treatment an amelioration of all clinical periodontal parameters was observed; CRP serum levels demonstrated a statistically significant reduction varying from 1.88 mg/L (SD=2.3) to 1.50 mg/L (SD= 2.38) (p=0.007) while IL-10, a potent anti-inflammatory cytokine, serum concentration incremented (p=0.001). No statistically significant differences were observed for the other hematochemical parameters.
A consistent reduction in CRP serum levels accompanied by an increment in IL-10 concentration was observed 3 months after non-surgical periodontal treatment. Scaling and root planing may moderate systemic inflammation. The impact on the risk of future systemic disease onset necessitates further investigations.

# IS IT POSSIBLE TO CONSIDER SURGICAL TREATMENT OF PERIODONTITIS AS A METHOD OF POSITIVE INFLUENCE ON VASCULAR BLOOD FLOW IN GREAT VESSELS?

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According to Green Paper the local infection in periodontium may affect the condition of the great vessels and is one of the risk factors of atherosclerosis.
To clarify if surgical treatment of local infection in periodontium can improve the condition of local and major vessels.
2 groups of patients with periodontitis and atherosclerosis of the brachiocephalic artery(BCA). 1st group (18 people)–a conservative treatment(CAT). 2nd (17 persons)–CAT + surgical treatment. The density of capillaries in the periodontium were assessed by capillaroscopy; intactness of glycocalyx layer–by darkfield microscopy; elasticity of the BCA - by ultrasonic scanning. The results were evaluated before, 2 weeks and 6 months after treatment. Statistical analysis ANOVA.

In the 1st group after 6 months the density of capillaries was increased, but intactness of glycocalyx and the tone of BCA has not changed. In the 2nd group after 6 months tone of the BCA was improved(1-2% $p \leq 0.05$), thickness of a damaged glycocalyx was decreased in the range of 0.30μm±0.5μm ($p \leq 0.001$). The density of capillaries progressively increased.
Surgical treatment of periodontitis restores the endothelial glycocalyx, improves tone of the BCA and recovers the periodontal microcirculation.

# CORONALLY ADVANCED FLAP VERSUS TUNNEL TECHNIQUE TO COVER GINGIVAL RECESSIONS: A RANDOMIZED, DOUBLE BLIND, MONO-CENTER PROSPECTIVE CLINICAL TRIAL

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Over the years, different periodontal surgery techniques have been introduced for the treatment of gingival recessions.
The aim of the present randomized clinical trial was to compare two surgical techniques to cover gingival recessions of Miller's class I and II using a connective tissue graft (CTG).
A total of 36 patients with 57 gingival recessions of Miller class I and II were recruited and randomly enrolled in a group of patients that underwent either the coronally advanced flap (CAF) or the modified microsurgical tunnel technique (MMTT). In both techniques a CTG was applied. In addition to clinical measurements, impressions were taken and digitally scanned to evaluate 3-dimensionally the quantitative changes of soft tissue in the operative region. Clinical evaluations were performed after 3, 6 and 12 months.
After a period of 12 months, significant differences were not found between the 2 groups. Root coverage was 98.1% for CAF and 96.4% for MMTT. The evaluation of the esthetic outcome using RES showed good results in both groups and was in accordance with patient satisfaction. There was no significant difference in evaluation of volumetric changes and gained keratinized tissue.
The CAF and MMTT associated with CTG are equally successful to cover gingival recessions of Miller class I and II with high esthetic results. All patients consented of willing a further periodontal surgery in other sites of the mouth if needed.

# OSSEOUS RESECTIVE SURGERY WITH AND WITHOUT FIBRE RETENTION TECHNIQUE IN THE TREATMENT OF SHALLOW INTRABONY DEFECTS: 3-YEARS ANALYSIS OF SOFT TISSUE RE-GROWTH

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Soft-tissue healing following osseous resective surgery is a critical issue in periodontal therapy. In fact, variations in gingival margin position, time necessary for complete healing and soft-tissue stability are important factors, especially when prosthetic treatment is scheduled. Heterogeneity among the surgical procedures may explain, at least in part, the variability in terms of amount of soft-tissue rebound following surgery.

The aim of this longitudinal observational study was to compare the soft-tissue re-growth after two different techniques for osseous resective surgery: the patients were selected 3 years before for a split-mouth clinical trial aimed to compare the clinical effectiveness of Apically Positioned Flap with Fibre Retention Osseous Resective Surgery (FibReORS) versus Osseous Resective Surgery (ORS) in the treatment of periodontal pockets associated with intrabony defects ≤3 mm at posterior natural teeth.

Twenty-six posterior sextants requiring osseous resective surgery were selected in 13 chronic periodontitis patients: 13 sextants were randomly assigned to ORS and 13 to FibReORS. Patients were recalled at 36 months postoperatively to assess clinical parameters. Clinical evaluation of probing depth (PD), gingival recession, clinical attachment level and quantity of keratinized tissue were recorded by an experienced and calibrated examiner. They were compared with 12-month records which were collected by the same clinician.

At 12-month examination PD changes did not significantly differ between the experimental groups. At 36 month examination PD values significantly increased for both groups, but remained in a physiological range. At 12 months ORS group showed significantly ($p < 0.001$) greater Recession and Clinical Attachment Level. At 36 months the Clinical Attachment Level remained stable for both groups. Recession values decreased, without a significant difference between the test and the control sextants. The amount of keratinized tissue significantly increased in both groups.

After 3 years mean PD values increased when compared to 12-month values but remained physiological, so both techniques demonstrate to be effective in maintaining a periodontal health in the long term. The creeping of soft tissues continues along the time, as discussed by Kaldahl in 1996, but the differences between the 2 groups decreased in terms of recession. The amount of keratinized tissue augmented, sign of periodontal stability and soft tissue health.

# THE REDOX PROPERTIES CHANGES OF PERIODONTAL TISSUES IN PATIENTS WITH GENERALIZED PERIODONTITIS USING DIFFERENT SURGICAL TECHNIQUES

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One of the main indicators of methabolic regulation system (MRS) of redox homeostasis in tissues and biological fluids became to be oxidative and reductive properties, that can be assessed with help of relation of thiols and disulphides (SH/SS) and according to relation of oxidative and reductive nicotinamide coenzymes (NAD/NADH).
To investigate the redox properties changes of periodontal tissues in patients with GP during usage of different surgical techniques.
Into study 80 patients (age 28-60) with GP were included after clinical and X-ray investigation. Oral liquid (OL) and gingival fluid (GF)were investigated to determine the redox status according to SH/SS and NAD/NADH relation in different terms: before treatment, 14 days postop, 3, 6, 12 months postop. Patients were divided into 4 main groups:
I group – proposed modification of flap operation including principles MIST, M-MIST (Cortellini P., Tonetti M. 2007, 2009) that was applied before pre-surgical tissue preparation including diode laser curettage (DLC) and EMD application during operation;
II group – Modified Widman flap (MWF) in combination with DLC;
III group - MWF in combination with EMD;
IV group – Open Flap Debridement (OFD).
Periodontal status: PPD= 5-10 mm, 2-6 intraosseous pockets of different anatomy per sextant, PMA-58,4%, BOP=87,7%, CAL- 8,7 mm, GR -1,7 mm. In OL and GF the content of SH/SH was provided by chemical reaction with Elman reagent by creation of tionitrophenol anion (TNPA). NAD/NADH coenzymes in OL was provided in ethanol extracts of OL with spectrometry during NADH formation in presence of enzymes with $\lambda$=340 nm.
The initial SH/SS relation in OL and GF was 9,6±0,3 and 9,0±0,8 respectively comparing to control - 0,7±0,01 and 2,5±0,04 respectively, revealed reduction of oxidative reactions of SS in OL in 14 times and in GF in 4 times. The initial NAD/NADH in OL - 0,289±0,01 comparing to control range - 0,81±0,03 was reduced in 3 times ($P<0,05$) showing reduction of oxidative properties in OL.
The presurgical tissue preparation in I group revealed reduction of SH/SS relation in OL - 1,3±0,03 and GF - 3,0±0,12 7,4 and 3 times respectively ($P<0,05$) comparing to initial range.
The same changes were observed in NAD/NADH OL relation – 0,63±0,01($P<0,05$) showing increasing level of oxidation in 2,2 times.
14 days postop the range of indexed was deteriorated in all groups, only in I group SH/SS and NAD/NADH relation was reduced in 1,5 times ($P<0,05$) comparing to results obtained in II, III, IV groups. 3 months postop in all investigated groups the range of investigated indexes reached ranges of control group only in I and III groups there wasn`t reliable difference ($P>0,05$) with control group.
6 months postop in I group improvement of indexes was observed - SH/SS relation in OL – 0,89±0,04 and GF - 2,8±0,07and NAD/NADH OL - 0,975±0,02 ($P<0,05$), in III group the ranges stayed at the same level ($P>0,05$). In II and IV the results were deteriorated with getting the initial level rates.
12 months postop in I group SH/SS relation in OL – 1,1±0,03 and GF - 2,7±0,11and NAD/NADH OL - 0,62±0,02 ($P<0,05$), showing prevalence of oxidative processes. In II, III, IVgroups the deterioration in ranges ($P<0,05$) of main indexes observed revealing shift into acidosis.

The inicial redox status of periodontal tissues may influence on postoperative clinical results and their longterm maintenance. The complex surgical operative methodic with usage of preoperative tissue preparation, laser irradiation, modern operative techniques and EMD should be applied to correct and maintain redox properties of periodontal tissues and enhance clinical results in patients with GP.

# CORONALLY ADVANCED FLAP PLUS COLLAGEN MATRIX IN THE TREATMENT OF GINGIVAL RECESSIONS WITH MINIMUM AMOUNT OF KERATINIZED TISSUE: 1 YEAR RESULTS OF A CLINICAL STUDY

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Cornily advanced flap is a well-documented technique in conjunction when necessary with the addiction of autogenous connective tissue grafts or collagene matrix substitutes.
Aim of the present prospective study was to evaluate the clinical results of a root coverage procedure with coronally advanced flap (CAF) plus a collagen matrix in the treatment of gingival recessions with minimum amount of residual keratinized tissue ( 1-2mm ), when a connective tissue graft should be conventionally indicated.
22 patients (17 females and 5 males , age between 33 e 51 years) in good systemic conditions, presenting at least one gingival recession with 1 or 2 mm of residual keratinized tissue were enrolled.
After scaling , root planning and instructions to effective and non-traumatic oral hygiene maneuvers, patients underwent surgery.
29 recessions were treated. Preoperatively and one year after treatment recession (REC), probing depth (PD) and keratinized tissue amount (KT) were measured. The differences for all three parameters were statistically analyzed by means of a Student's T-test for coupled data. Furthermore the rate of root coverage compared to the initial recession (RC) and the rate of recessions that achieved complete root coverage (CRC) were calculated.

The changes in all three parameters were the following: REC from 2.97+/-0.85 to 0.21+/-0.41mm with a highly significant statistical difference, PD from 1.24+/-0.43 to 1.04+/-0.19mm with a significant difference, KT from 1.43+/-0.49 to 2.03+/-0.52mm with a highly significant difference. RC was 93%, while CRC 79.3 %.
The investigated surgical technique after one year of follow up was effective for achieving root coverage in gingival recessions conventionally showing indication for the use of an autogenous connective tissue graft.
Further studies with a longer observation period will be necessary to evaluate the long term stability of the reported results.

# POLYDIOXANONE-BASED SCAFFOLDS FOR BONE TISSUE ENGINEERING

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Since the commercialization of polydioxanone (PDS) as a biodegradable monofilament suture by Ethicon in 1981, the polymer has received only limited interest. The limitations of polylactide-co-glycolide (PLGA) coupled with the growing need for materials with enhanced features and the advent of new fabrication techniques such as electrospinning have revived interest for PDS in medical devices and tissue engineering. Electrospun PDS mats show comparable mechanical properties as the major structural components of native vascular extracellular matrix (ECM) i.e. collagen and elastin.
This new material associated with new production techniques allows the design of the next generation of scaffolds for tissue engineering for application in regenerating such tissues as arteries, peripheral nerve and bone.
In collaboration with the Polytechnic of Turin it was tested the ability to build a PDS-based three-dimensional scaffold with controlled internal pore pattern for the replacement of bone tissue. The need to obtain a scaffold with an appropriate volume has ruled out the possibility of using the electrospinning, technique, well described in the literature. It was decided to validate the thermally induced phase separation (TIPS). The TIPS method has been widely used in recent years because of its potential to produce highly porous scaffolds with interconnected pore morphology. The scaffold architecture can be closely controlled by adjusting the process parameters, including polymer type and concentration, solvent composition, quenching temperature and time, and incorporation of inorganic particles.

The first prototyping phase resulted in the development of optimal concentrations of 1.1.1.3.3.3-Hexafluoro-2-propanol (HFP) in PDS and appropriate operational protocol. The Attenuated Total Reflectance Fourier Transform Infrared Spectra (ATR-FTIR) were performed and the images with a scanning electron microscope (SEM) were collected.

The samples obtained have adequate internal porosity with a pattern of pores in the longitudinal direction and good interconnection between them. The pore size was on average greater than 200μm. The internal porosity decreases by increasing the solvent concentration used. As the internal porosity also the mechanical characteristics vary according to the solvent concentrations. Based on the results of characterizations, the best concentration was 10% (wt / v).
This study yields promising results in producing a PDS-based porous scaffold with pore size range and pore morphology to potentially sustain three-dimensional growth of cells and guide new bone tissue formation. Mechanical and cellular testings are needed to validate the present results.

# SOFT TISSUE HEALING WITH A NEW XENOGENIC COLLAGEN MATRIX IN POST-EXTRACTIVE SOCKET SEALING PROCEDURES: PRELIMINARY RESULTS OF A PROSPECTIVE COHORT STUDY

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The recent introduction of xenogenic collagen matrixes further expanded the clinical alternatives in the management of soft tissues healing during pre-implant or peri-implant regenerative procedures.
The aim of this prospective cohort study is to test the performance of a new xenogenic collagen matrix (Mucoderm®, Botiss Dental, Germany) as a socket sealing material, to allow second-intention healing of post-extractive sockets filled with a xenogenic bone substitute or with an immediate submerged implant.
10 patients (4 males and 6 females - mean age: 53.2 years) were recruited, presenting with a single-rooted tooth scheduled for extraction, because of unsalvageable endo-perio lesions or vertical root fractures. After atraumatic tooth removal, the post-extractive alveolus received either a socket preservation procedure or an immediate submerged implant. Demineralized bovine bone mineral integrated in a 10% collagen matrix (Bio-Oss Collagen®, Geistlich Pharma, Switzerland) was used as a socket preservation material or to fill the gap between the implant surface and the bony walls of the alveolus. In both cases, the gingival margins of the alveolus were sealed with a xenogenic collagen matrix (Mucoderm®, Botiss Dental, Germany). Through 5/0 monofilament sutures, the matrix was gently stabilized subperiosteally under the palatal and buccal gingival margins of the socket for 2/3 of its surface, whether 1/3 remained exposed for second intention healing. In such a way the submerged surface of the matrix received vascular support from the bone crest and the periosteum, whether the exposed third of the matrix received no direct support from the oral cavity and from the underlying implant/xenograft. The following parameters were evaluated: a) exposed surface of the matrix at the end of surgery (T0); b) soft tissue healing at 1, 4, 6, and 8 weeks from surgery (T1-4); c) aesthetic performance provided by the socket sealing material, quantified deriving the colorimetric score ΔE between the regenerated site and the surrounding gingiva, 8 weeks after surgery (T4); d) histological aspect of gingiva samples, harvested 20 weeks after surgery (T5) from the regenerated area.
a) the mean postoperative exposure area of the matrix was 26,25 mm2 (14,2 to 38,84 mm2); b) 8 weeks after surgery (T4), full wound closure was achieved in 9 out of 10 sites with healthy keratinized tissue. A single patient (#3) did not achieve full wound closure at T4, starting from the highest postoperative matrix exposure rate of the cohort (38,84 mm2); c) the mean colorimetric score ΔE between the regenerated site and the surrounding gingiva at T4 was 3,76 (3 to 6,55). Seven out of 10 patients reported an excellent aesthetic integration of the matrix (ΔE score < 3,7). Two patients reported an acceptable integration of the matrix (ΔE = 3,95 and 4,28) and only a single patient (#3) reported a limited aesthetic result (ΔE=6,55) at T4; d) the histological evaluation of gingiva samples at T5 reveled the presence of healthy keratinized gingival tissue, with no signs of aberrations or anomalies.
Preliminary results from this study suggest that this new xenogenic porcine-derived collagen matrix could represent a valuable alternative to allow second intention healing of post-extractive sockets filled with a xenogenic bone substitute or with an immediate submerged implant. Further investigations are required to assess what extent of postoperative matrix exposure allows uneventful soft tissue healing with full wound closure, adequate keratinization and high aesthetic performances.

**GBR-VISTA: A NEW MINIMALLY INVASIVE TECHNIQUE FOR MANAGEMENT OF BUCCAL COLLAPSE AND SOFT-TISSUE RECESSION AFTER IMMEDIATE IMPLANT IN ESTHETIC ZONE: A CASE REPORT**

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**OBJECTIVE**: This study aimed to perform a new minimally invasive technique of periodontal plastic surgery able to correct the bone defects affecting the buccal collapse and soft-tissue recession after immediate implant in esthetic zone. With regards to soft-tissue deficiencies at implants, several procedures are available, but great heterogeneity among studies does not allow drawing conclusions at this time. Furthermore, in periodontal plastic surgery there is not experience and scientific evidence on peri-implant GBR.
**MATERIALS AND METHODS**: A patient, 7 years after immediate implant with mesial-distal and buccal bone graft in site1.1, showed a collapse of the buccal plate and a vestibular soft-tissue recession. A first surgery was performed by VISTA Technique (Vestibular Incision Subperiosteal Tunnel Access), modified, to allow an adequate blood supply to thin marginal tissue and a GBR with equine bone graft welded to a collagen dermal matrix by fibrin sealant. The dermal matrix guided the correct placement of the combined graft inside the tunnel. After 6 months, was performed a second surgery of CTG by VISTA approach. Clinical and radiographic (CBCT) measurements were made before-after surgery, at 6 months and at 1 year.
**RESULTS**: *Baseline*: Soft-tissue recession -1.5 mm, buccal bone thickness at implant 0 mm. An intra-oral digital radiography showed the maintenance of mesial-distal bone. *First Surgery*: The control to 7 days showed the coverage of recession and the regular blood supply of marginal soft-tissue. A CBCT verifyed the thickness of the bone graft between the threads 1-2, 3-4, 5-6 of implant. The measurements were 2.42, 3.15, 3.15 mm with average of 2.91 mm. At 6 months the recession was partially covered by soft-tissue not keratinized. *Second Surgery*: After 6 months the marginal soft-tissue appeared more thick with coronal gain of +1.5 mm. One year after the first surgery the bone thickness at 1-2, 3-4, 5-6 threads were 2.08, 3.09, 3.09 mm. The mean change compared to GBR was -0.16 mm. The mean horizontal gain compared to baseline was +2.75 mm.
**CONCLUSION**: This study introduces a new, more complete approach to treatment of soft-tissue deficiencies at implants in esthetic zone. The GBR-VISTA technique seems to be able to correct the horizontal bone loss affecting the buccal collapse and the mucosal recession. Wider applications will however be necessary, such as randomized controlled trials, with follow-up long-term, before coming to any conclusion.

**KEY WORDS**: dental implant; buccal collapse; implant recession; fibrin sealant; GBR

# WHICH IS THE BEST ANTIBIOTIC PROPHYLAXIS PROTOCOL TO PREVENT EARLY FAILURES AT DENTAL IMPLANT PLACEMENT? A SYSTEMATIC REVIEW AND BAYESIAN NETWORK META-ANALYSIS

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Even if there is a moderate quality of evidence supporting the use of antibiotics at dental implant placement to prevent early failures (Cochrane 2013), it remains unclear which is the best antibiotic prophylaxis protocol among those proposed.
This systematic review of RCTs with Bayesian Network Meta-analysis aims to answer to the following question:
"In patients undergoing dental implant placement, which is the best antibiotic prophylaxis protocol to prevent implant failures?"
This abstract is reported according to the "PRISMA for Abstracts" guidelines.

Inclusion criteria:
(P) Any type of patients undergoing dental implant placement;
(I) Any type of antibiotic, pre-, intra- or post-operatively administered, or combination of these, in any dose and for any duration;
(C) Any possible comparison among the included antibiotic types and posologies, including placebo and no treatment;
(O) Early Implant failures;
(S) Only RCTs of at least 3 months follow-up and including at least 20 patients for each arm were considered for the inclusion in this systematic review. No studies have been excluded on the basis of language, date of publication or publication status.

The MEDLINE, SCOPUS, CENTRAL and Web of Knowledge electronic databases were searched in duplicate for RCTs on this topic up to and including 19th February 2015. The following journals were also hand-searched in duplicate: JCP, COIR, CIDRR, JOP, EJOI, JOMI. Additional relevant literature was identified using both hand-searching on reference lists within published systematic reviews and included studies, and screenings of ClinicalTrials, OpenSIGLE and NTIS.

The screening of eligible studies and their inclusion, the assessment of the risk of bias of the trials (with ROB tool from the Cochrane Collaboration) and the data extraction were all conducted in duplicate and independently by two review authors.

We conducted a Bayesian Network Meta-Analyses to compare all antibiotic prophylaxis protocols simultaneously for the primary outcome (early implant failures), using the Markov chain Monte Carlo method with WinBUGS 14, as per the guidance from the NICE DSU. We calculated the odds ratios (OR) with 95% credible intervals (CrI) using a random-effects model. The probability that each of the antibiotic prophylaxis protocol included in the analysis was the Best was estimated.
Seven studies were included in the network meta-analysis, with a total of 1.242 participants. Six of these trials compared the use of one or more protocols of antibiotic prophylaxis with no treatment or treatment with a placebo. The remaining trial compared the use of different protocols, without the use of a no treatment/placebo group. The antibiotic type used in every trial was only amoxicillin: there were no trial looking at alternative antibiotics. Doses and timing of doses varied, although most protocols used a single dose taken just before the implant placement.

The antibiotic prophylaxis protocol with the highest probability of being the Best to prevent implant failures was the one which provides a single dose of 3 g of amoxicillin administered 1-h pre-operatively (Pr = 49%).
Even if the single dose of 2 g of amoxicillin administered 1-h pre-operatively is the most commonly used, it achieved only a probability of 3% to be the Best prophylaxis protocol.
Basing on current available RCTs, the use of 3 g of amoxicillin administered 1-h pre-operatively might be considered the gold standard antibiotic prophylaxis protocol at dental implant placement. However, the quality of evidence is still very low, and further studies with direct comparisons, with higher statistical power and testing also other antibiotic types are required to verify these results.
PROSPERO registration: CRD42015029708

# PATIENT-REPORTED OUTCOMES OF IMPLANT PLACEMENT PERFORMED CONCOMITANTLY WITH TRANSCRESTAL SINUS FLOOR ELEVATION OR ENTIRELY IN NATIVE BONE

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For patients receiving dental implants, the impact of conventional implant surgery and the related postoperative sequelae on daily life was shown to be minimal, limited to the first postoperative days (Al-Khabbaz et al. 2007, Seferli et al. 2014). In the posterior maxillary sextants, the insertion of implants of desired length and diameter may be limited by the dimensional alterations of the bone crest occurring following tooth loss (Eufinger et al. 1997, 1999, Pramstraller et al. 2011), partly due to the pneumatization of the maxillary sinus (Farina et al. 2011). Transcrestal maxillary sinus floor elevation (tSFE) represents an effective surgical option to vertically enhance the available bone in the edentulous posterior maxilla (Pjetursson & Lang 2014). tSFE, however, is not free of intra- and post-surgery complications, the most frequent being the perforation of the Schneiderian membrane and the occurrence of postoperative infection, respectively (Tan et al. 2008).In 2008, a procedure for tSFE was proposed (Trombelli et al. 2008). The major novelty resides in the fact that all manual and rotating instruments are used following a standardized sequence. Low incidence of intra- and post-surgical complications, low scores for patient pain/discomfort, limited postoperative assumption of analgesics and high propensity of patients to undergo the same surgery again if needed were reported for this technique (Trombelli et al. 2010, 2012, 2014, Franceschetti et al. 2014, 2015).

The present study was based on the hypothesis that tSFE does not increase the intra- and postoperative morbidity of implant surgery. To test this hypothesis, a multicenter retrospective case series was implemented to evaluate the patient-reported outcomes as well as the type and incidence of complications when implants are placed either concomitantly with tSFE or in native bone.

Data from the record charts of patients undergone implant placement for single-tooth rehabilitation in the posterior maxilla were retrospectively obtained from 4 clinical centers. Cases for tSFE group were included if they showed an extent of sinus lift ≥ 4 mm concomitantly to implant placement. Cases for N group were included when implant placement was performed entirely in native bone. Patient-reported outcomes had been assessed using 100-mm visual analogue scales (postoperative pain, VASpain) and visual rating scales (level of discomfort, VRSdiscomfort; willingness to undergo the same surgery, VRSwillingness). The dose of analgesics had been self-recorded.

A convenience sample of 14 patients and 17 patients (contributing with one implant site each) treated with tSFE and N, respectively, was obtained for the present study. Membrane perforation occurred in 1 tSFE case, without compromising the completion of the procedure. VASpain remained low (<12) in both groups. A tendency of VASpain to decrease with time was observed in both groups. The Area Under the Curve for VASpain (AUCpain), indicating the level of pain experience through the first week following surgery, was 18.0 (IR: 8.5 – 85.0) and 11.5 (IR: 4.5 – 18.5) in tSFE and N groups, respectively, with no significant inter-group differences (p= 0.084). The dose of analgesics was similarly low between groups. No significant inter-group difference in VRSdiscomfort and VRSwillingness was observed.

Implant placement performed either concomitantly with tSFE (according to Trombelli et al. 2009) or entirely in native bone are associated with limited incidence of complications, low postoperative pain and medication and are both well tolerated.

# INFLUENCE ON BONE STRESS DISTRIBUTION OF NUMBER OF IMPLANTS, CROWN HEIGHT AND IMPLANT LENGTH FOR 3-UNIT BRIDGES IN THE POSTERIOR MANDIBLE: A 3D FINITE ELEMENT ANALYSIS

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Bone volume reduction caused by bone resorption could be a critical limitation for placing dental implants, particularly in the posterior section of the mandible.
Short dental implants' placement was introduced alternatively to surgical bone augmentation procedures. Recent studies indicated that in short and medium term short implants could present survival and success rates similar to conventional implants. However their biomechanical efficiency is controversial also because higher crowns may be necessary to compensate the bone resorption, leading to a less suitable crown-to-implant ratio.
The aim of this study was to evaluate the stress transmitted to surrounding bone by different configurations of number of implants, implant length and crown height in a three-unit bridge positioned in the posterior mandible by means of finite element analysis.
The 3D geometry of the edentulous mandible was reconstructed from computerized tomography (CT) scans. Bone material elastic properties were assigned to each tetrahedral element based on the Grey Value. The implants' meshes were placed in second premolar and second molar position for the two implants configurations and also in first molar position for the three implants configurations. A superstructure representing a porcelain three unit bridge was built using beam elements for each configuration. Six different implant configurations were compared: LS2) two 4mm wide x 11mm long implants with 8mm high crowns; LS3) three 4 mm wide x 11mm long implants with 8mm high crowns SS2) two 4mm wide x 6mm long implants with 8mm high crowns; SS3) three 4mm wide x 6mm long implants with 8mm high crowns; SL2) two 4 mm wide x 6 mm long implants with 13 mm high crowns; SL3) three 4 mm wide x 6 mm long implants with 13 mm high crowns. A 200 N axial and 45° oblique loads were applied to each crown. For each configuration the effect of both loading scenarios was evaluated in terms of state of stress in the bone-implant interface. (Von Mises stress, maximum and minimum principal stresses)
In all configurations the stress was more concentrated in the cervical area of the peri-implant bone but especially under oblique load. Under oblique load it was several times higher than under axial load, particularly the maximum principal stress was from 15 to 35 times higher. Under oblique load the maximum peri-implant stress was found in the SL2 configuration while the minimum peri-implant stress was found in the LS3 configuration. The increase of stress parameters values in SS configurations respect to respective LS configurations was on average of the 15%. The average increase of stress values in SL configurations respect to SS configuration was about the 42% under tilted load. Configurations with 2 implants were recorded to undergo the 31% more stress on average than the respective 3 implants configurations.
Crown height, implant number and implant length seem to be all influencing factors on implant bone stress, however the augmentation of crown height seems to have a greater effect than the reduction of implant length. Even if the stress observed in all configurations was within a physiological range, a three-unit bridge with 13 mm long crowns supported by two short implants may be biomechanically hazardous in the presence of horizontal forces, and the addition of another short implant or increase of bone volume may be suggested to dissipate the stress at bone-implant interface. The use of short dental implants to support a three unit bridge in the posterior mandible can be considered a potential alternative to standard length implants, but crown height and lateral forces have to be carefully analyzed in every patient.

## Hyperhydrophilicity of microstructured implant surfaces affects human osteoblastic cells adhesion: A study with Focused Ion Beam microscopy

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The aim of this study was to investigate the response of human osteoblastic cells to microstructured titanium surfaces with normal or increased hydrophilicity. The study focused on the evaluation of cell morphology and adhesion on surfaces by using Scanning Electron Microscopy (SEM) with a Focused Ion Beam (FIB).

Sandblasted and acid-etched titanium discs with normal wettability or hyperhydrophilic were characterized by Raman spectroscopy. Protein adsorption on surfaces was studied through a Bradford assay. Subsequently, human osteoblastic cells (hOB) were seeded on surfaces, and the growth monitored through a chemiluminescence assay. Cell adhesion and morphology were investigated by scanning electron microscopy (SEM), associated with cutting of the specimens with a gallium focused ions beam (FIB).

The hyperhydrophilic surface was characterized by an increase of cell proliferation and a different pattern of cell adhesion. The FIB analysis showed that cells on normal wettability microstructured surfaces adhere preferentially to the surface peaks. On hyperhydrophilic surfaces a closer adhesion of the entire cell body to the peaks and valleys was evident. Cells seems to be thinner and spread on the entire surface of the sample.

In conclusion, these data show that the hyperhydrophilic surface influences osteoblasts behavior, in particular by eliciting a higher cell adhesion and a consequentely a different cell morphology.

# COMPARATIVE EVALUATION OF TWO DIFFERENT DIODE LASER WAVELENGTHS WITH AND WITHOUT PHOTOSENSITIZATION FOR SUPPRESSING BACTERIAL COLONIZATION ON DENTAL IMPLANTS SURFACES. EX-VIVO STUDY

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Peri-implant disease is now an important topic in the dental implant literature. Therapeutic use of the diode laser has shown promising results in management of peri-imlantitis. Photodynamic therapy (PDT) is based on the application of photosensitive dyes activated by light, with a specific wavelengths in order to destroy bacteria. It usually includes three basic elements: low level diode laser, nontoxic photosensitizer, and oxygen. When activated by light, the photosensitizer produces a reactive singlet oxygen, which in turn, causes cell death.

The aim of this ex-vivo study is to evaluate the efficacy of diode laser, used at 2 different wavelengths, with or without the aid of indocyanine green photosensitization, in reducing colonization of S. sanguis, on smooth dental implant surfaces. In addition, we assessed the increase of temperature on the implants, after irradiation with the two diode lasers, under conditions that closely replicate those of the human body.
Twenty-two smooth surface sterile implants per group were placed into sterile porcine bone blocks. A standardized angular bony defect was created at the implant coronal bone surface. Defects were inoculated with 10 µL of S. sanguinis. Blocks were then incubated in a 5%CO2, 37 °C atmosphere for 24hours. The implants were then subjected to different treatment protocols: 810nmor 980nm laser, with or without PDT. We used 2 control groups, one non treated by laser, and one non treated but coated with indocyanine green dye, for a total of 6 groups. The laser fiber optic tip was placed into the defects for 60 seconds set at 1.0W continuous. We used an “up-and-down motion” to apply the laser to the angular defect. The treated bone- implant blocks were rinsed with triptic soy broth, and plated in a standard fashion. Colony forming units (CFU) were counted 48 hours after incubation.
The irradiation was then repeated without contamination, and initial temperatures were recorded with the aid of thermocouples monitoring the change in temperature until they cooled down to the initial values. The irradiation was repeated, at room temperature, and in a 37°C waterbath with the following settings: 0.6W, 0.8W, 1W continuous and pulsed.
Our study shows that both wavelengths minimize CFU counts. The use of PDT showed a modest increase in the decontamination effect, with the difference being more marked in the 810nmgroup. However, there was no statistically significant difference compared to non-PDT groups. A critical increase in temperature was never observed when the bone block was placed in a 37°C waterbath prior to laser application.
The use of diode lasers at 810 and 980nm, in implant surface decontamination is efficacious in this ex-vivo study regardless of the use of indocyanine green PDT and with no dangerous increase of temperature.

# IN VIVO QUANTIFICATION OF BIOFILM STRUCTURE ON TITANIUM IMPLANT SURFACES BY THE NOVEL COMPUTER PROGRAM COMSTAT

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Titanium is used as the principal component of dental implants available with various surface characteristics. Studies demonstrate that rough surfaces increase bone-to-implant contact. In the contrast, the risk of peri-implantitis of these implants is higher than the smooth surfaces.
This is due to the implant surface being exposed to the oral cavity (transmucosal portion) that is immediately covered by the salivary pellicle and colonized by microorganisms (biofilm formation).
For this reason, a large number of works studying different implant surface properties are now available.
The aim of the present study is to investigate in vivo, from a quantitative point of view, the oral biofilm (BF) formation on three different implant titanium surfaces to establish the best one in terms of reduction of bacterial adhesion.
Three students aged between 21-25 years with excellent oral and systematic health were recruited.
In vivo BF formation was studied on sandblasted (SB), laser-treated (LT) and machined (M) titanium disc surfaces, which were applied in their mouth on individual removable intraoral acrylic appliance worn for 4 days 24 h/day. Were evaluated Different BF parameters: Roughness coefficient (Ra), Average Thickness and Surface to Biovolume ratio were evaluated.
Images were obtained with Confocal Laser Scanning Microscope (CLSM), using two fluorescence probes: Acridine Orange 0.1% (AO), which binds the nucleic acids and FilmTracer™ SYPRO® Ruby Biofilm Matrix Stain (Ruby), which stains the biofilm proteins. Images were elaborated with COMSTAT program, that is used to quantify the 3D structure of BF; those have been analysed by Matlab software (MathWorks®).
With AO at day 1, SB showed a higher median Ra 0.41±0.49 μm; LT=0.16±0.06 μm and M=0.15±0.06μm were quite similar. As regards the spatial size of BF (Average Thickness) was SB=26.99±12.98 μm, LT=33.88±4.26 μm and M=33.09±2.93 μm. The three-dimension BF's development are different comparing the three surfaces. The Surface to Biovolume was SB=2.41±2.00 μm2/μm3, LT=1.12±0.69 μm2/μm3 and M=1.01±0.2 μm2/μm3 . This value reflects what fraction of BF is actually exposed to the nutrient flow; in case of low nutrient concentration, this value would increase in order to optimize access to the limited nutrients.
At day 4, the BF distribution seemed to be quite uniform on all the specimens, Ra SB=0.09±0.1 μm, LT=0.10±0.08 μm, M=0.09±0.08 μm. Thickness showed no significant difference between SB=37.02±4.79 μm, LT=39.28±2.35 μm and M=39.08±2.93 μm. Surface to Biovolume SB=1.07±0.5 μm2/μm3, LT=0.90±0.1 μm2/μm3 and M 0.90±0.2 μm2/μm3.
Ruby, was used to evaluate the proteins of saliva (Albumin, Mucin), confirmed AO's results.
At day 1 all the BFs have similar spatial size but different Ra. The SB has a higher Ra value, that indicates major BF heterogeneity. Irregularities present on SB discs seem to be able to support the mass growth of BF material at higher peaks, thus causing a vertical growth; so it is seems to occupy more space than on the other substrate. The value, Surface to Biovolume, shows us what portion of BF is exposed to the nutrient flow, and how the BF adapts to the environment. SB shows a higher value of Surface to Biovolume than M and LT. This can be seen as a negative factor for the biofilm growth, showing that BF, on SB surfaces, has difficulties to reach the nutrient flow; that permits the bacterias to live. The surface treatments of dental implants influence the volume and the performance of BF, which can develop on the implant surface in case of fixture exposition to oral cavity. Quantitative experimental data may improve our understanding of microbial BF development.

**TREATMENT OF PERI-IMPLANTITIS USING AN AIR POLISHING DEVICE WITH ERYTHRITOL POWDER OR MECHANICAL ULTRASONIC AND CURET DEBRIDEMENT. TWO YEAR FOLLOW-UP OF A RANDOMIZED, CONTROLLED SPLIT MOUTH CLINICAL STUDY**

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Several studies focused on peri-implant disease treatment with conflicting results.
Biofilm removal plays a central role in the prevention and therapy of peri-implant diseases associated to microbial infections. Subgingival air polishing with micropowders has been shown to remove biofilms in shallow periodontal pockets and recently employed for peri-implant diseases.
The aim of this randomized, split mouth, controlled clinical study was to compare the clinical outcomes of the peri-implant treatment by an air-polishing device (APD) with a low abrasive erythritol and 0.3% chlorexidine powder and by ultrasonic peek tips and teflon curettes (UCT) in moderate peri-implantitis.
20 implants affected by peri-implantitis in 10 patients were enrolled in the study, submitted to an oral hygiene program (OHI) and randomly treated using either (1) APD with erythritol powder or (2) teflon curets and ultrasonic peek tips (UCT). Clinical parameters (Modified Gingival Index (MGI), Peri-implant Probing Depth (PPD), Clinical Attachment Level (CAL) and Mucosal Recession(MR)) were measured at baseline, 3 and 24 months after treatment. Primary clinical outcome was CAL. Time needed to complete a single site procedure was recorded. Data were statistically analyzed by Student t test ($\alpha<0.05$).Mean treatment time with APD was significantly shorter ($p<0.01$) then in UCT (3.5 vs 13.5 minutes/site). At the 3 months evaluation all clinical parameters improved significantly in both groups. APD vs UCT: ΔMGI -2.3 ±0.4 vs -1.9 ±0.6, ΔREC 1.5±0.7mm vs 1.3±0.5mm, CALgain 1.4±0.5mm vs 0.7±0.6mm ($p<0.05$), PPD -2.9±0.7mm vs -2.3±0.7 mm ($p<0.05$), without any significant variation at the 24 months follow-up (Table 1).

| TABLE 1 | APD | | | UCT | | | |
|---|---|---|---|---|---|---|---|
| (±SD) | baseline | 3 Months | 24 Months | baseline | 3 Months | 24 Months | p 0-3 months |
| Modified Gingival Index | 2,5 (0,52) | 0,2 (0,42) | 0,4 (0,51) | 2,4 (0,51) | 0,5 (0,52) | 0,8 (0,78) | 0,053 |
| Peri-implant Probing Depth | 5,5 (0,84) | 2,6 (0,51) | 2,7 (0,67) | 5,2 (0,63) | 2,9 (0,31) | 3,1 (0,31) | 0,037 |
| Marginal gingival recession | 0,5 (0,52) | 2 (0,47) | 1,7 (0,48) | 0,6 (0,51) | 1,9 (0,56) | 2 (0,47) | 0,23 |
| Clinical Attachment Level | 6 (0,81) | 4,6 (0,69) | 4,4 (0,84) | 5,8 (0,63) | 5,1 (0,31) | 5,1 (0,31) | 0,008 |

No adverse event was noted in any subject for the test or control treatment.
CONCLUSIONS: Air polishing with erythritol/chlorexidine seems to be a suitable alternative to the mechanical treatment with curets and ultrasonic plastic tips for moderate peri-implantitis in the medium follow-up period. Peri-implant treatment with APD was safe and was more time-efficient than mechanical traditional debridement.

# PERI-IMPLANT KERATINISED MUCOSA DIMENSIONS FROM HEALTH TO PERI-IMPLANT DISEASE STATUS: A 2-YEAR PROSPECTIVE PILOT STUDY

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The dimensions of the peri-implant mucosa may be considered as essential aspects of peri-implant soft tissue condition. When groups of individuals having sufficient or insufficient keratinised mucosa around implants were compared with regard to various clinical parameters, significantly favorable results were interpreted in the presence of keratinised mucosa. Implants with a compromised width of keratinised mucosa were found to be more susceptible to plaque accumulation, bleeding and mucosal recession. The presence of an adequate width of keratinised mucosa is suggested to be necessary to reduce the risk of mucosal recession and crestal bone loss around implants in the long-term. Also mucosal thickness has been reported to be an essential factor for the maintenance of implant success.

There is a scarcity of information on the long-term significance of keratinised mucosa dimensions on peri-implant condition, the purpose of this study is to assess the correlation of peri-implant mucosa dimensions with clinical parameters around single-tooth implants in 2 years period.
The subjects were selected from a patient population attending the Oral Implantology Department in Istanbul University for recall visits. The following inclusion criteria were considered:
1. All subjects had a single-tooth implant to substitute for mandibular first molars.
2. None of the implants had lost more than 0.5 mm marginal bone at the end of the 1st year of loading, as evidenced by panoramic radiographs taken immediately after implantation and at the 1st year of loading. Plaque index (PI), gingival index (GI) and probing depth (PD), width of keratinised mucosa (WKM), mucosal thickness (MT) and mucosal recession (MR) were detected around 116 single-tooth implants placed in 116 patients at the 1st and 3rd years of loading. The implants were categorised depending on WKM and MT as follows: WKM<2 mm (Group A), WKM ≥2 mm (Group B), MT≤1.5 mm (Group C) and MT>1.5 mm (Group D).
All 116 patients completed the investigation by attending each visit and no deviation from the study protocol occured. The survival rate was reported to be 100% for all implants at the end of the 3rd year of loading. PI, GI, PD, WKM and MR demonstrated significant changes at the 3rd year of loading comparing with the 1st year (P=0.051, P=0.006, P=0.000, P=0.000 and P=0.001 respectively). MT demonstrated no significant differences between 2 time points (P=0.158). Group A (WKM<2) exhibited significantly higher changes in GI (P=0.013), PD (P=0.000) and MR (P=0.002) at the 3rd year of loading.
Group C (MT≤ 1.5 mm) demonstrated significantly greater changes in GI (P=0.019), PD (P=0.041) and MR (P=0.046) at the 3rd year of loading. There was a significant increase in PD at the 3rd year of loading compared to the 1st year (Table 1). The PD values were significantly deeper in implants with narrow zones of keratinised mucosa and in implants with a thinner surrounding mucosa.

The dimensions of peri-implant mucosa affect clinical peri-implant parameters. Insufficient width of keratinised mucosa may lead to peri-implant pocket formation and mucosal recession. The presence of an adequate amount of keratinised mucosa may be considered as a prerequisite in the vicinity of implants. Actual dimensions of keratinised mucosa around an implant might be of predictive value for a possible future deterioration of peri-implant condition.

# SURGICAL APPROACHES FOR THE TREATMENT OF PERI-IMPLANTITIS. A ONE YEAR FOLLOW-UP CASE SERIES

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Peri-implant diseases are commonly associated with similar etiologic factors involved in destructive periodontitis. Despite the goal and the rationale of therapy are very similar, there are marked differences regarding predictability of treatment outcomes, mainly due to implant surface characteristics that may hamper successful decontamination. Although the ultimate goal of treatment is re-oseointegration of the exposed implant surface, resective surgical approaches have been also proposed.
The aim of this preliminary report is to compare two different surgical approaches in terms of clinical and patient related outcome variables.
Four patients attending the department of Periodontology of the Complutense University of Madrid presenting one implant each showing clear signs of peri-implantitis (Rx-bone loss, BOP and/or Suppuration) were included in the study. At baseline a peri-apical x-ray was performed and a periodontal chart was recorded to assess probing pocket depth (PPD), clinical attachment level (CAL) plaque index (PI), gingival index (GI) and bleeding on probing (BOP). Patients received a comprehensive cause-related therapy and were divided in group A reconstructive approach (collagen membrane + Deproteinized bovine bone mineral and submerged healing) and group B, resective approach (apically postioned flap plus implantoplasty). Patients were monitored monthly for the first 3 months and every 3months during the following year for periodontal supportive care. At one year clinical and radiological were re-assessed.
At baseline the patients in group A presented a PPD of 7.5 mm e 8 mm while patients in group B a resective approach presented a PD of 6 mm e 7 mm. In all cases implants displayed BOP and Supuration. At 1 year the group A showed a mean PPD reduction of 3mm whreasin group B the corresponding was 2.5mm at 1year. No mayor differences have been detected between the two groups in terms of patient related outcomes. Three of the four implants treated did not exhibited BOP at any site at 1 year.
Both surgical strategies demonstrated to provide a beneficial effect achieving a good end-point of therapy meant as marked reduction of PPD, absence of bleeding and most likely the arrest of the destructive process. The morphology of the defect, the biological understanding of the peri-implant wound healing and the aesthetic demand of the patient play an important role in the treatment decision and outcome.

## IMPLANTOPLASTY AND PLAQUE ACCUMULATION, A NOVEL IN SITU STUDY

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Similarly to periodontitis, perimplantitis is a disease correlated with the presence of oral biofilm (dental plaque). Implantoplasty has been proposed to make the implant surface less attractive for microorganisms; this procedure includes removing the threads, then smoothing and polishing the surface with rotary instruments. The efficacy of implantoplasty in association with resective surgery has already been observed in a clinical trial, but it is still not clear how surface modification influences plaque accumulation.
The main purpose of this study is to observe the effects of implantoplasty on the amount and structure of plaque adherent to the implant surface. An additional aim is to validate a novel in situ method for the evaluation of the interactions between oral biofilms and implant surfaces
Four identical implants, two treated with implantoplasty and two untreated (surface-etched, coated with nano-sized calcium-phosphate particles), were fixed on both lingual sides of a thermoformed retainer with half of their surface exposed. Two additional implants, one treated and one untreated, were fixed on the same retainer, then covered with a layer of impression material in order to simulate the subgingival environment. One volunteer wore the retainer for five days without interruptions excepting meal-time and daily oral care. Every 24 h standardized photographs of the implant surfaces were taken and the area covered by plaque was measured. After five days, all implant surfaces were processed and observed through scanning electron microscopy (SEM) and confocal laser-scanning microscopy (CLSM).
After five days, the surface covered by plaque was 4.06 time less for implant treated with implantoplasty than for untreated implant.
SEM and CLSM showed very different plaque structure depending on the surface treatment. Implantoplasty prevented the formation of mature biofilm structures, showing a prevalence of cocci embedded in extra-cellular matrix. Untreated surfaces showed mature, complex biofilm structures with wide morphological diversity expressing active replication and inter-species communication through pili. A similar difference was observed between the covered implant surfaces, however biofilms had smaller diversity being mostly composed by bacilli and filamentous microorganisms. The difference between smooth and untreated surfaces could therefore not be entirely explained by more effective debris removal from smooth implantoplasty surfaces.

Implantoplasty may be encouraged for the treatment of peri-implantitis since it reduces plaque adhesion and influences plaque structure in both aerobical and microaerophile environments. These data require confirmation through similar studies with larger samples.