Flapless surgery – which influence has the minimally invasive approach on periimplant soft tissue regeneration?

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Aim: The aim of our study was the comparative investigation of periimplant soft tissue regeneration following flapless and conventional flap surgery.

Materials and Methods: One month following extraction of all premolar teeth 2 implants were inserted in each mandibular quadrant in 12 minipigs. One quadrant was randomized to flapless insertion, while the other was chosen for flap surgery in each animal. Following 1, 2, 4 and 12 weeks of transmucosal implant healing, biopsies were retrieved from the periimplant soft tissue sample. Subjects were subjected to standard histology and a leukocyte count as well as pangenomic gene-expression analysis employing an IlluminaChip array.

Results: Employing the flapless insertion technique leukocyte influx in the peri-implant soft tissue was significantly smaller compared with open surgery until week 4 post-op. Pangenomic gene-expression analysis revealed significant overexpression of molecules associated with reactive oxygen species (ROS) detoxification and -epithelialization (e. g. Epidermal Growth Factor [EGF]) in the flapless group. In contrast, myofibroblast-differentiation and -activation associated gene transcripts were significantly enriched in the flap surgery group.

Conclusions: Reduced inflammation and improved detoxification during the early period of wound healing might cause enhanced reepithelialization and reduced fibrosis of the periimplant soft tissue following flapless surgery. Consequently, flapless surgery might improve the quality of the regenerated periimplant soft tissue resulting in an enhanced long-term stability of the dental implants.

Characterization of the biointegration of extracellular matrix-based scaffolds used for periimplant soft tissue augmentation

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Aim: Autogenous mucosa grafts from the hard palate are the gold standard for augmentation of periimplant fixed, keratinized gingiva. However, the amount of tissue, that can be harvested safely, is limited and morbidity of the palatal donor site is well described. Allogenous and xenogenous biomaterials were introduced as an alternative. Our study aimed at testing the biointegration of an allogenous, acellular dermal matrix (aADM) in the animal model.

Materials and Methods: Test membranes were implanted in the groin region in 20 Wistar rats. One side received an aADM, while the other was chosen for implantation of an autogenous dermis graft in each rat. Biopsies were obtained from the wound regions 7 and 14 days post-op. and subjected to an immunochemical (targets: macrophages-CD68, CD197, CD163; myofibroblasts-alpha smooth muscle actin; neovessels-CD105) and Western Blot (targets: vascular endothelial growth factor [VEGF]; transforming growth factor [TGF] beta 1) analysis.

Results: Proinflammatory M1-macrophages significantly (p = 0.002) enriched in the healing area of the aADMs, while regeneration promoting M2-macrophages dominated following transplantation of autogenous dermis. Furthermore, significantly (p = 0.032) myofibroblast enrichment, reduced vessel density, TGF beta1 overexpression (p = 0.042) and VEGF suppression (p = 0.001) were detectable in the healing area surrounding the aADMS.

Conclusions: aADMs might trigger fibrotic tissue rearrangement with myofibroblast-mediated contraction via perpetuation of inflammatory reactions. To prevent postoperative complications aADMS might not be used as an alternative to the autogenous gold standard.

A RCT evaluating a synthetic gel-membrane used in GBR around dental implants – 1- and 3-year results

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Objectives: The objective of this randomized, controlled clinical study was to test whether a synthetic bioreabsorbable polyethylene-glycol (PEG) hydrogel membrane could result in a similar clinical as well as radiographic outcome as a standard collagen membrane after a follow-up period of 3 years.

Materials and Methods: This clinical study enrolled 37 patients requiring implant treatment with an expected osseous defect in the posterior maxilla or mandible. Defects around implants were grafted with bovine bone mineral and randomly covered with either a collagen membrane (control group) or a PEG membrane (test group), which is applied as a liquid and gelates in situ. After a healing period of 6 months, surgical re-entry was performed and fixed partial dentures were inserted. Patients were examined clinically and radiographically after 12 and 36 months.

Results: All patients could be reexamined except one drop-out in the second year revealing a total number of 36. The implant survival rate at 3 years was 100 % for both groups. The periimplant tissues were healthy without any difference between the two groups. Compared to surgery the mean change in the distance between the first bone to implant contact to the transition point (i. e. rough implant surface to polished neck portion) at 1 year was 0.43 ± 0.56 mm (test) and 0.21 ± 0.36 mm (control) and 0.61 ± 0.89 mm (test) and 0.33 ± 0.64 mm (control) at 3 years. The respective differences between groups from the analysis of covariance models were 0.13 mm (year 1) and 0.31 mm (year 3). Neither the group difference at year 1 nor the one at year 3 was statistically significant.

Conclusion: The present PEG hydrogel was as successful as a standard collagen membrane in the treatment of bony dehiscence defects around dental implants after a follow-up period of 1 and 3 years.
Heat production during different ultrasonic and conventional osteotomy preparation for dental implants

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Objective: The aim of the present study was to evaluate the heat production by ultrasonic and conventional implant site preparation.

Material and Method: One conventional osteotome (Straumann, Basel, Switzerland) and two ultrasonic osteotomes (Mectron Medical Technology, Carasco, Italy; NSK, Tochigi, Japan) were evaluated. Temperature modifications in cortical and cancellous bone were measured in fresh equally tempered bovine ribs. Two thermocouples (TC 100, B+B thermal technology, Donaueschingen, Germany) were placed at a depth of 1.5 mm (cortical bone) and 7 mm (cancellous bone) respectively 1 mm around the future implant site. For every osteotomy system 10 measurements with and without pilot drilling with pressing forces of 5 N, 8 N, 15 N and 20 N respectively were recorded. Statistical analysis was performed using SPSS 17 for Windows (SPSS Inc., Chicago, USA).

Results: Maximum temperatures were 24.6 °C during conventional drilling, 31.9 °C using the Mectron system and 36.6 °C using the NSK system. All systems revealed a highly significant temperature rise (p < 0.01) for drillings with increased drill diameter without previous pilot drilling, but not if pilot drillings were conducted as recommended by the manufacturer. Increased pressing forces generated significantly higher temperatures (p < 0.01) during conventional drilling in both cortical and cancellous bone, whereas the heat production during ultrasonic processing was not affected. The critical value of 47 °C was never exceeded.

Conclusion: None of the tested osteotomes produced temperatures that are potentially harmful for the bone. However, the recommended pilot drillings should be applied in order to minimize the temperature rise during the implant site preparation with increased drill diameter.

Soft tissue expansion with self-filling osmotic tissue expanders prior to vertical ridge augmentation – a proof of principle study

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Objective: In patients with severely resorbed ridges, vertical bone augmentation is necessary for successful implant therapy. However, soft tissue deficiency may hamper primary wound closure and result in post-surgical graft exposition and loss of grafted bone. Soft tissue expansion (STE) by implantation of osmotic self-filling tissue expanders before reconstructive surgery is an effective method for generation of soft tissue, but has not been applied before vertical augmentation of edentulous ridges.

Methods: 24 tissue expanders were implanted in 12 patients requiring vertical bone augmentation. Augmentation with onlay grafts was carried out after 2 months of STE. 53 implants were placed 4–6 months after augmentation. Vertical bone gain was analysed with Cone beam CTs. Biopsies of regenerated bone were investigated with micro-computed tomography (μCT).

Results: At bone augmentation after STE, primary wound closure was easily achieved and the incidence of graft expositions was low (4 %). At implant placement, high vertical bone gain of 7.5+/−2.4 mm was found. μCT analysis of bone revealed a good ratio of bone volume/tissue volume (mean BV/TV = 0.1614+/−0.0582) and regular trabecular structures. All implants were osseointegrated and were successfully used for prosthetics.

Conclusions: The combination of STE and subsequent vertical augmentation provides high gain of well-structured bone for further successful implant therapy and is accompanied by minimal complications.

Effects of simultaneous bone augmentation on the prognosis of dental implants

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Objectives: The aim of this study was to investigate the effect of different bone augmentation techniques on the survival and complication rate of dental implants.

Methods: Within a prospective clinical study 958 implants were placed in 404 patients (mean age 58.18). In 304 cases of reduced bone width bone spreading (n = 217) with hand osteotomes, or bone splitting (n = 15), or guided bone regeneration (GBR, n = 72) combined with autogenous bone grafts were performed. 88 implants were placed in combination with simultaneous internal sinus floor elevation without using graft material. For 194 additional implants, several augmentation techniques were combined because of extended bone deficiencies. 372 conventionally placed implants served as controls. Implant failures and complications were recorded after a mean observation period of 2.1 years (min. 0.5 years; max. 6.9 years). Survival analyses were used to estimate survival curves for the implants and to isolate risk factors for implant failures and complications.

Results: A total of 20 implant failures were recorded, and 6 additional implants demonstrated major problems (bone loss, peri-implantitis). After 4 years the probability of survival without complication was 97.5 % for conventionally placed implants, and 96 % for implants placed in combination with a singular augmentation technique. If several augmentation techniques were combined in cases of advanced bone defects the probability decreased to 94 %. The differences between combined augmentation techniques and conventionally placed implants were significant (p = 0.004). However, the effects of other variables like age, sex, location (mandible/maxilla, anterior/posterior) were not significant.

Conclusions: If several augmentation techniques are combined, a slightly decreased probability of implant survival has to be considered. For a detailed risk factor analysis of specific combinations of augmentation techniques a higher sample size is required.
Implant failure after sinuslift procedures – a retrospective study over 16 years and 1541 implants

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Introduction: Between 1994 and 2010 (since 16 years) 1541 dental implants (Ankylos Friadent Dentsply, Mannheim Germany) have been placed in combination with sinuslift procedures. The present retrospective study shows the amounts and reasons of implant losses in grafted bone after sinuslifting.

Materials and methods:
All sinuslift procedures are documented in a computerbased database (ImpDat Kea Soft GmbH Germany) with a standardized protocol. Augmentation procedures, grafting materials, region, indication class, implant size and diameter are documented. A standardized implant control is performed at the time of second stage surgery, prothetical reconstruction and after that yearly. All implant losses are documented with time of failure and reasons of implant loss or explantation.

Results: 1541 implants have been placed in combination with sinus grafting procedures in 770 patients with a maximum observation time of 16 years. 28 implant losses occurred in 26 patients with a total survival rate of 98 %. 40 % (12) of the implant losses are early losses (within the first six months), among the implant losses that occurred after 6 months a lack of osseointegration was the biggest group with 21 % (6), periimplantitis was a rare reason for implant loss with 7 % (2). Further reasons were fractures of the implant or prosthetic components and overloading.

60 % of the implant losses happenend during the first year after placement. The survival rate of implants placed with BioOss (Geistlich, Schweiz) as single grafting material was 98.5 % (12/800), BioOss as mixture with grafted bone was 95.4 % (7/153), grafted bone as single augmentation material was 97 % (5/180) and internal sinus floor elevation without grafting materials was 99 % (4/408).

Discussion: Depending on the clinical situation and the existing vertical dimension of the bony sinus floor all described sinuslift procedures can be recommended as safe methods to graft an insufficient vertical bone height in the maxilla.

Immediate loading of implants in the edentulous maxilla: What is possible? When do we fail?

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Praxis in Aschaffenburg

Introduction: In a prospective case series 59 patients were treated with dental implants in the edentulous maxilla. The implants were loaded immediately with fixed dentures. The objective was to find out which treatment protocols are successful in case of immediate loading in the edentulous maxilla. Against the background of an ongoing trend towards small diameter implants the following factors were assumed to be variable: 1. the implant diameter (4.1 mm vs. 3.3 mm) or the implant material (titan vs. Roxolid), 2. time of implant placement (immediate vs. delayed).

Method: 59 patients were assigned to five test groups. Each patient was treated with 5 implants, placed inter sinusally in the edentulous maxilla. All implants were loaded immediately after insertion. Observation period was 18 month.

Test group 1: 16 patients with immediate implant placement of 5 Straumann Plus Implants of 4.1 mm diameter.

Test group 2: 15 patients with delayed implant placement of 5 Straumann Plus Implants of 4.1 mm diameter.

Test group 3: 10 patients with immediate implant placement of 3 Straumann Plus Implants of 4.1 mm diameter and 2 Straumann Roxolid Implants of 3.3 mm diameter.

Test group 4: 11 patients with delayed implant placement of 5 Straumann Roxolid Implants of 3.3 mm diameter.

Test group 5: 7 patients with immediate implant placement of 5 Straumann Roxolid Implants of 3.3 mm diameter.

Results: Immediate loading of dental implants in the edentulous maxilla was successful in test groups 1, 2, 3 and 4. Using immediate implant placement with reduced diameter implants alone led to higher failure rates when immediate loading was used.

Conclusion: Present data indicates that usage of solely small diameter implants in immediate implant placement and immediate loading in the maxilla is related to increased failure rates. Further studies with larger number of implants are needed to verify this observation.

A clinical, microbiological and immunological follow-up of anti-infective peri-implantitis therapy in patients with bar-retained lower overdentures

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Aim: Origin, treatment strategies and prognosis of peri-implantitis lesions are not well understood. The aim of the present study was to follow-up clinical, microbiological and immunological findings in individuals wearing bar-retained lower complete dentures with and without peri-implantitis pre and post treatment.

Methods: From the Tübingen Implant Registry recall program 16 peri-implantitis patients were compared to 16 healthy implant patients in a prospective study. Patients with peri-implantitis were treated with a single anti-infective therapy according the CIST protocol while the healthy controls received professional implant cleaning. The following findings were recorded at four time points before treatment (T1) and 30, 90, and 360 days post treatment (T2–T4): sulcular fluid flow rate, probing depth, plaque and bleeding index, implant stability (Periotest), and the sulcular concentrations of interleukin-1 beta, plasminogen activator inhibitor 2, prostaglandin E2, and the sum score of five periodontopathogenic bacteria species by PCR (Hain Microdent test).

Results: Statistically significant differences between healthy and diseased implants were found for probing depth, bleeding on probing, bacterial load, and implant stability. For the first three, the severity of the finding decreased significantly after treatment but reached initial pre treatment values within one
year again. In comparison, no changes could be observed in the individuals without peri-implantitis.

**Conclusion:** The results of the present study confirm marked differences in peri-implant findings between sites with and without peri-implantitis. They also demonstrate that a single anti-infective intervention can initially – but not sustained – reduce probing depth, bleeding on probing, and the total bacterial load as evident from PCR diagnostics considerably. Further immunological diagnostic measures do not seem to provide significant additional information in the patients investigated.

**Primary implant stability after maxillary sinus augmentation with autogenous mesenchymal stem cells – biomechanical evaluation in rabbits**

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**Objectives:** The effect of transplantation of precultured pre-osteoblasts derived from autogenic adult stem cells (aMSC) on primary dental implant stability was mechanically evaluated in an experimental sinus floor augmentation model in rabbits and was compared to conventional augmentation procedures.

**Material and methods:** 6 weeks after experimental sinus floor augmentation with a synthetic bone substitute, an autogenous bone transplantation or osteoblast precursor cells the primary stability of implants inserted in the edentulous part of the upper jaw of New Zealand White Rabbits was examined. Mechanical evaluation was performed by determination of insertion torque values (Osseocare), percussion testing (Periotest), resonance frequency analysis (Ostell and scanning laser Doppler vibrometer) and measurement of extraction forces.

**Results:** Transplantation of autogenous bone graft resulted in highest primary implant stability in all examination modalities. Evaluation of mechanical properties with percussion testing and resonance frequency analysis with Osstell revealed slightly higher primary stability of the stem cell group whereas the scanning laser Doppler vibrometer and measurement of pull-out forces showed no significant difference to the bone substitute group.

**Conclusions:** The tested examination modalities proved suitable for the determination of primary implant stability. The experimental maxillary sinus floor augmentation with precultured osteoblast precursor cells from autogenic stems cells clearly enhanced primary stability of implants compared to the unaugmented sinus and lead to comparable primary mechanical properties to bone substitutes in rabbits. In comparison to the autogenous bone graft stability enhancement by stem cell transplantation declined but is associated with reduced harvesting morbidity.

**Bioactive nucleic-acid coatings for implants as an innovative approach for difficult bone conditions – an experimental study in minipigs**

**Ralf Smeets**

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**Objective:** Particularly in difficult bone situations dental implants are able to expand their indications by osteoinductive coatings. The transfer of nucleic acids enables strengthening the body’s own cell production of particular cytokines like BMP-2 without the drawbacks of recombinant proteins. Until now, central issue of bioactive surfaces has been stability and release behavior. By a newly developed PDLLA-coating procedure, called Pivot-manuever, this problem could be sorted out completely. Pre-test series yielded an abrasion of 4% of the complete coating during the implantation procedure.

**Method:** In an experimental study with Gottingen minipigs 6 implants coated with different concentrations of BMP-2-plasmid were inserted into the maxilla by using a split-mouth-design. Controls were made with reporter gene respectively recombinant protein BMP-2. Evaluation of bone-implant-interface and bone regeneration took place after 28 and 56 days by performing μCT, histology, immunohistochemistry and polymerase chain reaction (PCR).

**Results:** All coatings with nucleic acid achieved significantly higher mineralization rates after 28 days (31.4% ± 4.8%/64.5% ± 5.1) than controls (22.9 % ± 4.3%/47.8 % ± 8.4) (p < 0.05), also osseointegration was significantly more advanced in the plasmid groups. The most effective combination seems to be BMP-2 with a DNA concentration of 12 µg, because the precedent vascularization enhances the dimension stability of the newly formed bone. Implants coated by recombinant protein BMP-2 osseointegrated faster, but with less stability of dimensions.

**Conclusion:** Results of this study first realized with human, nucleic-acid-coated implants demonstrated a significant positive effect of the plasmids concerning optimizing bone regeneration and osseointegration. There is only transient integration into the cell genome, so that nothing gets in the way of the application to humans in the future.

**Influence of intra-operative storage on autogenous spongiosa**

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**Introduction:** The success of autogenous spongiosa transplantations and the vitality of the osteoblasts depend on numerous factors. Autogenous spongiosa is subjected to various methods of storage intra-operatively when immediate re-implantation is not possible. Customary is the dry storage or the moist storage in saline solution. Aim of this study was to identify the optimal storage method.

**Materials/methods:** Bone was harvested from the iliac crest and divided into 10 equal pieces, each one placed in flask. Each flask was treated differently leading to 5 different groups:
– Dry storage
– Moist gauze (NaCl 0.9 %)
– Saline solution
– Glucose solution (5 %)
– Culture medium

After 2 hours or 4 hours the bone was transferred to a culture medium and incubated for 1 week, until a confluent cell layer developed. Consecutively, a cell-count was performed. To assess the metabolic activity, following the cell-count, a XTT-test was performed.

Results: This study portrays the influence of the intra-operative storage on the vitality of the harvested cells. The results showed that a dry storage, especially for a longer period of time, leads to a lower proliferation rate of the osteoblasts. Furthermore, storage in saline solution or in moist gauze in comparison to the dry storage leads to a higher vitality of the osteoblasts. In respect to storage in 5 % glucose solution or in culture medium for 4 hours, these methods proved advantageous in comparison to the saline solution, whereby after 2 hours, the highest vitality was observed in the 5 % glucose group. By storage durations exceeding 4 hours however, the culture medium leads to a higher proliferation rate.

Conclusion: Moist storage in solution should be aspired. Recommendable for this purpose are 5 % glucose or saline solution, since both are easily accessible in operating theatres. Dry storage should be avoided.

Posterdeemonstrationen

The influence of flapless implant placement on initial bone loss and pain sensation

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Background: Some initial loss of marginal bone around dental implants is generally accepted. The purpose of this prospective, clinical, controlled cohort investigation was to examine the influence of flapless implant placement on initial bone loss and the inconveniences for the patients compared to a full flap approach.

Materials and methods: A total number of 447 implants with a conical implant-abutment interface were inserted. 207 sites offered the possibility of implantation without augmentative procedures in the marginal region. 103 implant sites were assigned to the flapless test-group by alternating assignment and 104 implants were inserted by preparing a full flap. The healing in all cases occurred non-submerged. The height of the marginal bone was measured by calibrated digital intraoral radiographs at the end of surgery and after 12 months. All patients noted their feeling of pain on a visual-analogue-scale from 0 to 10.

Results: After one year an overall marginal bone loss of 0.24 mm (± 0.62) was measured. The remodeling led in the flapless-group to a slight increase in marginal bone height of 0.09 mm (± 0.49). In the full-flap-group, an average bone loss of 0.55 mm (± 0.57) was measured. The difference was highly significant (p < 0.001). The patients recorded an overall pain of 2.9 (± 1.2). The felt pain was significantly lower in the flapless-group with 2.3 (± 0.9), compared to the full-flap-group with 3.5 (± 1.2).

Discussion: The x-rays were digitally calibrated and an error of measurement of 0.1 mm was determined, but did not offer a three-dimensional view on the surrounding bone.

Conclusions: In general, implantation without flap retraction led to no bone loss and was less painful. The examined implant system seems to have a positive influence on the initial marginal bone loss compared to results of other systems in the literature. The reasons are assumed in the platform switching and reduction of micro movements.

RFA (Ostell) and damping capacity assessment (Periotest) in the non-invasive determination of the bone level of osseointegrated implants in-vitro

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Aim: The objective of this study was to compare resonance frequency analysis and damping capacity assessment in the detection of progressive peri-implant bone loss and also in the detection of de-novo bone formation after simulated peri-implant augmentation.

Methods: Implants with varying geometry and surface characteristics were inserted into blocks of acrylic resin and bovine ribs. Defects were created by removing the peri-implant bone in millimeter increments. Later the defects were augmented with a bone substitute (BioOss) and resin mixture, also in millimeter steps. Implant stability was measured using the Ostell (Resonance frequency analysis) and Periotest (damping capacity assessment) devices at each millimeter step during break-down and build-up.

Results: The results show that it is possible to monitor progressive peri-implant bone loss as well as formation of new bone around the implants by continuous measurements using Periotest and Ostell, both in a very similar manner. Complete filling of the peri-implant defect with a bone substitute-enriched agar gel mimicking a freshly augmented site did not affect the measurement values of either method. The simulation of implant re-osseointegration in the acrylic block set-up showed that the measured values of bone loss and bone built-up coincide. A comparison between different implant types and homologous implants showed identical trends but large discrepancies in the actual measurement values.

Conclusion: In conclusion continuous measurements of an osseo-integrated implant using resonance frequency analysis and damping capacity assessment over a longer period can complement a clinical check-up in a sensible way in both the detection of bone loss and augmentation follow-up. The stability of different implants should not be compared, however, due to implant and site-specific influence on the actual measurement values.
Titanium granules for the improvement of the contour of the alveolar ridge (a clinical study)

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Implantatium in Gernsbach

Objective: The collapse of the alveolar ridge after extraction makes it often difficult to achieve perfect esthetical results with dental restorations. This clinical study had the objective to evaluate the potential of porous titanium granules (PTG) as a graft material in the surgical treatment of osseous deficits in vertical and horizontal direction.

Methods: Nine patients with osseous deficits on the buccal side of implants (6) and with vertical deficits between two implants for a planned FPD (3) were treated with white titanium granules, following the instructions of the manufacturer. No membrane was used to cover the graft material. Sutures were removed after one week. All treated sides healed uneventfully with an instant improvement of the contour. After a healing period of three months, all patients received the restorations within a period of 7 weeks after the reentry.

Results: All augmented sides remained stable over a follow-up period of 6 months without signs for loss of volume. There was no discolouration of the soft tissue at the augmented sides.

Conclusion: No adverse effects from PTG augmentation were observed. The granules are easy to shape and easy to use. The early results are promising and justify further clinical use.

Nonsurgical treatment of peri-implantitis: a controlled clinical study

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Objectives: The aim of this prospective, parallel group designed, controlled clinical study is to evaluate the effectiveness of an air-powder system for the treatment of peri-implantitis.

Methods: 16 patients, each of whom displayed at least one implant with initial or moderate peri-implantitis, were randomly instrumented using either (1) an air-powder flow (glycin based powder) (APF) or (2) mechanical debridement using plastic curettes and antiseptic therapy with chlorhexidine digluconate (MDA). The following clinical parameters were measured at baseline, 3 and 6 months after treatment: bleeding on probing (BOP), clinical attachment level (CAL). The following clinical parameters were measured at baseline, 3 and 6 months after treatment: bleeding on probing (BOP), clinical attachment level (CAL).

Results: At 6 months, the sites treated with APF revealed a reduction in mean BOP values of 40.53 % (p < 0.05) and a CAL change of 0.64 mm (p < 0.05). The sites treated with MDA revealed a reduction in mean BOP values of 18.8 % (p > 0.05) and a CAL change of 0.4 mm (p > 0.05) at 6 months, respectively. Even though clinical improvements in terms of BOP reductions and CAL gains tended to be higher in the APF group, these differences did not reach statistical significance (p > 0.05, respectively).

Conclusion: It was concluded that nonsurgical treatment of peri-implantitis using either APF or MDA may result in comparable short-term clinical results.

Prevalence and therapy of sinus membrane perforation during sinus floor elevation: a review

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Introduction: The most common complication of sinus floor elevation (SFE) is the perforation of sinus membrane (SM), which may cause loss of graft material and early failure of dental implants. This presentation shows the prevalence of SM-perforation during SFE and lists options for repair, which are finally discussed respecting implant survival rates (ISR).

Materials and methods: This presentation is a literature research from the database of Pub Med and libraries of the University Münster. The following keywords were used even in combination: „sinus floor elevation, prevalence, perforation, complication, sinus membrane, Schneiderian membrane, repair, closure, dental implants, survival rate”.

Results: The prevalence of SM-perforation out of 23 publications (1993–2008) ranges from 4.7 % to 56.16 %, with an average of 22.5 %. No significant difference between piezo-electric device and conventional instruments could be observed for the secure elevation of the sinus mucosa. There are 4 general options for the treatment of the perforated mucosa: fibrin glue, sutures, resorbable barriers and autogenous bone blocks. Histologically, perforations repaired with fibrin glue led to newly formed continuous epithelium and those repaired with resorbable barriers showed fibrosis, inflammatory infiltration and absent epithelium. ISR in grafted sinuses with perforation generally ranged between 90.8 % to 94.4 %. The use of resorbable barriers is the most common option which may lead to complications and lower ISR as reported by Proussaefs et al.

Discussion/Conclusions: In nearly every fourth SFE a perforation of the SM does occur often combined with anatomical findings like sinus septa. The use of piezo-instruments does not reduce numbers of perforations or needed time, possibly due to the less tactile feeling. The closure of a perforation with sutures or fibrin glue is the most save and physiologic therapy in contrast to covering with resorbable barriers.

Long-term retention characteristics of locator attachments for implant overdentures

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Objectives: Locator-attachments (LA, Zest, Escondido, USA) are an alternative option for the retention of removable dental prostheses to dental implants. Following manufacturers’ information different pivoting Locator-males from polyamide resin provide varying retention forces without any resulting loss of retention. The aim of this study was to compare the long-term retention characteristics of different LA used to retain overdentures to dental implants.

Methods: From each LA-design (blue, pink, clear) 10 specimens were tested 20 times in a calibrated pull-off test machine (v = 50 mm/min, s = 20 mm). LA were tested before, during and after in-vitro long-term use simulating 5 years of clinical wear
Evaluation of accuracy of multiple dental implant impressions using two different impression trays

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Purpose: The aim of the present study was to compare the accuracy of casts obtained from an open custom tray (OCT) and a new implant tray with foil technique (TFT) for multiple dental implants.

Materials and methods: A reference model with 6 implants was fabricated with denture base heat-curing acrylic resin. These implants were placed in regions 016 – 014 – 012 – 022 – 024 – 026 of the maxilla. Impressions of the reference model were made using polyether impression material with an open custom tray (OCT) and an implant tray with foil technique (TFT). 5 impressions were made for each group and casts were poured in type IV dental stone. Linear differences in interimplant distances in the x-, y-axes were measured on the reference model and on the casts of both groups using a coordinate measuring machine. Deviations of casts were compared with the reference model using unpaired t-tests.

Results: Casts obtained from both impression trays (OCT and TFT) exhibited deviations from the reference model. In 8 out of 9 interimplant distances measured, the casts of the implant tray with foil technique group (TFT) showed smaller or similar deviations from the reference model in the x- and y-axes.

Conclusion: The results suggest that the new impression tray with the foil technique may be used as an alternative to the customised open tray technique.

Evaluation of the location of the inferior alveolar nerve. Metric analysis of DVT scans and human cadavers

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Aim: Prior to placement of endosseous cylindrical implants, if the bone volume is insufficient in height and/or width, bone reconstructive treatment is essential. Autogenous bone still represents the gold standard for reconstruction of bony defects of alveolar crests. The mandibular retromolar region is a common donor site. When harvesting bone block grafts the inferior alveolar nerve position determines the osteotomy.

Materials and methods: In 100 DVT scans the distance between the inferior alveolar nerve and the buccal bone wall of the mandible was measured. All DVT-scans were performed by GALILEOS (SIRONA) and analyzed with the calibrated diagnostic metric tool of the GALAXIS-software. In parallel the location of the inferior alveolar nerve was measured in 30 THIEL-fixed human cadavers following a calibrated measuring system.

Results: In DVT-scans the distance between the inferior alveolar nerve and the buccal bone wall of the mandible was measured. The depth in average was 5.1 mm in the region distal of the first molar, 4.5 mm in the region of the second molar, 4.0 mm in the region of the third molar and 3.1 mm at the mesial border of the ramus. In human cadavers the distance between the inferior alveolar nerve and the buccal bone wall of the mandible was measured also. The average depth was 5.3 mm in the region distal of the first molar, 4.6 mm in the region of the second molar, 3.8 mm in the region of the third molar and 2.9 mm at the mesial border of the ramus.

Conclusion: No significant differences were found in the location of the inferior alveolar nerve between DVT-scans and human cadavers. The average distance is important for retromolar bone harvesting. In order to avoid injury of the inferior alveolar nerve maximum penetration depth for the osteotomies and a safety distance could be defined.

Solution to a big problem in tissue engineering: Oxy-sterole and Purmorphamine: An innovation for osteogenic differentiation

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Introduction: High cell numbers are necessary to generate biotechnologically viable bone. Mesenchymal stem cells (MSC) seem highly suitable for this purpose due to their multi-potency and their proliferation capacity. Aim of this study was to optimise the osteogenic differentiation process, with emphasis on the accelerated transplantation of pre-differentiated MSCs for bone reconstruction.

Materials/Methods: MSC were isolated from the femur bone of rats, expanded and differentiated. In the experimental groups, the efficiency of the osteogenic differentiation was compared to standard methods. As an adjunct, Purmorphamine, Fluvastatine, Lovastatine or Hydroxycholesterol were added. The
degree of osteogenic differentiation was determined by measuring the activity of alkaline phosphatase, quantification of the extracellular bone matrix or semi-quantitatively using a RT-PCR analysis of bone marker genes.

**Results:** None of the 4 additives influenced the MSCs proliferation rate. After differentiation, the Alizarin Red stain showed that Oxysterole and Purrmorphamine lead to an accelerated deposition of extracellular bone matrix. After 7 days, the cells showed high levels of mineralisation, which are usually encountered after 21 days. The expression of the bone marker genes showed that the addition of Purrmorphamine and Oxysterole induced earlier and higher levels of the osteogenic specific marker expression.

**Discussion:** The results show that by addition of different reagents the osteogenic differentiation can be accelerated. Purrmorphamine and Oxysterole in conjunction with the classical culture medium in MSCs were able to accelerate this process. It seems justified to complement the osteogenic differentiation protocol by these reagents, however, this should be preceded by further stem cell based bone regeneration investigations.

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**Biomechanics of conical implant-abutment connections – avoiding crestal bone overload and microgaps**

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**Objectives:** Avoiding crestal bone loss around oral implants is one of the major objectives in implant engineering. According to the well-accepted theory by Frost unphysiologic mechanical overload causes high peak bone stress that could lead to bone loss. Other studies conclude bacterial contamination promoted by micro-gaps in the implant-abutment connection may cause bone loss as well. Previous biomechanical studies demonstrated the positive effect of conical connections with an angle of less than 15 degrees. These studies were based on limited mechanical principles. The objective of this study is to theoretically determine the influence of physiological dynamic loading forces on micro gapping and crestal bone stress.

**Material and method:** In this study three-dimensional non-linear finite element models with different angles of implant-abutment connections were generated and analysed.

**Results:** Applying physiological dynamic forces of 150 Ncm to conical connections of dental implants with small angles (<15°) leads to absence of micro-gaps but to significantly higher bone loading than in flat connections. Conical connections with an angle of 45° lead to absence of micro-gaps combined with a significant reduction of bone loading.

**Conclusion:** The present study revealed that under physiological conditions a 45° angle is the optimized conical implant-abutment connection to avoid micro-gaps and to reduce unphysiological bone overloading forces around dental implants.

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**Dislocation of a dental implant into the mandible – case report**

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**Introduction:** A rather unusual complication during implant placement in the molar area of the mandible is the dislocation of the implant into the jawbone.

**Clinical case:** The complication took place during a standard implantation in region 36 and 37 with a 52 year old female patient. The poor bone quality was recorded during drilling of the implant beds, based on the hand-felt perception of the drilling resistance. Both regions showed a D4 bone type with a thin cortical layer. The preparation was carried out by using bone condensers. Both implants were inserted slightly subcrestally. While testing the primary stability in region 36 the implant slipped downwards into the soft bone. Several attempts to remove the implant through the implant bed remained unsuccessful. Therefore, a cortical bone plate was outlined and raised to ease the access to the implant. After removal of the implant, the bone was slightly curetted to provoke a bleeding and the bone blockgraft was replaced and fixed with a miniscrew. Four months later, the screw was removed and an Ankylos implant was inserted again in region 36. Three month later, the implants 36 and 37 were successfully provided with single metal-ceramic crowns.

**Conclusion:** The surgeon should not underestimate the risk of an implant dislocation during a standard implant placement in soft bone areas. Experience to manage this unusual complication during dental implant placement in the mandible is required.
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