Research Competition (Oral presentations - Abstracts 35 to 44)

35 | Research Competition (oral presentation)

Histomorphometry of peri-implant tissues in implant-tooth-supported bridges with different abutments

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Objectives: To compare bone and soft tissue integration in implant-tooth-supported bridges with two different abutment designs.

Methods: Extractions of lower molars were performed in eight adult monkeys (*Macaca fascicularis*), healing allowed for one month, following which standard 8 mm Ankylos® implants were inserted in the second molar regions using a submerged healing approach. Abutment connections and prosthesis placement were carried out 3 months later, one side with tapered(T) abutment and the other with butt-joint(B) abutment, in a split mouth design. The monkeys were sacrificed after 6 months of loading. Thin undecalcified sections were prepared from specimens cut mesio-distally, parallel to implant long axis. Histomorphometry was performed for bone-implant contact(BIC), thread bone volume (TBV), apical(A)BV and five soft tissue indices i.e. coronal gingival-to-implant top distance(DIM), sulcus depth (SD), junctional epithelium(JE), connective-tissue-contact (CTC), and biologic width (SD + JE + CTC = BW). For natural abutment tooth, gingival mucosa height, SD and JE were measured.

Results: High BIC and BV in both abutment groups were scored (Table). Soft tissue dimensions in T group were similar to natural tooth abutment, but differed significantly from B group(SD, JE and BW $p < 0.05$).

Indices	T abutment	B abutment	p value
BIC	90.43% ± 11.17%	93.46% ± 10.75%	0.59
TBV	86.28% ± 18.82%	88.66% ± 15.40%	0.74
ABV	71.82% ± 26.66%	84.61% ± 22.11%	0.53
DIM	0.85 ± 0.19 mm	0.93 ± 0.29 mm	0.53
SD	0.41 ± 0.10 mm	0.59 ± 0.15 mm	0.04
JE	0.43 ± 0.05 mm	0.59 ± 0.16 mm	0.04
CTC	0.49 ± 0.09 mm	0.77 ± 0.37 mm	0.10
BW	1.31 ± 0.16 mm	1.89 ± 0.52 mm	0.03

Conclusions: Present findings suggest that the Ankylos implant system is suitable for implant-tooth-supported bridges, while the physiologically-shaped gap-free tapered abutment promotes and enhances soft tissue integration. This research was supported by Friadent, GmbH, Dentsply, Germany R&D 40-02-03-002.

36 | Research Competition (oral presentation)

OCCLUSAL OVERLOAD AS PRIMARY RISK FACTOR OF PROSTHETIC IMPLANT FAILURES

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Aim: The aim of this study was to evaluate the effects of abnormal occlusal forces on dental implants in patients with temporomandibular disorders (TMD), and to focus on concepts and the clinical procedures to reduce the potential risk factors for implant failure.

Methods and materials: Twenty-eight TMD patients were compared to 28 no-TMD patients in which were inserted 267 implants with the same features as number, size, position, design. Besides, were considered type of restoration, cemented or screwed, malocclusion type, smoking, load timing. The heavy force of compression, clenching and grinding, as in bruxism, simultaneously applied strong pressures to the implants, crestal bone, restorations and temporomandibular joints. This was a potential risk factor for crestal bone loss, loss of integration before and after restoration, abutment screw loosening and fracture, implant fracture, decementation of restorations and fracture of the porcelain.

Results: The results indicate that increasing the number of implants and reducing cantilevers decreases the stress on each one; using the longest and widest implant possible increases implant/bone surface area and reduces also strain on the restorations. Also implant design, occlusal table size, the direction, duration and magnification of the forces influences the stress at the crestal bone/implant surface. Anterior guidance during excursive movements reduces forces and eliminate all lateral occlusal contact.

Conclusion: Developing treatment plan that control the chronic bruxism through night-guards and modify the occlusal forces on implants and their restorations, patients with temporomandibular disorders and bruxism can be candidates for implants.

37 | Research Competition (oral presentation)

Occurrence of Tissue Formation Defects Following Alveolar Distraction Osteogenesis

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This retrospective study was designed to evaluate the occurrence of insufficient hard and soft tissue formation at the moment of implant placement in distracted alveolar bone.

The study included 43 implants placed in seventeen cases of alveolar distraction osteogenesis. Occurrence of insufficient tissue formation was related with the performed protocol.

Placement of all 43 implants resulted with sufficient attached gingiva. Alveolar ridge augmentation with the range 4.5–6.5 mm gave as a result the placement of 22 implants without bone formation defect, 8 implants with bone fenestration and 3 implants with bone dehiscence defects. All 10 implants placed in the ridges augmented with the range 6.5–10.5 mm demonstrated bone dehiscence defects at the moment of implant placement. Regarding the percent of augmentation performed, bone formation defects occurred in 1 out of 22 implants placed in alveolar ridges distracted up to 25% and 20 out of 21 implants in ridges distracted over 25% from the original bone height.

Alveolar ridge distraction up to 25% of initial bone height seems more predictable considering complications that could occur at the moment of implant placement. In augmentation mayor then 25% from original height, an additional treatment should be considered.

38 | Research Competition (oral presentation)

Guided bone regeneration for residual ridge augmentation: clinical, histologic and histomorphometric study in 20 patients

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Aim: The aim of this study was to evaluate the quantity and quality of regenerated bone in relation to the materials used, by clinical, histologic and histomorphometric criteria.

Materials and methods: 20 adult patients (12 male and 8 female, aged 30–65 years) of the Department of Dental Implants and Tissue Regeneration of Hygeia Hospital participated in this study. The histopathologic examination was performed in the Division of Basic Biomedical Sciences and Oral Biology of University of Athens. The materials used were: a) autologous bone, only (6 cases), b) autologous bone in combination with platelet-rich plasma (PRP) (2 cases), c) autologous bone in combination with allograft (7 cases), d) autologous bone in combination with allograft and PRP (2 cases), e) allograft, only (3 cases). In 11 cases a resorbable collagen membrane and in 9 cases a non-resorbable e-PTFE membrane were used. After a healing period of 4 to 12 months, the bone collected from the augmented sites at the time of implant placement by the trephine bur was fixed in 10% buffered formalin, decalcified, and embedded in paraffin. Five-micron thick sections, stained with hematoxylin-eosin and Masson's trichrome, were used.

Results: Adequate bone volume was clinically observed in all cases. Bone augmentation was evident both in horizontal (4.1–7.3 mm) and vertical dimension (2.3–8.5 mm, sinus augmentation included). Microscopic and histomorphometric evaluation revealed predominance of new bone in all cases. Osteoid and residual graft material was occasionally seen, while inflammation was insignificant. In cases where autologous bone graft was used, bone maturation and augmentation was faster and qualitatively higher according to clinical and histologic evaluation. In cases where PRP was used, clinical and radiographic evidences of bone maturation were earlier, but histologic examination revealed no differences in bone quality. In 2 cases, exposure of non-resorbable e-PTFE membrane occurred after the 8th week, and the membranes were removed, without any further complication.

Conclusions: Autologous bone in combination with non-resorbable e-PTFE membrane resulted in faster bone maturation. The addition of PRP did not appear to significantly enhance bone formation. Overall, no serious complication was seen during the healing period, in all patients.

39 | Research Competition (oral presentation)

Treatment of critical size defects – a baboon study

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Guided bone regeneration with membranes is a state of the art method to achieve ideal bony support for dental implants. However, there is little available data on bone resorption in augmented bone.

The aim of this study was to evaluate resorption in cortical bone areas after lateral ridge augmentation.

The augmentation of the critical size defects was performed in 6 baboons 3 months after extraction of the first or second molars. Each individual was treated with 4 different concepts. 1. autogenous bone block only ABB. 2. ABB covered with PTLM (new type of experimental bioresorbable Protoype – trilayer-membrane. 3. Deproteinized bovine bone mineral DBBM covered with PTLM. 4. empty control defect.

After 9 months the baboons were humanely sacrificed and a histologic / histomorphometric analysis was performed.

The main landmark for resorptive activity was the presence of Howship's lacunae at 80 different locations buccal and palatal / lingual.

Both the mandibles and the maxillae demonstrated statistically significant differences of resorption between ABB + PTLM and control ($p = 0.01$) and ABB + PTLM versus ABB (0.01).

Buccal areas proved to depict more resorption in general than the palatal / Lingual sides. The apical areas of the defects showed no differences of resorption activity. In terms of overall resorption, there were just slight differences between the maxillae (22.1%) and the mandibles (20.4%), ($p - 0.668$).

The results show, that cortical resorption is not affected by the used augmentation material, however, defects covered with membranes show less bone loss.

40 | Research Competition (oral presentation)

Nanotechnology and Osseointegration: Influence of Coating Nanothickness in Biomechanical Performance

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The expansion of processes able to produce materials of confined dimensions from laboratories to industrial settings has been of interest of biomaterials/tissue engineering research groups. Previous studies have shown that nano-thick Ion Beam Assisted Deposited (IBAD) Ca/P-based coatings on Ti-6Al-4 V implants have increased both osseoactivity levels and biomechanical properties of the bone-biomaterial interface at early implantation times.

Objective: a series of in-vitro and in-vivo studies to physico/chemically characterize IBAD coatings of different thicknesses and to evaluate its biomechanical performance in a beagle model.

Methods: SEM, EDS, XPS, XPS/ Ion-Milling (depth profiling), and Thin-Film X-ray Diffraction (TFXRD) were used for IBAD 1, IBAD 2, and Control (C- sand-blasted/acid etched) characterization. The in-vivo model comprised three male adult beagle dogs receiving 5 cylindrical implants on the proximal tibiae, which remained in-situ for 5 and 3 weeks. After euthanization, the implants were torqued at a 0.5 in/min rate.

Results: SEM revealed both thin-films undetectable (invisible). EDS showed Ti/Al/V for C and IBAD 1 and little evidence of Ca for IBAD 2. XPS showed the presence of Ca and P at both IBAD-coated implants' surfaces outer layers, and XPS/Ion-Milling revealed IBAD 2 thicker (300–500 nm) than IBAD 1 (25–50 nm). TFXRD revealed amorphous coatings. ANOVA showed a significant effect ($P < 0.02$) of implant surface and no effect of time in-vivo in torque values. The torque values obtained in N.cm were 50.21 ± 13.19^{a} (C), 58.96 ± 12.49^{a} (IBAD 1), and 79.63 ± 14.96^{b} (IBAD 2).

Conclusion: according to the results obtained, 300–500 nm amorphous Ca/P-based coatings increased the biomechanical performance of implants.

41 | Research Competition (oral presentation)

Osteogenic potential of human bone cells cultured from the human maxillary alveolar ridge

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Introduction: In this study we characterized bone cell cultures derived from the human maxillary alveolar ridge, which could be a potential cell-source for tissue engineering of the severely resorbed maxilla.

Methods: From ten individuals an osseous core was obtained. Ten explant cultures were established and the morphology of the cells was studied with light microscopy (LM). Explant-cultures were analysed by flow cytometry with respect to size, granularity and surface marker expression. Fluorochrom-conjugated antibodies (CD13, CD31, CD44, CD90 or CD73) were used.

Cells were cultured in standard medium (SCM) or osteoinductive medium (OIM) for 21 days and analysed for alkaline phosphatase (ALP) expression and calcium deposits. Furthermore osteogenic gene-expression (osteocalcin, ALP, collagen type 1) were analysed by RT-PCR.

Results: LM demonstrated that cells had a polygonal morphology containing a central nucleus with 2–3 nucleoli. Size/granularity analysis revealed differences between individuals. Immunophenotypically, these cells were positive for CD13, CD44, CD90 and CD73 while negative for CD31.

Cells cultured in SCM for 21 days showed moderate ALP staining and many calcium deposits. Culturing cells in OIM for 21 days significantly increased both ALP staining and the number of calcium deposits. RT-PCR demonstrated expression of osteogenic marker-genes.

Discussion: To our knowledge it is the first time that surface marker expression has been studied on bone cells originating from this site. Cells were positive for markers characteristic for immature mesenchymal stem cells and had osteogenic differentiation capability. This study indicates, that cells derived from maxilla biopsies could be a potential cell source for tissue engineering.

42 | Research Competition (oral presentation)

Randomized study of early-loading in the maxilla: first results, RFA-values

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Objectives: Early loading concepts in challenged bone situations often are lacking controlled studies. The aim of this study was to show equivalence between implants in the maxilla loaded after 12 weeks vs. those loaded after 4 weeks.

Materials and Methods: This is a controlled, randomized, prospective, two arm study. Patients, who had received transgingival, primary stable implants in the maxilla (no radiation, no augmentation within last 3 months), were assigned to either 12 or 4 weeks of unloaded healing. 4 centers took part in this study. Implants (Straumann) were SLA-coated, 4.1 mm diameter; 10–14 mm length. The primary outcome criterion was implant success with RFA as a secondary outcome criterion. The results presented are preliminary after 6 months of loading.

Results: From 03/2001 to 03/2003 $n = 296$ implants were randomized patient-wise. The results are given in the table below. Paired RFA data for individual follow-up was available for $n = 136$ implants. There was no statistical difference for RFA at insertion and loading between the implants loaded at 4 weeks and those loaded at 12 weeks ($p = 0.085$).

Healing time	Implants randomized	Implant failure	ISQ at insertion	ISQ change insertion to loading
4 weeks	178	5 (3%)	55 ± 12	−2.7 ± 12
12 weeks	118	4 (3%)	55 ± 6	1.3 ± 9

Conclusion: Loading of standard SLA implants in the maxilla at 4 weeks compared to 12 weeks does not lead to a higher implant failure rate or critical stability changes. Long term follow up data is following. (Financial support by ITI foundation)

43 | Research Competition (oral presentation)

Alveolar ridge augmentation with a prototype trilayer membrane and various bone grafts. A histomorphometric study in baboons

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Alveolar ridge augmentation using barrier membranes has become a standard treatment option to enhance the bone volume of deficient recipient sites prior to implant placement.

In the present study a biodegradable/bioresorbable prototype trilayer membrane (PTLM) was examined for its potential to promote osteoneogenesis. Two superficial collagen layers and a polylactide layer interposed between them were compared for alveolar ridge augmentation in combination with different bone grafting materials.

In each jaw of six baboons clinically relevant cavities were made 3 months after the extraction of the first and second molars. Each animal was treated with four different regimens: 1. Autogenous bone block alone (ABB), 2. autogenous bone block + PTLM, 3. deproteinized bovine bone mineral (DBBM) + PTLM and 4. no treatment (controls). After a healing time of 9 months the baboons were sacrificed for histologic and histomorphometric analyses.

Membrane-protected sites showed a well-preserved ridge profile, whereas non-protected bone blocks and control sites underwent resorption resulting in knife-edge ridge profiles. Areas of newly formed bone 1, 3, 7 and 10 mm from crestal were larger in the groups grafted with membrane. Significant differences were found between ABB + PTLM and ABB ($p = .0137$ to $p = .0232$) and controls ($p = .0003$ to $p = .0036$) and between DBBM + PTLM and ABB ($p = .0396$ to $p = .0439$) and controls ($p = .0006$ to $p = .0070$). Analogous results were seen for separate measurements in cortical and cancellous bone. The difference between ABB + PTLM and DBBM + PTLM was marginal.

The present study supports the use of the biodegradable/bioresorbable prototype trilayer membrane with autografts and deproteinized bovine bone mineral for lateral ridge augmentation in this type of bone defects.

44 | Research Competition (oral presentation)

ALP enzymatic activity related to different implant surface microtopographies

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The aim of this study was an *in vitro* investigation of the Alkaline Phosphatase (ALP) enzymatic activity related to different surface treatments applied to ten implant systems in order to assess if the interaction between cells and implant (osteoblastic proliferation and differentiation) was influenced by the surface structure and/or surface composition of the fixture. The originality of this study was that all implants were tested as manufactured for clinical use. The implant systems object of this study divided by the surface treatment were the following: **Machined:** Mk III Branemark; **Sandblasted:** Ankylos, Silhouette and Galant (experimental fixture); **Etched:** Osseotite, Mac System, MK 4 (experimental fixture), ITI; **Oxided:** Ti Unite, Pilot. We used Sa-OS2 cultured osteoblasts and we analyzed n°4 fixtures for each implant system (n°1 fixture for the cellular growth curve and n°3 fixtures for the ALP activity). After 14 days the assay for the ALP activity was carried out according to Wataha et al. (JBMR, 1997) After the cellular growth evaluation in a Burker's hemocytometer chamber we quantify by a spectrophotometer at 405 nm the absorbance value for each sample (the absorbance value indicate the amount of the conversion by ALP of the P-Nitro-Phenyl-Phosphate into P-Nitro-Phenol) and we corrected the mean value for cell number determined before. The data were statistically analyzed by ANOVA and Post hoc Scheffè Test. Within the limits of the in vitro investigations we can conclude that:

- The etched surfaces shown more cellular growth than others.
- The sandblasted surfaces shown the smallest amount of cellular proliferation but a very high differentiation (according to Postiglione et al 2003 that found an inverse correlation between the two factors)
- We found a statistically significant difference in ALP activity only between oxided and etched surfaces ($p < 0.05$)
- The sandblasted and oxided surfaces shown more osteoblastic differentiation (more ALP enzymatic activity)
- The machined surface is competitive, as regard the osteoblastic differentiation, with the rougher surfaces.
- Actually it's still difficult to recommend a particular rougher surface.

Poster presentations (Abstracts 45 to 175)

45 | Poster – Topic Implant Esthetics

Implants for maximum orthodontic anchorage

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In orthodontics the anchorage is the system that permit to dissipate reactional forces. Anchorage planning often is a critical phase of orthodontic treatment. Intraoral anchorage system, represented by teeth, are limited by the risk of loss anchorage, while extraoral system is hardly dependent on patient compliance. Oral implant placed in alveolar bone can provide maximum anchorage: reactional forces can load directly on the implant structure and can be completely avoid without patient compliance. In the beginning, implants for orthodontic anchorage were used only when they can be placed in edentulous space with a prosthetic aim. Triaca at the first, in 1992, experimented a screw type in the mid-sagittal area of the palate allowing a better assurance in anchorage-critical situation, like periodontal desease patient. After Triaca experience, many Authors have demonstrated the validity of this system and others non conventional site were chosen for orthodontic implants. The introduction of mini screws has permit to place implant in vestibular and oral alveolar bone and in retromolar area, so that offer a wide spread indications to this system. This work presents the Authors clinical experience on orthodontics implant.

46 | Poster – Topic Implant Esthetics

Effect of interimplant distances on papilla formation and crestal resorption

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Background: Implant esthetics has been the focus of attention for the last few years and one of the most important points is the effect that interimplant distances can have on interimplant papilla formation and crestal bone loss.

The aim of this study was to evaluate the effect that distances of 1, 2 and 3 mm between implants after prosthetic restoration will have on papilla formation and crestal resorption in submerged and non-submerged Ankylos implants.

Methods: The mandibular bilateral premolars of 7 dogs were extracted and after 12 weeks each dog received 8 implants, totaling 56 implants. They were placed so that two bridges, with 3 interimplant contacts, with 1 (group 1), 2 (group 2) and 3 mm (group 3) distances could be constructed on each side. The sides and the position of the groups were randomly selected. After 12 weeks, the implants received metallic prostheses with 5 mm between the contact point and the bone crest. After 8 weeks, the distance between the contact point and the papilla (CP-P) and the gingival height at the distal extension of the prosthesis (CP-DE) were measured. Radiographic images were obtained to measure the distance of the contact point to the bone crest adjacent to the interimplant surfaces (CP-ÍP) and adjacent to the edentulous surfaces (CP-ED).

Results: The clinical measurement of CP-P for submerged(sub) and non-submerged (nonsub) implants was for group 1: 3.57 $\pm$ 1.17 and 3.10 $\pm$ 0.82 mm, for group 2 it was 3.57 $\pm$ 0.78 and 3.16 $\pm$ 0.87 mm and for group 3 it was 3.35 $\pm$ 0.55 and 3.07 $\pm$ 0.93 mm respectively. The CP-DE was 3.25 $\pm$ 0.77 for submerged and 2.78 $\pm$ 0.64 mm for non-submerged implants. The CP-IP for the sub and nonsub group 1 was 6.91 $\pm$ 0.95 and 7.68 $\pm$ 2.73, group 2 it was 7.46 $\pm$ 1.43 and 5.87 $\pm$ 1.71 and for group 3 it was 7.72 $\pm$ 0.81 and 7.59 $\pm$ 1.33 mm respectively. The CP-ED was 6.77 $\pm$ 1.33 for submerged and 6.03 $\pm$ 1.58 mm for the non-submerged implants. There was no statistical difference for any of the parameters (ANOVA). We can conclude that interimplant distances of 1 to 3 mm, submerged or not, did not affect papilla formation or crestal resorption, when the distance from the contact point to the bone crest was 5 mm. This distance, for implant supported prosthesis, should be less than the 5 mm that has been suggested for the restoration of natural teeth if interimplant papilla formation is the objective. Sponsored by Dentsply Friadent.

47 | Poster – Topic Implant Esthetics

Dimension of interimplant papilla in Astra and Branemark implants

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Object: To measure and to compare the dimension of interimplant papilla in Astra (A) and Brånemark (B) implant system.

Methods: This study involved 50 interproximal papillae between two adjacent implants (inter-implant papilla) in 50 patients, who had implants placed adjacent to each other and who had prosthesis in place more than 1 year (24 patients for (A) and 26 patients for (B)). The shortest distance between the radiopaque material on the tip of inter-implant papilla and most coronal portion of the inter-implant crestal bone was measured (radiographic length of papilla, RL). The horizontal distance between the two adjacent implants was measured at the fixture-abutment interface level (horizontal distance, HD). Considering the possible effect of interimplant crestal bone resorption in case of closely implanted sites, HD were divided into 2 categories, HD < 3 mm and > 3. Mann-Whitney test was performed in order to find the difference in the dimension of interimplant papilla.

Results: In case of HD less than 3 mm, RL was 3.20 mm and 2.92 mm respectively in (A) and (B), which did not differ

statistically. Also, in case of HD more than 3 mm, RL was 3.02 mm and 3.21 mm in (A) and (B), respectively, which did not show statistically significant difference.

Conclusion: Both System had similar dimension of interimplant papilla, irrespective of horizontal distance of fixture.

48 | Poster – Topic Implant Esthetics

Changes in soft tissue dimension following three different techniques of second-stage surgery

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Objective: The aim of this study was to compare the increase of keratinized mucosa (in height and thickness) using three different techniques for second-stage-surgery in implant dentistry.

Materials and methods: 30 patients receiving prosthetic rehabilitation of the maxilla with dental implants (1 to 8) were selected for this study. The patients were divided into three groups (10 patients each) based on preoperative anatomical considerations. Second stage surgery was performed using either the roll flap (group RF) or the apically repositioned flap (group ARF) or an apically repositioned flap combined with a connective tissue graft (group ARFCT). The height and thickness of the keratinized mucosa was measured preoperatively, postoperatively, at 2 weeks and 3 months after surgery. To have a reliable comparison all measures (height and thickness) were performed through a reference guide fixed on the neighbouring teeth.

Results: After three months taking all three techniques together the average gain of thickness and height of keratinised mucosa was 3,3 mm and 4,8 mm, respectively. ARF and ARFCT increased the amount of keratinised mucosa significantly more compared to RF while gain of volume was significantly increased by RF and ARFCT compared to ARF.

Conclusion: From the preliminary results it can be concluded that in case of missing volume a roll flap should be performed while a lack of keratized mucosa indicates the apically repositioned flap. When there is the necessity to increase keratinised mucosa as well as soft tissue volume an apically repositioned flap combined with a free connective tissue graft can be recommended.

49 | Poster – Topic Implant Esthetics

Flapless vis delayed implant placement: aesthetic and radiographic outcome

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Since the maintenance of a harmonious soft tissue contour around anterior maxillary implants is particularly difficult, the aim of our study was to compare gingival aspect and peri-implant bone resorption of flapless technique (associated to immediate temporization) to standard technique.

51 Screw-Vent implant (Zimmer dental, Carlsbad USA) were placed in esthetic anterior region in 37 patients. 23 implants (group A) were placed using flapless technique associated with immediate temporization and 28 implants (group B) using standard submerged technique. A temporary crown was placed at the second stage surgery. Radiographical control (1, 2, 3, 6 months and 1 year) enabled us to evaluate bone resorption for both techniques. Soft tissue contour was also evaluated (1, 2, 3, 6 months and 1 year) for the flapless technique and 6 month and 1 year after implant placement for the standard technique (3 and 6 months after 2nd stage surgery).

Implant survival rate at 1 year was similar. The result of bone resorption at 1 year was comparable (1.1 mm for group A, and 1.03 for group B). Concerning the gingival contour, at 6 month, the flapless technique demonstrated better papilla preservation. However, at one year, there was no statistically significant difference. Regarding the buccal aspect, flapless technique showed more contour modification during the first six months, as a result of uncontrolled bone remodeling.

In conclusion, flapless technique is less invasive and better accepted by the patient, however, the standard technique enable us to enhance the buccal aspect by soft and hard tissue management.

50 | Poster – Topic Implant Surgery

Effects of anodized oxidation implants after using the trabecular compaction techniques

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Objectives: The aim of this study was to compare the bone healing characteristics between anodic oxidation surfaces and machined surfaces after implant installation using the trabecular compaction technique or the conventional drilling technique in the soft bone area.

Material and methods: A total of 72 implants (36 anodic oxidation surface and 36 machined surface implants) were inserted into the distal end of the femur head of 12 dogs by two different surgical techniques. There were four experimental groups: 1) DM group; drilling + machined, 2) DO group; drilling + oxidation, 3) CM group; compaction + machined, 4) CO group; compaction + oxidation. The resonance frequency was measured and six specimens per treatment group were obtained at 0, 3 and 8 weeks postoperatively. Undecalcified ground sections were prepared for histologic and histomorphometric examinations.

Results: At week 0, the trabecular compaction groups showed a higher bone to implant contact ratio (BIC) and a higher implant stability quotient (ISQ) than the conventional drilling groups, regardless of surface types. At week 3, the oxidation groups showed a higher BIC and higher ISQ than the machined groups, regardless of surgical techniques. At week 8, there was no statistically significant difference among the groups. The CO group showed a rapid increase of the BIC from week 0 to week 3 and a higher ISQ at each observation time.

Conclusion: The trabecular compaction technique combined with an anodic oxidation surface increased the bone to implant contact ratio markedly in the early healing phase and could be an effective technique in cases of early loading at the soft bone regions.

51 | Poster – Topic Implant Surgery

A new systematic implant planning concept

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Objectives: Treatment with implants requires accurate preoperative planning. In the primary planning phase, after clinical evaluation of the patient, a thorough analysis of available bone at the possible implant site is mandatory. The purpose is to simplify the primary phase of a new systematic implant planning.
Methods: This presentation represents a semiquantitative classification of available bone. As a standard means of diagnosis, an orthopantomogram (OPT) permits the measurement of the vertical and mesiodistal dimension of available bone at the desired implant site with the help of suitable anatomic references. Based on the clinical evaluation of the dentition and the edentulous site, information about the width of the implant site can be obtained and documented. According to a new concept of systematic planning for implants will be presented in two case reports.
Results: The Anatomical Site Classification for Implant Insertion (ASCIi) is used. The feasibility of the classification for planning and documentation of immediately loaded implants is presented in two case reports. With the system presented the site by site classification of Bone dimension for primary implant planning is substantially simplified. These findings permit systematic primary planning for implants.
Conclusions: Thus the new systematic implant planning (ASCIi-classification) permits a clear protocol of bone findings for the implant case with all information available during the primary appointment for treatment planning as a basis of further diagnostic and therapeutic measures.

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Pre-operative bone quality estimation and primary implant stability

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Aim: This study verified the possibility of an pre-operative estimation of the implant stability at the moment of insertion, via a careful analysis of the cross-sectional images reformatted from axial slices obtained via CT.
Materials and methods: The cross- sectional images (spiral CT, dental CT software) of 35 patients were analysed for the bone quality. From each future implant location (n = 100), 5 different bony areas were scored for their Hounsfield values (both cortices, and the coronal, middle and apical part at the latter implant position), together with a total area evaluation. These Hounsfiefd scores were compared to the cutting torque data (OsseoCare®) recorded during insertion of TiUnite® implants (Nobel Biocare).
Results: The cutting torque data correlated ($p < 0.0001$, $r = 0.50$) with the pre-operatively estimated Hounsfield scores. The formula for this relationship was: Hounsfield value = 184 + 11.5 x OsseoCare® score.
Conclusions: These observations indicate that one can easily predict primary implant stability on the basis of CT scan images. The latter can guide the clinician in the choice between immediate and delayed loading.

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RANKL - OPG ratio is increased in crevicular fluid from implants periimplantitis

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Receptor activator of NF-kappaB ligand (RANKL) and its decor receptor osteoprotegerin (OPG) are key factors in the formation, activity, and survival of bone resorbing osteoclast. Aim of this study was to determine the concentration of soluble RANKL and OPG in crevicular fluid (CF) of dental implants with and without periimplantitis. Twelve subjects with periimplantitis in a total of 16 implants, and ten patients with a total of 12 osseointegrated implants were included in the study. Pocket probing depth (PPD), gingival index (GI), and bleeding on probing (BOP) was determined. Periimplant CF was collected from buccal and lingual with filter paper strips and soluble RANKL and OPG measured by ELISA. In CF from periimplantitis the ratio of soluble RANKL to OPG was higher when compared to healthy subjects. RANKL and OPG levels did not differ between buccal and lingual periimplant CF. RANKL and OPG levels both correlated with the clinical parameters of periimplantitis. These results suggest that periimplantitis is associated with a shift of the RANKL and OPG ratio that favors bone resorption.

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Prospective study on single tooth immediate function: results at 18 months follow-up

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With the trend of shorthening treatment time and patient discomfort, immediate implant loading seems to be an alternative approach

to the original 2-stage surgery with submerged healing. The results of a clinical and radiographical study to evaluate the treatment outcome of single tooth replacement with artificial crowns retained to implants installed according to a 1-stage surgical procedure and immediate function after 18 months, is presented. 10 missing teeth were selected to be replaced with single implant crown restorations. Inclusion criteria were:- single partially edentulous space anterior to the molars, - enough bone for at least a 10 mm fixture,- bilateral occlusal stability,- good oral hygiene,- absence of active periodontitis, - no parafunctions. Exclusion criteria were:- bad general health conditions, - inadequate amount of bone, - type IV bone. Ten threaded implants (5 Replace; Nobel Biocare, Goteborg, Sweden – 5 Osseotite; 3i Implants Innovations, Palm Beach, Florida, USA) were placed.

Standardized periapical radiographs were made after implant insertion. A screw-retained implant-supported provisional prosthesis was placed immediately after the surgery. The crown occlusion was without contacts in maximum intercuspation position and lateral excursions.

Six months after the surgery, impressions were taken and a permanent all ceramic crown was fabricated.

The marginal bone loss at 6 months was, on average, 0.93 mm as compared with the radiograph made immediately after surgery. The corresponding marginal bone loss at 12 months follow-up was 1.49 mm and at the final check up (18 months) 1.51 mm.

The post-loading implant survival rate was 100%.

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Immediate socket preparation after tooth extraction allows flapless implant surgery

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Purpose: Flapless implantation is minimally invasive surgery, though is in a sense very dangerous one. The purpose of this study is to confirm whether or not clinical application of immediately socket preparation after extraction allows flapless implant surgery and what percentage is success rate.

Material & method: Eighteen patients (8 female & 10 male) aged 30 ~ 70 (mean 44.6) without general diseases, non-smokers, were chosen for the study and twenty-two posterior partial edentulous regions in maxilla were examined. Forty Tapered Effect SLA surface Straumann implants (Straumann, Waldenburg, Switzerland) were installed. At the time of tooth extraction, enough buccal and lingual bone walls, of course, medial and distal walls, and enough attached gingiva on both buccal and lingual sides of implantation sites were confirmed, which were important criteria, and immediately, socket preparation which was drilling of implantation hole or osteotomy with trephine and/or sinus elevation with osteotome were performed. After two and half–three months, the above implants were installed as non-submerged method without flap. The patients were followed for a period ranging from 9 to 18 months.

Results: After installation, patients had little pain and swelling as like minimally invasive implant surgery. After about four ~ five months, 39 implants of 40 were confirmed osseointegration, More one month later, restorative treatments were performed. Its success rate was 97.5%.

Conclusion: Clinical application of immediately socket preparation after tooth extraction, following the above criteria, allows flapless implant surgery and its success rate is about the same as conventional implant surgery.

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Simultaneous transmucosal implant placement associated with ridge splitting technique

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Background: Inadequate width of the alveolar ridge present an anatomical limitation to the placement of implants. Recently, the ridge splitting technique has been introduced to reestablish an appropriate alveolar ridge width. This case report demonstrates simultaneous transmucosal implant placement associated with ridge splitting technique and guided tissue regeneration.

Methods: Two male patients (26 and 36years) with mandibular alveolar atrophy were presented. A series of chisel specially designed for splitting technique was used to make a fine cut and spread apart the labial and lingual cortical plates. Strauman ITI implants were simultaneously placed and bony defects were covered with expanded polytetrafluoroethylene membrane. The membrane was removed 4 weeks postsurgery. In both cases, the defect was filled with newly-formed tissue and further healing was uneventful. Restorative treatment was done 5 months after the surgery.

Results: Clinical examination performed over a 2-year after the surgery revealed probing depths around implants of ≤ 3 mm at all sites, without bleeding on probing. A periapical radiograph was taken and showed no radiolucency around implants. A favorable marginal bone level was observed during a follow-up period.

Conclusion: The positive clinical and radiographic results over a 2-year period encourage the use of this technique.

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Alveolar ridge preservation using DFDB and collagen membrane

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Background: The use of GBR in combination with placement of different graft materials in the region of the extraction socket are

techniques designed to preserve and reduce alveolar ridge resorption.

Aim: The purpose of the study was to evaluate effects of application of demineralized freeze-dried bone (DFDB) in combination with collagen membrane in the alveolar socket region after immediate implant placement on reduction of alveolar ridge resorption.

Materials and methods: Twenty patients participated in this study. All patients were planned for extraction of one or more compromised teeth. Following extraction of teeth, 20 ITI implants were placed into alveolar sockets. In 10 cases empty space between implant surface and socket walls were filled with DFDB and completely covered with collagen membrane (experimental group). In control group (10 extraction sockets) only ITI implants were placed. Re-entry procedure for abutment connection was performed 6 months following the extractions and the first surgical procedure.

Results: Reentry results in experimental group showed significantly higher level of reduction of vertical ridge resorption in comparation with results achieved in control group (0.4 ± 0.12 mm vs. 2.1 ± 0.41 mm, $p < 0.01$). Bone fill of defects around implants in experimental group exhibited mean value of 2.5 ± 0.37 mm in comparation with 1.1 ± 0.30 mm of bone fill achieved in control group.

Conclusion: The use of DFDB graft associated with collagen membrane during immediate implant placement demonstrated to be predictable procedure for effective alveolar ridge preservation.

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Bone response to implants placed in gap with varying depths

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Objectives: During immediate implantation a space between implant and bone is a common finding. This study was to investigate the bone growth pattern in a defective bone area with various depth.

Materials and methods: Four mongrel dogs have been used. Mandibular premolars were extracted and left to heal for two months. Test sites (T1, T2) and control (C) were prepared on both sides of mandible. Using a step drill, bone defects with width of 5.3 mm and depth of 2.5 mm for T1 and 5.0 mm for T2 were prepared. In each site implants 3.3 mm diameter and 10 mm length were placed. They were all submerged. There were eight T1 and T2 test sites and 7 control sites. Four of each test sites and control were block dissected after 8 weeks of healing and remainders at week 12 for ground sectioning and histological examination.

Results: In the test sites of both week 8 and 12 were fully filled with bone in the defective area. The mean of Bone-Implant Contact (BIC) of control at week 8 was 44.1%, 28.0% for T1 and 29.3% for T2. The test sites' mean was lower than the control but there was no significance between the test sites, T1 and T2. In week 12, the control BIC was 58.2% and depth defect of 2.5 mm had higher BIC of 49.5%. However, in the 5 mm defect area, the BIC was 38.3%.

Conclusion: Within the limits of this study it can be concluded that the bone healing between an implant and marginal bone was compromised at a greater defect in depth when the width of the bone defect was 1.5 mm.

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Early functional loading of Branemark implants in edentulous maxilla

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Background: the predictability of implant supported fixed restorations with immediate or early loading in the lower anterior area have been well reported. In the maxilla, few studies have indicated this possibility.

Purpose: the purpose of this study was to test the behaviour of Bränemark implants placed in edentulous maxilla when early functional loading is performed 1 to 5 days after surgery.

Material and methods: this clinical study included 14 patients with 126 implants installed. Provisional upper screw retained restorations were screwed in within a 1 to 5 day-delay. Ten implants were not incorporated in the provisional prostheses.

Results: 6 early functional loaded implants were lost in 2 patients. The cumulative survival rate is 94.4% after one year. The restoration's survival rate is 100%.

Conclusions: this study based on a 1 to 5 years observation period shows the possibility to load Bränemark implants in the maxilla 1 to 5. Days after placement with a fixed provisional rigid cross-arch screw-retained bridge.

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Bacterial adhesion on TiN-coated and uncoated transmucosal healing screw: an in-vivo human study

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Objectives: Titanium nitride (TiN) has been used in many fields as a coating of surgical instruments and in osteointregrated Implant Surface (P.H.I., Milano, Italy), with the purpose of obtaining surgical materials more resistant to wear and corrosion. Aim of the present study was an *in vivo* evaluation of the bacterial adhesion to TiN coated (test) and uncoated (control) Transmucosal Healing Screws.

Methods and material: Ten patients, aged between 25 and 32 years and in excellent systemic health, participated in the study. All the participants gave their informed consent. The participants

were selected on the basis of a good periodontal health and no signs of mouth breathing. In each of the 10 participants, a removable acrylic device was adapted to the molar-premolar region of each quadrant of the jaws. Three titanium healing screw (P.H.I., San Vittore Olona, Milano, Italy) was glued to the buccal aspect of each device. Machined titanium covered the entire surface of the screws. Two Test Screws were glued to the right devices and two control Screws were glued to the left devices. After 24 hours, the Screws were removed from each device and processed for scanning electron microscopy for evaluation of the surfaces portion of the Healing Screws covered by bacteria. A total of 40 healing screws were used in this study, 20 tests and 20 controls. Surface characterization of the machined portion of the healing screws was performed on an additional 20 healing screws (10 tests and 10 controls).

Results: On test implants the healing screws surfaces covered by bacteria was significantly lower compared to that of control healing screws ($P = 0.0001$). The surface roughness was similar in both groups.

Conclusion: TiN surfaces showed a significant reduction of the presence of bacteria, and this fact could probably be important in the decrease of the inflammation of the peri-implant soft tissues.

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Radiographic Changes of Immediately Restored Implants In Periodontally Susceptible Patients

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Objectives: 1. to evaluate the radiographic bone level changes (ΔCB) of immediately loaded (L) vs. non loaded (NL) dental implants. 2. to compare radiographic bone level changes between jaws and between healed and extraction sites in periodontally compromised patients.

Materials and methods: Chronic periodontitis patients with hopeless teeth received initial periodontal therapy after which implant surgery was performed and a provisional restoration immediately provided on part of the implants. Results are reported in mm as mean ± SE of bone level changes between insertion, 6 and 12 months.

Results: 74 implants were inserted in nineteen patients, receiving 3 maxillary and 2 mandibular full arch cases, 7 maxillary and 5 mandibular partial arch cases and 5 single tooth cases, one of which was mandibular. 12 implants failed, resulting in an overall of 84% survival rate, 78% in the maxilla and 94% in the mandible. L implants in extraction sites had a 65% survival rate vs. 94% in healed non extraction sites. NL implants placed in extraction sites had an 86% survival rate vs. 100% in healed non extraction sites. For L vs. NL groups CB0–6 months was -0.99 ± 0.13 vs. -0.81 ± 0.16 ($p > 0.05$), ΔCB6–12 months was -0.24 ± 0.13 vs. -0.81 ± 0.13 ($p < 0.05$) and ΔCB0–12 months was -1.12 ± 0.18 vs. -1.67 ± 0.17 ($p > 0.05$). There were no differences in ΔCB at any time-point in extraction vs. non-extraction or in maxillary vs. mandibular implants.

Conclusions: 1. Bone level changes in loaded implants do not differ from those in unloaded implants. 2. Bone level changes of loaded implants are within range reported.

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Implants Placed Immediately Into Fresh Extraction Sites Of Molar Teeth

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The present study is designed to evaluate the clinical treatment outcomes of immediate transmucosal implants placed into extraction sockets of molar, with concomitant application of bone augmentation. Twelve patients who needed the extraction of one single molar tooth were treated with immediate placement of an ITI® (Straumann AG, Waldenburg. Switzerland) implant. At the time of implantation all implants presented dehiscence defects of the alveolar bone partly exposing the cylindrical, screw shaped, tapered TE ITI® surfaces. Guided bone regeneration were performed simultaneously by the use of deproteinized bovine bone mineraI (Bio-Oss®) filled into the defect around the implant. This were covered with a resorbable collagen membrane (Bio Gide®) adapting around the neck of the implant. Clinical measurements were taken at 6 sites around each implant using a calibrated periodontal probe. These inc1uded: 1) defect depht measured frame the shoulder of the implant to the first bone-to-implant contact; 2) infrabony defect component measured from the bone crest to the first bone-to-implant contact; 3) defect width measured from the crest to the implant body. Radiological and clinical parameters were measured at the time of implants placement and al 1,3,6,12-month follow up. Prosthetic rehabilitation were performed 3 months after surgery by the use of a resin crown for 30+/− 10 days and subsequently by porcelain fused 10 metal crown.

In conclusion the present study showed !hat the immediate placement or transmucosal implants into an extraction socket of a molar site, combined with deproteinized bovine bone mineral and resorbable collagen membrane is a safe and successful procedure that can be used also in sites with peri-implant defect.

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Periimplant Bone Reactions To Different Microgap Designs In Two-Stage Implants

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The vertical location of the implant-abutment-interface (microgap) is known to influence periimplant bone levels. To what extent different microgap designs cause bone reactions is unclear though. Therefore the aim of this histometric dog study was to compare the bone morphology of two different implant systems. Three months after mandibular tooth extraction in 8 mongrel dogs, an oxidized screw implant with external hex (3.75 × 8.5 mm; TiUnite®, Nobel Biocare;TIU group) was placed on one side whereas the contralateral side received a grit-blasted screw implant with internal Morse taper (3.5 × 8 mm;ANKYLOS®,Dentsply Friadent; ANK group). Both implants were placed level with the ridge. After three months healing abutments were installed. Three months after surgical uncovering, the vertical distance between the periimplant bone and the microgap (PBL), the vertical distance between the first bone-to-implant contact point and the microgap (BICP), the horizontal distance between the periimplant bone and the outer implant length axis (HD), and the steepness of the periimplant bone slope (SLO) were histometrically assessed. Healing was uneventful in all implants. No significant differences ($p > 0.05$) between the groups could be detected in PBL (TIU: -0.91 ± 0.48 mm;ANK: -0.69 ± 0.47 mm), BICP (TIU: -1.53 ± 0.43 mm;ANK: -1.61 ± 0.97 mm), and HD (TIU: -0.51 ± 0.32 mm;ANK: -0.23 ± 0.23 mm), but a clear tendency in favor of the ANK group was visible. Significant differences existed, however, regarding SLO (TIU: $63{,}22^\circ \pm 16{,}75^\circ$; ANK: $35{,}36^\circ \pm 25{,}79^\circ$; $p < 0.001$, all paired t tests). Within the study limits it is concluded that different microgap designs can influence the morphology of the periimplant bone. This may be of clinical interest whenever periimplant bone maintenance is crucial for the long term success of an implant restoration.

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Implant-Patients After

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Introduction: Bone-resorption of 3–4 mm in both buccolingual and apicoronal direction following tooth extraction is the major problem for an implant-placement 4–6 months after the extraction according to the standard-protocol. Meanwhile immediate implant-placement is a common procedure, but the primary stability of the implants is very often compromised, especially after the extraction of the first or second molar in the maxilla and in patients with severe periodontal bone-loss.

Alveolar ridge and socket-grafting after the extraction will maintain the normal alveolar ridge architecture and an adequate soft-tissue-support.

Material and methods: From 12/2001–12/2004 64 implants were placed following the extraction of the first or second molars in patients with severe periodontal bone-loss.The alveolar ridge and socket grafting after the extraction was performed according to our surgical protocol:

- extraction of the teeth
- removing of all the inflammated soft-tissue
- augmentation with Bio-Oss® and autogenous bone with venous blood

The augmented defects were covered by a collagenous membrane (Bio-Guide®) without primary closure of the defect, allowing the maintainance of the normal ridge-configuration and especially the maintainance of the attached gingiva on the buccal side. 6 months after the augmentation implants were placed in the maxilla in combination with sinus-elevation in one-stage surgery. The uncovering of the implants was carried out 6 months after the implant-placement. All implants placed had a minimum implant-length of 11.5 mm with high primary stability (minimum torque of 20 ncm). All implants were uncovered approximately 6 months after the placement and the final restoration was carried out with implants supported porcelain-fused crowns.

Results: We lost 2 implants according to an insufficient stability after the 6 months healing-period.

Table 1

Patients	female	Male	total implants	implant-average	implant-loss
16	11	5	64	20–22 months	2

We had no further implant-losses after the adaption of the restoration.

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Resonance frequency analysis of early loaded palatal implants

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Aim: To investigate the behaviour of early loaded palatal implants when observed with Resonance Frequency Analysis (RFA).

Subjects and methods: Twenty patients (mean age 26,4 years) received one palatal implant each (Orthosystem®, Institut Straumann, Switzerland) in order to achieve maximum orthodontic anchorage. The implant, a single-unit self-tapping type with a length of 4 mm and a diameter of 3.3 mm, was placed transmucosally. The palatal implants' stability was observed by RFA. Measurements were carried out at time of surgery, after first loading, and subsequently once a week over a period of 12 weeks. The L-shaped transducer was connected with the

Osstell™-measuring device, which automatically translated the resonance frequency value into an Implant Stability Quotient (ISQ).
Results: Two palatal implants were lost after an average time of 12 days post surgery while loaded. The other 18 remained stable for the observation period.

The average period from insertion to early loading was 6,7 ± 0,8 days. The mean force applied during orthodontic therapy was up to 400cN. The ISQ-value at time of surgery averaged 69,4 ± 3,9. The mean ISQ value 6,7 days after insertion was 69,8 ± 3,6. Twelve weeks post surgery the mean ISQ value was 69,8 ± 3,5. Statistically a significant difference was observed between the mean ISQ values measured after 1 week (ISQ = 69,7 ± 3,34) and 2 weeks (ISQ = 67,9 ± 4,6).
Conclusion: Within the limitations of this study, the results suggest that the healing time of palatal implants reported in the literature (12 weeks) should be discussed. A loading of palatal implants 42 days post surgery seems to be justified.

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Autologous fibrin glue for closing sinus membrane perforation

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Sinus lift procedures depend greatly on fragile structures and anatomical variations. These procedures may cause sinus membrane perforations, which can lead to graft infection and early failure. The aim of this study was to assess the efficacy of autologous fibrin glue in the management of large perforations of the maxillary sinus membrane occurring during sinus lifts. After elevating the sinus membrane in the bilateral maxillary sinuses of six adult female mongrel dogs, a laceration (about 2.0 cm in length) was made in the membrane and either repaired with autologous fibrin glue or covered with a bioabsorbable collagen membrane as a control. Wounded areas were biopsied 2 weeks after the operation. Wounds repaired with autologous fibrin glue showed newly formed continuous epithelium across the previous perforation site. However, extensive fibrosis, inflammatory infiltration, and absent epithelium were observed in wounds treated with collagen membrane. Our results support the clinical use of autologous fibrin glue for repairing sinus membrane perforations.

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The effect of dental implants placed in the maxillary sinus on sinus function

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Purpose: The aim of this study was to investigate whether dental implants exposed to the maxillary sinus increase the risk of maxillary sinus complications.
Materials and methods: A study was undertaken in five adult female mongrel dogs. Implants were placed bilaterally in the maxillary sinus in such a way that they penetrated the bone and mucous membrane of the maxillary sinus to the extent of either 4 mm or 8 mm.The implants were then left for 6 months.
Results: Radiographic and histologic examinations did not show any signs of maxillary sinusitis in all of the five dogs.
Conclusion: This study indicates that the protrusion of implants into the maxillary sinus cavity is not related to the development of sinus complications.

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Possibility of immediate loading in a severely resorbed mandibular molar region

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Objectives: The purpose of this study was to modify the method of implant placement using the osteotome technique with the aim of immediately loading in a severely resorbed posterior part of the mandible. This study was a histopathological investigation of bone formation around the implant and nerve injury after implant placement in dogs with this method.
Methods: Two months after extraction of the 4th premolars of the mandible, titanium endosseous implants were inserted using the osteotome technique in 3 adult mongrel dogs. An initial hole was made at the implant site by drilling through cortical bone. The osteotome was then inserted into the pilot hole along the buccal cortical plate, until it arrived at the bottom of the mandible. After the osteotomy was enlarged by sequentially inserting larger osteotomes, a custom-ordered cuneiform implant (KYOCERA Co., Kyoto, Japan) was inserted. After the surgery, abutments and acrylic resin superstructures were placed immediately. The animals were sacrificed at 5 and 10 weeks after surgery for histological examination.
Results: In cases of implant placement without potential damage to the inferior alveolar nerve, histological examination showed virtually normal findings. At 5 weeks after surgery,

histologic analysis revealed newly formed bone around the implant. At 10 weeks after implantation, nearly mature bone formation was seen at the neck and bottom of the implants, and the surface of the implants was attached firmly to the surrounding osseous tissues.

Conclusion: This minimally invasive surgical procedure should be applicable for treatment of severely resorbed mandibular molar region with implant-supported prostheses.

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Sinus membrane lifting with lateral grooving technique: a new surgical technique for maxillary sinus floor augmentation.

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Background: Various maxillary sinus floor augmentation techniques using bone grafts and bone substitutes are frequently used to enable placement of dental implants in the posterior maxilla. Many review articles was introduced the possibility of promoting bone formation in the sinus by lifting with membrane and high success rate of sinus lifting. However, the predictability and simplicity of this techniques is not known.

Purpose: The aim of this study was to introduce new surgical technique for maxillary sinus lifting and utility of lateral grooving techniques. Second aim of this study was to investigate whether sinus membrane elevation with lateral grooving technique and the simultaneous insertion of titanium implant and success rate of various sinus lifting techniques.

Materials and methods: The study group comprised 10 patients in whom a total of 10 maxillary sinus floor augmentations were performed. Lateral window techniques and Lateral grooving techniques were performed 10cases respectively. Bone height was measured directly at each implant site at the time of insertion. Panoramic radiograph was performed at the immediate postoperative period and 6 months later, prior to exposure of the implants.

Results: A total of 24 implants (Pitt-Easy Bio-Oss Implants System. Oraltronics Bremen, Germany) in lengths of 10 to 14 mm were placed, with an average residual bone height of 6 mm (range, 4–10 mm). All implants remained clinically stable during the study period. Comparisons of pre- and postoperative panoramic radiograpy clearly demonstrated new bone formation within the compartment created by the sinus membrane elevation technique.

Conclusions: There was greater potential for healing and bone formation in the maxillary sinus with lateral grooving techniques. The survival rate for lateral grooving techniques and simultaneous insertion of Pitt-Easy Bio-Oss implants in maxilla is higher than lateral window techniques and simultaneous insertion of implants. The precise measurement methods are not known and further long term follow-up checks are needed..

Keywords: dental implants, survival rate, lateral grooving techniques, lateral window techniques, Pitt-Easy implant

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Stability time dependence of loaded and unloaded dental implants

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Objectives: The aim of this study was to determine the effect of primary stability and loading on stability time dependence.

Methods: The study included 21 mandibular screw-form Impladent STI-Bio implants whose stability was measured using an Osstell device (Integration Diagnostics AB, Sweden). The implants were divided into 3 groups. Group IL1 consisted of 10 immediately loaded implants measured at the time of placement and after 23weeks of healing. Group IL2 consisted of 6 immediately loaded implants, which were measured periodically (once a week) up to 9 weeks. Group UL was composed of 5 unloaded implants monitored once a week up to 13 weeks healing period.

Results: The mean primary stability of implants in groups IL1, IL2, UL was 66.1 $\pm$ 2.9, 68.9 $\pm$ 4.1 and 73.1 $\pm$ 10.2 respectively. The mean stability of IL1 group increased after 23 weeks to 70.0 $\pm$ 1.9 and this increase was statistically significant ($p = 0.01$). The stability changes of the IL2 and UL groups remained insignificant. All implants were clinically stable at the end of the monitoring period.

Implants with a high primary stability (ISQ >70) showed a stability decrease in all groups. Primarily middle-stable implants (ISQ 66–70) remained unchanged. Implants with a low primary stability (ISQ <65) showed a significant stability increase in the groups IL1 and UL.

Conclusions: Although based on a limited number of cases, these results showed that both loaded and unloaded implants in all groups, regardless of their primary stability, reach a stability value in the range of 67–70 ISQ at the end of the monitoring period.

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Bone remodelling after one-stage surgery implant placement in the posterior mandible

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Objectives: With implants placed with a 2-stage surgical procedure, a crestal bone loss of approximately 1 mm generally occurs during the first year and approximately 0.2 mm annually after. The aim of our study was to analyse the marginal bone remodelling at various implant systems placed in the posterior mandible following a 1-stage surgical procedure.

Material and method: 52 partially edentulous patients received a total of 127 dental implants in the posterior mandibular area between September 2003 and December 2004: 106 one-piece implants (53 Straumann® TE and 53 Replace® Select Straight) and 21 2-piece implants (Brånemark System® MK 4). All

implants were placed in a single-stage procedure, non-submerged; attempts were made to place 1-piece implants with the rough surface, but not the smooth neck, at an intrabony level. All implants were restored by means of single crowns or of 3 to 4 unit bridges. X-rays were taken at the time of surgery, 6 weeks post-surgery and within 6 weeks to 14 months after loading. The X-rays were digitalized and the crestal bone level at the mesial and distal aspects of each fixture was determined.

Results: After loading, the bone level reached the 1st thread for 47.1% of TE, 31.4% of Replace and 64.3% of Mk4, at the 2nd thread for 23.6% of TE, 45.3% of Replace and 26.2% of Mk4 and at the 3rd thread for 15.1% of TE, 13.2% of Replace and 7.1% of Mk4 (bone location at the 1st thread corresponds to a 1.2–1.6 mm bone loss on TE, but to 0.3 to 0.8 mm on Replace/Mk4; the 2nd thread is at 2.0 to 2.4 mm on TE, at 0.9 to 1.6 mm on Replace/Mk4). Grossly 50% of the bone loss had already occurred 6w post-surgery in all implant types. On implants having lost bone till or over the 3rd thread, absence of fibrous mucosa with high muscular insertion and/or bruxism could most often be noted.

Conclusions: It can be concluded from these data that the pattern of bone remodelling is comparable on 1- or 2-piece implants placed following a 1-stage approach. The rough surface alone most often failed to retain the bone level on TE implants; the bone level reached the first or second thread on a majority of implants, independently of their type.

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The effect of primary stability on early loaded implants

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Purpose: The purpose of this study was to evaluate the parameters affecting the primary stability of implants and to determine the effect of primary stability on the stability development during loading.

Materials and methods: 34 patients received 90 screw implants (Impladent, STI-Bio). 53 (58.9%) were placed in the mandible and 48 implants (41.1%) in the maxilla. Implants were loaded 4 weeks after insertion. Implant stability quotient (ISQ) was measured using Osstell instrument (Integration Diagnostics AB, Sweden) at implant placement and after 1, 4 and 13 weeks of healing. Insertion torque (q) was estimated using torque ratchet.

Results: The mean primary stability (ISQp) of mandibular and maxillary implants was 63.6 ± 8.9 ($n = 37$) and 57.8 ± 5.6 ($n = 53$) respectively and the difference was significant ($p = 0.0003$). The difference in ISQp of implants with diameter 3.7 mm ($n = 60$; ISQp $= 62.4 \pm 6.6$) and those with diameter 5.0 mm ($n = 30$; ISQp $= 59.0 \pm 5.7$) was significant ($p < 0.05$). The ISQp increased significantly with increasing bone density (according to Lekholm and Zarb). Implants with low ISQp (< 50) and implants with medium ISQp (50–60) reached the mean ISQ value (after 13 weeks) of 54.6 ± 5.6 and 56.0 ± 2.7 resp. and the difference was insignificant ($p = 0.3$). Implants with high primary ISQp (ISQp > 60) showed significantly higher ISQ value (62.1 ± 4.9; $p = 2.10^{-8}$) than the implants in the medium ISQp group. The plot of ISQp versus q showed a linear correlation with the R^2 value of 0.94.

Conclusion: The insertion torque, the bone density and the implant diameter significantly affect the primary stability (ISQp). Loaded implants with higher ISQp reach higher ISQ after 13 weeks.

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A 1 and 5 years clinical study of implants after sinus floor elevation.

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Objectives: The objectives of this study were (1) to evaluate the survival of implants placed in the maxillary sinus augmented with a mixture of 70:30 of autogenous bone and Bio-Oss at 1 and 5 years, (2) to observe the difference in success between one-stage and two-stage procedure and (3) to compare rough-surfaced implants versus machine-surfaced implants.

Experimental methods: 48 maxillary sinus in 30 consecutive patients were augmented with a lateral osteotomy technique. One stage approach was used for 11 sinus when the Tomography evaluation of residual bone under the floor of the sinus was $\geq 4,5$ mm (mean 5,3 mm), and two stage for 37 sinus when this parameter was below (mean 2,5 mm). 140 implants: 62 Frialit-2 System implants with rough surface and 78 Branemark MK II machined implants were placed.

Results: Of the 140 implants inserted 6 were not integrated at uncovering time for an overall survival rate of 95,7%. At the 1 year control 1 implant was mobile for relative success rate of 99,2% and cumulative of 95%. In the 12 pazients with a total of 48 implants evaluated at 5 years the relative success rate was 97,9%. Implant failure in the simultaneous procedure was statistically superior to the staged procedure. Machined implants had an higher failure rate than roughed implants, however, this difference was not statistically significant.

Conclusions: a combination of autogenous bone and Bio-Oss in the sinus lift technique showed a high rate of success, also with a minimal amount of residual bone present.

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Immediate placement and provisionalization of single implants

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Aim: To evaluate the radiological, clinical and aesthetical implantation success in four post extraction implants in the superior (Upper) maxillary region, with a follow up of 12 months.

Material and methods: Four patients were used in this study (3 females and 1 male). One Nobel Direct (Nobel Biocare, Yorba Linda, CA USA) implant was inserted in post extract sites using the ''flapless'' technique and provisionalized immediately.

The definitive prosthetic restoration took place 3 months later.

In order to evaluate mesial and distal marginal bone loss, radiological checks took place using the ''Rinn'' method at 1, 3, 6 and 12 months.

Results: At 12 months all the implants are osseointegrated. The radiographic exams showed evidence of an average mesial and distal bone loss equal to -0.50 mm.

Clinically, preservation of the mesial and distal papillae was obtained along with optimal aesthetic results.

Conclusion: In the post extraction site, the ''one piece'' implant allows us to maintain an almost unaltered marginal bone loss along with conservation of interdental papillae, both thanks to flapless surgery procedure. This allows us to obtain and maintain an optimal result both clinically and aesthetically.

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Interim restoration prior complex oral rehabilitation using immediate loaded implants

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Objective: In cases of complex implant supported restorations in combination with multiple extractions prior to augmentation and implantation patients desire fixed provisional restorations. Additionally soft tissue-supported dentures may lead to irritation of the augmented bone.

Materials and Methods: 24 patients undergoing complex bone transplantation procedures received from 2002 to 2004 73 XIVE™ implants with a reduced diameter (3.0 mm to 3.4 mm) mainly in the upper jaw (59 implants). One to four Implants with the grit blasted/acid etched/neutralized surface (Friadent CellPlus®) were inserted to support remaining teeth or be loaded on its own by a bridge with a metal framework within one week. Until definitive restoration was integrated the patient had always a fixed provisional.

Results: All restorations proved. Patients were very satisfied with the fixed provisional restoration and noticed a significant improvement of the oral situation prior to treatment especially those who had already a removable denture (9 patients).

From the 73 implants loaded immediately one had to be removed because of loss of Osseointegration. All other implants could consequently be integrated in the definite restoration. The average bone loss of the remaining 72 implants measured on the x-ray was about 1.6 mm after a period of at least 12 month.

Conclusion: It can be concluded that Implants with a reduced diameter can be used for supporting a provisional restoration in patients undergoing complex oral rehabilitations. In contrast to other provisional implants which have to be removed the implants with the new surface could be integrated in the definitive restoration.

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Bone reactions with one stage, subcrestal, Morse taper implants

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Objectives: The purpose of this study is designed to determine if the subcrestal location of two-piece implant influences the level of peri-implant bone with Morse-taper design.

Material and Methods: In the healed sites of the first mandibular molar loss Ankylos® (Dentsply-Friadent GmbH, Hanau/ Germany) implants are placed in one-stage. After three months implants are restored with a metal post and a metal-ceramic crown in functional intercuspation. Radiographic retrospective evaluation of the bone level around single dental implant and their adjacent teeth was performed with standardised right-angle holder to evaluate the alveolar ridge. Radiographs have been taken at baseline, 3, 9, 12, 18 months postoperatively. The most coronal crestal bone and the most coronal bone to implant are located on the radiographs to the top of implant and the enamel-cement junction of adjacent teeth.

Results: Twenty four (24) implants were placed at 1.5 mm +/ -0.5 mm under level to the alveolar crest. The implant length ranges from 9.5 to 11 mm with diameter of 4.5 mm.During the time frame of the observations there was neither loss nor loosening of an implant. There is not vertical bone lost detected around the peri-implant bone.

Conclusion: The results of this study suggest that the marginal bone level from the time of implant placement can be preserved with one-stage, subcrestal, two-piece Morse-taper implant in mandibula.

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CT scanning image analysis for implant installation: Problems and solutions

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Due to the rapid increase of multi-slicing medical computer tomographic (CT) machines, 3D reconstruction and diagnosis of the maxiilo-mandibular bone complex in implant treatments became relatively easy among dental clinicians. Moreover, with the recent development of the dental come-beam CT machine, the safety and reliability of implant placement operation have been greatly improved. Along with the development of CT machines, many diagnostic software as well as navigation systems for implant operation also have been introduced.

Although there are still some inherent problems in existing CT machine such as distortions up to 10%, some clinicians do not recognize these problems and relay heavily on these diagnostic software and/or navigation system without any doubt.

The purpose of our study was to elucidate the problems of existing CT machines and method of data acquisition, and to give cautions in using CT image data and the navigation for implant placement.

Existing problems of CT machine are such as follows;

1) With using medical CT, images are usually enlarged in the axial direction due to the movement of the machine table.
2) Accuracy of CT value (Hounsfield units) and its calibration is questionable.
3) Artifact such as metallic ones cannot be avoided.
4) Some cone-beam CT machine using CCD-II do not have accurate quantitative correction.

In our presentation, we will discuss these problems one by one and propose possible solutions.

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Sinus floor augmentation and simultaneous implant placement: analysis of implant stability

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Empirically, for implant placement associated with sinus floor augmentation a minimum of four mm of residual crestal bone height has been recommended in order to achieve a sufficient initial stability. It has been the aim of the study to test this assumption in an experimental animal trial.

In four minipigs three premolars and two molars were removed on both sides of the maxilla. Three months later the height of the alveolar crest was reduced to 2, 4, 6 and 8 mm, resp. 6 implants (Xive, Dentsply Friadent, diameter 3.8 mm, length 13 mm) were placed on each side of the maxilla and a sinus floor augmentation was carried out. Implant stability was assessed by resonance frequency analysis at the time of implant placement (To), after six months of unloaded healing (T1) and after 6 months of functional loading (T2).

The statistical analysis of implant stability data revealed a correlation between crestal bone height and implant stability at To ($P = 0.023$) and at T1 ($P = 0.044$). At T2, there was no longer a statistically significant correlation ($P = 0.114$). For the different residual alveolar crest bone heights there was only one statistically significant difference in implant stability at T1 between the implant stability in a two mm high residual alveolar crest (ISQ 69.5 ± 5.5) and an eight mm high residual alveolar crest.

This study was supported by a grant of Friadent GmbH, Mannheim, Germany. (76.2 ± 8.0, $P = 0.009$).

From an experimental point of view, the assumption that 4 mm residual crestal bone height are a relevant threshold for simultaneous implant placement and sinus floor augmentation, is not supported.

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Survival and marginal bone loss rates of tapered implants: 51-month results

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Background: Several manufacturers have introduced tapered screw implant designs, but little has been published on their long-term functioning, especially with regard to marginal bone levels. This prospective study evaluated tapered screw implants placed with a variety of compromising clinical variables.

Materials and methods: Sixty patients were treated with 219 implants; each case included one or more clinical variables generally associated with increased rates of implant failure or periimplant bone loss: periodontitis (23%), type-1 diabetes (2%), short implants (50%) maxillary implants (61%), partial edentulism (97%) and placement into extraction sockets (91%). The implants were restored with a variety of restorations. Marginal bone changes were calculated utilizing periapical radiographs taken at placement and last clinical follow-up utilizing a standardized paralleling device and a 1 mm grid system.

Results: Implants were clinically monitored for an average of 51 months (range: 1–81 months). Four implants failed to integrate and were immediately replaced by wide-diameter implants. Seven crowns sustained porcelain fracture ($n = 6$) or cement failure ($n = 1$) and were replaced. No periimplant marginal bone loss was observed for 98% of the implants; the remaining 2% exhibited 1 mm of bone loss.

Discussion: The implants achieved stability regardless of bone quality, implant length or the other compromising variables involved. Concerns that tapered implant designs may be more prone to crestal bone loss than cylinder designs are unsupported by the results of this study.

Conclusions: The tapered implant design maintained integration and marginal bone levels despite the presence of one or more compromising variables.

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Total fixed implant-prosthodontic reconstructions in the maxilla

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Complete fixed reconstructions of the entire dental row still pose a great esthetic challenge for implant dentistry. While the osseointegration of the implant bodies can be considered as given, a comprehensive assessment of all structures in the maxilla is still required for the soft-tissue esthetics. The esthetic demands are frequently assessed simply by fabrication of a facial mask. However, for hygiene reasons this always requires a removable superstructure, but most patients consider this no more than a compromise solution. For this reason the primary fixed reconstruction must be developed with the subsequent prosthetic solution in mind from the

earliest stages of planning. Because edentulism in older people is generally the result of periodontal atrophy processes, in many of these cases the primary consideration is the reconstruction of the atrophied alveolar ridge by grafting procedures. Grafting enables not only delivery of the required implant lengths and diameters but also, and most important, the required reconstruction of the positions of the alveolar ridges with reference to each other and also their relationship to the surrounding tissue, such as lips and cheeks. For example, the result is that a vertical superposition of the maxilla must be considered even if a sinus-floor elevation could provide sufficient implant stability. This presentation discusses these questions by describing the surgical and prosthetic measures and their results as derived from selected case histories.

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Minimum number of implants for the edentulous mandible

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In our previous study (IADR2004), we found that 4 implants placement with the high anterior-posterior (AP) ratio can effectively reestablish the stable occlusal support using a simple 3D finite element mandible model. Connecting the wide spread 4 implants throughout the mandible, however, should be considered in terms of mandibular bone deformation and the stress concentration at implants.

The purpose of this study was to examine the influence of number and location of implants on stress distribution and deformation of the mandible with various superstructure designs and materials using 3D finite element edentulous mandible models with muscle vectors. In this study, we once again tried to examine the efficacy of 4 implants configuration in re-establishing the similar occlusal support as the 14 implants using the improved 3D finite element model. In this model, it was possible to install implants into the bone as we clinically do.

In terms of the deformation and stress distribution in the mandible, 4 implants placement (two in canine area and two in molar area) showed the similar effect as the 14 implants placement. In terms of the stress concentration in and around implants, the super structure with metal material showed higher value than with resin material.

From our current results, we can suggest to connect anterior two implants using the metal structure and to leave un-connect posterior two implants by placing attachments using an overdenture in terms of mandibular bone deformation and the stress concentration in the 4 implants configuration.

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Tooth-Implant Supported RPDs: a 3-D Finite Element Study

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Objective: To evaluate the efficacy of using a single posterior implant as a support and a stabilizer of distal extension RPDs, a 3-D finite element analysis was used.

Methods: In the 3-D FE program, four mandibles wearing distal extension RPDs with left and right canines as natural abutments were modeled. On the first model, no implants were placed. On the second, third and fourth models, left and right single posterior implants(Oneplant, Warantec, Korea) were placed, and on each models, ball & socket, zest anchor and magnet were used as abutment systems connecting the implants and the RPDs, respectively. On all the four models, a 100N of occlusal forces were applied and the amount and the distribution pattern of load transfer to natural abutments, peri-abutment tissues, and peri-implant tissues were evaluated.

Results: Maximum Effective Stress [MPa]

	Peri-abutment tissue	Natural abutment	Peri-implant tissue
No implants	1.10	525.87	1.21
Ball & socket	0.53	73.28	136.66
Zest anchor	0.36	208.21	77.45
Magnet	0.29	235.40	74.10

Conclusions: Posterior single implants significantly decreased the amount of load transfer to the peri-abutment tissues. Among the abutment systems used in the present study, ball & socket significantly decreased the amount of load transfer to natural abutments, whereas zest anchor and magnet significantly decreased the amount of load transfer to peri-implant tissues.

This study was supported by a grant of the Korea Health 21 Project, Ministry of Health and Welfare, Republic of Korea.

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Implant or conventional resection therapy in molar with furcation involvement

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The periodontitists may choose to treat maxillary molar furcation involvements (FI) utilizing a root resection technique because of the inconsistent results of periodontal and prosthetic therapy. Indition, poor root morphology of the remaining root following root resection technique is usually considered a high risk factor for long-term periodontal and prosthetic success. Utilizing implant supported fixed partial prosthesis to replace the maxillary molar with FI seems

to have a good prognosis to maintain the function and alveolar bone volume. But the destruction of periodontitis might reduce the height and width of supporting bone to prop the implant to have primary stability. So, sinus floor augmentation was needed to create a adequate bone field but it also took 6 to 12 months to wait the new bone formation in severe atrophy alveolar ridge.

The purpose of this retrospective study was to investigate difference in the period of the treatment courses and the degree of patient's satisfaction between in maxillary molars with FI which were treated by resection technique or replaced by implants. A total 38 abutments (21 implant, 17 molar after resection surgery, with successful fixed prosthodontic treatment,) show that more patient were satisfied with endosseous implant therapy included in functional and treatment procedures, and it also took less chair time even all patient had had a open window sinus elevation. The author recommended that endosseous implant to replace the maxillary molar with FI (> Grade II) provided a good results than conventional rescetion therapy.

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Clinical experiences with new cercon ceramic abutment used for single tooth replacement

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The poster presents clinical experiences with the ceramic abutment (cercon-abutment) using the Ankylos® implant system for anterior single tooth replacement after 42 month follow up. The purpose of this research was to study the mechanical property of the ceramic abutment, the periimplant tissue reaction and the aesthetic outcome of the crown- abutment complex.

In 11 Patients, 12 single tooth implants were inserted. In all cases individualized cercon abutments (circonia Y-TZP) had been used and full ceramic crowns were cemented. Clinical examinations were performed 2 weeks after seating, at 6 and 12 months and followed by every 12 months. Examination included periapical x-ray, gingival index, plaque index at the implant and the reference tooth at contralateral side. Treatment result from aesthetical and functional aspect was judged by the patient and clinician (note 1 to 5).

During loading period (range 18–42 month) no implant was failed and no cercon abutment and/or abutment screw loosening or fracture was observed. Healthy periimplant soft tissue conditions were recorded. There was less plaque then on natural reference teeth. In two cases temporary irritations after cementation of the crowns were observed.

The radiographic follow up has revealed, a most favourable maintenance of marginal bone, with a mean marginal bone loss from the implant shoulder, of − 0,12 mm (middle of mesially and distally)at crown seating; − 0,23 mm at 12 months, and − 0,19 mm at last control (middle: 34 mounth after crown cementation.

Both, clinicians and patients evaluation showed excellent results (middle 1,1) for all cases.

The results of these first single tooth reconstuctions on this implant system using the new ceramic abutment demonstrate aesthetic advantages and functional stability of the implant-abutment complex after 42 months follow up.

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Immediate implant loading in augmented upper and lower jaw

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Immediate loaded implants after hipbone graft, let alone immediate loading of implants in the upper jaw with and without hipbone grafting have not been examined.

An in vivo-study with a group of 10 Patients was performed to evaluate the implant stability of immediate loaded implants. Measurement was taken during implantation and after 3 month of loading. Within the group of immediate loaded patients we implanted six implants in the upper and 4 implants in the lower jaw. Immediate loading was performed if the mean insertion torque was higher than 35 Ncm. A metal- or resin-bar-supported denture was inserted few hours post operativ. The implant stability was assessed by the Osstell®-device (Integration Diagnostics AB, Gothenburg, Sweden) and with clinical and radiological examination.

Comparison of the data did not show significant differences in implant stability between the regular loaded implant and the immediate loaded implants at implant-placement and at recal. A mean of 83 ISQ (Implant Stability Quotient) was found in the immediate loaded group for the lower jaw implants, 78 ISQ in the upper jaw, compared to 79 ISQ in the upper and 82 ISQ for the lower jaw after 3 months of loading. Furthermore no clinical and radiological difference was visible.

On the basis of the data collected, it can be shown that independent of augmentation a immediate loading can be realized with 6 connected implants in the upper and 4 connected implants in the lower jaw. Validation of these results requires further clinical investigation.

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Clinical Management of Ectodermal Dysplasia: Report of a Case

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Ectodermal Dysplasia is a genetic disorder in which there are congenital birth defects (abnormalities) of 2 or more ectodermal structures. Severity differs, even among people affected with the same type of ED.

The diagnosis of ED can be difficult because of the variety of types, range of abnormalities, and severity of defects singularly and collectively. It is important to identify the diagnostic components of the disorder so that appropriate treatment can be rendered to ensure

the best quality of life for ED patients. It is also important to understand the genetic hereditary patterns so that the parents of the affected child can be counseled and better predict the chances that future offspring will be affected.

Children with ED may have hypodontia or anodontia and are often treated dentally with conventional prosthesis which is focused only on the oral manifestation of the syndrome. This case report describes the management of an ED patient to provide improved esthetics, function, and emotional development. The treatment was planned in a multi-disciplinary clinic involving pediatric dentistry, orthodontics, prosthodontics and oral maxillofacial surgery for future dental habilitation and rehabilitation. A specially designed overdenture, a removable prosthesis of osseointegrated implants were constructed. Periodic recall visits were advised to monitor the dentures of implants during period of growth & development, and eruption of the permanent teeth.

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Clinical and crestal bone evaluation of implant-tooth-supported bridges

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The maintenance of peri-implant soft and bony tissues is considered essential for successful implant treatment

Objectives: To compare clinical and crestal bone responses of implant-tooth-supported bridges to two different abutment designs.

Methods: After extraction of all mandibular molar teeth and 1 month healing, standard 8 mm implants (Ankylos®, Dentsply Friadent, Germany) were placed in the region of the second molars of 8 M. fascicularis monkeys. Following three months of submerged healing, the implant in one side of each jaw was connected with a tapered (T) abutment and the implant on the contralateral side with a butt joint (B) abutment. The second mandibular premolars were trimmed to form the natural tooth abutments. Metal 3-unit bridges that extended from the second premolar to the second molar were constructed connecting implant abutment to natural tooth abutment. Periodontal (Modified Plaque Index, Sulcus Bleeding Index, Probing Pocket Depth and Keratinised Mucosa) and radiographic records were taken at baseline, 3 months and 6 months. Mobility tests were carried out at baseline and after 6 months of function. After 6 months of function, the animals were sacrificed for histometrical examination. The radiographs were digitized and images magnified to evaluate crestal bone levels on a 5-point scale. An image analyser was used to obtain histometrical measurements of distance from implant top to top of crestal bone (CBL) and distance from implant top to first bone contact (DIB).

Results: Clinically there was no significant difference in mobility and the various periodontal indices between the two abutment designs. Radiographically, horizontal crestal bone loss was insignificant but there was significantly more ($p < 0.05$) vertical crestal bone loss found in implants with B abutments. The results concur with histometrical findings whereby differences in DIB values were significantly more ($p < 0.05$) for implants with B abutment (0.92 ± 0.59 mm) as compared to implants with T abutments (0.45 ± 0.25 mm). CBL differences were not significant.

Conclusions: It is concluded that the Ankylos implant system is suitable for implant-tooth-supported fixed bridges, while the tapered abutment enhances peri-implant soft and bony tissue stability. This research was supported by Friadent, GmbH, Dentsply, Germany R&D 40-02-03-002.

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Does ceramic veneering affect the accuracy of superstructure fit?

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Objectives: The passivity of implant superstructures is influenced by every step of the fabrication process. The objective of the study was to quantify the strain development of various fixed partial dentures (FPDs) both in the condition as cast and after ceramic-veneering.

Experimental methods: Four different types ($n = 10$) of 5-unit FPDs (cementable, screw retained/plastic cylinder, screw retained/gold cylinder, screw retained/bonded) representing commonly used FPD-types were investigated before and after ceramic veneering. Three implants were anchored in a measurement model and strain gauges were mounted mesially and distally adjacent to the implants. The strain development was recorded during cement setting and screw fixation. For statistical analysis, multivariate 2-sample tests were performed with the level of significance set at $p = 0.1$.

Results: All FPDs revealed measurable amounts of strain. Neither the retention types nor the fabrication modes for conventional screw-retained FPDs had a significant influence on strain development. Ceramic veneering caused an increase in strain development for the conventional fixed partial denture types. The lowest strains were found in FPDs bonded to gold cylinders on the measurement model for the metal frames and the ceramic-veneered FPDs.

Conclusions: Conventional procedures are unable to produce superstructures with absolute passive fit. Ceramic veneering seems to increase the strain development and thus the inaccuracy of the fit. The technique of bonding superstructures to prefabricated components directly on the implants can compensate for dimensional errors caused by impression making and superstructure fabrication.

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A clinical analysis of wide frialit 2 implants

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Purpose: This study was intended to provide the detailed results of the outcome of wide (5.5 mm) Frialit-2 implants used for several forms of prosthetic rehabilitation.

Material and methods: In this retrospective study, 121 wide (5.5 mm) implants (74 maxilla, 47 mandible) were placed in 114 patients (61 female, 53 male, 37.2 ± 14.9 years) to support single teeth, fixed partial dentures, removable overdentures and fixed full arch dentures. The most frequent site for the placement of the 5.5 mm Frialit-2 implants was the molar region (n = 87) in both maxilla (n = 47) and mandible (n = 40). The follow-up period for the implants was 12 to 114 months with a mean follow-up time of 41.8 ± 18.5 months.

Results: Overall, two maxillary implants were lost due to inadequate osseointegration representing a survival rate of 98.3% (CSR: maxilla: 97.3%; CSR: mandible: 100%). Both lost implants had been placed in augmented maxillary molar regions where sinus lift procedure had been done for implant insertion and for anchoring a removable or fixed full maxillary denture. No failures occurred in any of the 5.5 mm implants used for single tooth restorations and as abutments for partial fixed restorations. Additionally peri-implant condition, bone resorption and Periotest values indicated satisfactory results.

Discussion: High survival rate may be attributed to the avoidance of the use of short wide-diameter implants, and the primary intention to insert wide-diameter implants. Preferential use in the molar region was an obvious consequence of the peri-implant bone situation in the premolar region, which was frequently inadequate for a 5.5 mm implant.

Conclusion: The use of wide-diameter implants have been a good addition to the available choices of implant design and provide welcome benefits in posterior regions for long-term maintenance of various implant prosthetic rehabilitations.

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Retentive strength of cement-retained suprastructure with different luting agents

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Objective: The purpose of this study was to evaluate the retentive strength of metal copings on prefabricated abutments with six different luting cements.

Material and methods: Eight Easy Abutments (Nobel Biocare, Sweden) were placed on Replace Select Straight implants (Nobel Biocare, Sweden) with 35 Ncm. Metal copings were made from prefabricated plastic copings (Nobel Biocare, Sweden) and Au-Pt-Pd alloy (DeguDent Universal, Degussa, Germany). The cements used were zinc oxide eugenol free temporary cement (Freegenol Temporary Pack; TP, GC, Japan), polycarboxylate temporary cement (Hy-Bond Temporary Cement Hard; TC, Shofu, Japan), zinc phosphate cement (Elite Cement 100; EC, GC, Japan), glass ionomer cement (Fuji I; FJ, GC, Japan), resin reinforced glass ionomer cement (Fuji Luting S; FL, GC, Japan), and resin cement (Panavia F; PV, Kuraray Medical, Japan). Retentive strength was measured with Instron universal testing machine at a crosshead speed of 0.5 mm/min. The means of each experimental group were compared by one-way ANOVA and Tukey-Kramer multiple comparison intervals, at a significance level of $p < 0.05$.

Results: The mean in Newton and the standard deviation of the retentive strength were as follows: TP (56 ± 12), TC (176 ± 36), EC (158 ± 79), FJ (132 ± 29), FL (477 ± 52), and PV (478 ± 50). Compared to others, the retentive strength of FL and PV was significantly higher, whereas that of TP was significantly lower.

Conclusion: The retentive strength of metal copings are rather different to that of conventional cemented restorations of the natural teeth. Surface roughness, and the taper of the abutments could have influenced these differences.

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The 3D FEA study of the new designed tripod implant

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The three dimensional finite element analysis(FEA) was used to compare the stress distribution and resultant displacement between new designed Tripod implant and conventional implant.

The Tripod implant was designed tapered 6.0 mm diameter, 8 mm height. Inside the 3.8 mm abutment connection hall, the 3 other screw halls were made for the 2 mm miniscrew of various length to connect lateral cortical anchorage.

We modeled the cement retained implant crown on the upper & lower molar area.

Five hundred and five Newton force was applied axially or 45° axially on the central fossa and on the cusp.

The stress concentration and distribution, resultant displacement was evaluated.

For the FEA study, NISA/DISPLAY IV VERSION 12.0(EMRC Co. USA) computer soft wear was used.

The result was as follows:

1. the highest stresses were concentrated to the neck region in the conventional cylindric implant.
2. With the Tripod implant, the stresses were spread out to the apically and to the miniscrews.
3. Cervical stresses appeared weaker with the Tripod implant.
4. The resultant displacements apperared smaller with Tripod implant at any condition especially in the maxilla.

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Syncrystallization: A new technique for temporarization of immediately loaded implants

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An increasing interest is being expressed in the early and immediate loading of implants to encourage an expedite restorative outcome. Recently published results of a 7-year follow-up of immediately loaded implants obtained comparable outcomes to delayed loaded implants with a satisfactory level of osseointegration and high success rates. A successful accelerated protocol for implant reconstructions are dependent upon several factors acting in concert: Beside proper pre-surgical diagnostics and treatment planning; implant macro- and micro design; the adequate fixation and immobility of the implant is of utmost importance to prevent the risk of micromovements in relation to the surrounding bone. Up to the present, the reinforcement of acrylic provisional restorations for immediate implant loading was solely achieved by a time consuming fabrication of a casted metal framework in the laboratory.

The introduction of an innovative technique allows to welder temporary implant abutments with a pre-fabricated titanium ribbon directly in the oral cavity (System Argon Control, IMPLAMED, Cremona, Italy). The welding process is electrical and protected by an argon gas supply (Syncrystallization). This presentation aims to: (1) describe the treatment of edentulous and partially edentulous patients with fixed implant-supported restorations, including simultaneous same-day immediate loading with fixed, metal reinforced processed acrylic resin provisional restorations; and (2) illustrate a new accelerated step-by-step innovative restoration approach.

Literature: J Oral Implantol. 2005;31(1):25–31.

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A simplified procedure for immediate loading in the edentulous mandible: a 4-year retrospective study

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Objectives: The aim of the present study was to evaluate the clinical efficacy of a simplified technique for immediate loading of implants placed in edentulous mandibles with a fixed provisional bridge before Procera® Implant Bridge placement.

Experimental methods: The present sample comprised a total of 199 implants placed in 36 patients. An adequate complete denture was first prepared and served as a surgical guide so as to obtain a prosthesis-driven implant placement. This denture was then simply converted to a provisional fixed bridge within 2–48 hours. 2–3 months later, the implants were individually checked and the final bridge was fabricated. 86% of the implants had a rough surface (Replace® Select or MK IV, Bränemark System®) when 14% had a machined surface (Conical implants, Bränemark System®). 17 patients were provided with 5 implants, and 19 patients with 6 implants. 29 implants were placed distal to the mental foramina, when 39 implants were placed into immediate extraction sockets. The final fixed prosthesis was inserted on average 5 months after implant placement. The follow-up period ranged from 1 to 36 months after final loading.

Results: 2 implants were lost during the provisional loading period and could be replaced without removing the provisional bridge. Both replaced implants were successful but are not included in our statistics that lead to an implant survival rate of 99%, while the prosthesis survival rate was 100%. All implants placed distal to the mental foramina were successful. One implant developed a periimplantitis 2 months after final loading that necessitated a surgical treatment. One final bridge suffered from repeated fracture of the resin from the framework.

Conclusions: The simplified prosthesis-driven procedure described here does not necessitate any specific material and allows loading of implants placed in the edentulous mandible the same day or within 48 hours and leads to 100 % of prosthesis survival rate. Importantly, all implants are functionally loaded through a non expensive provisional bridge, and no implant failure occurred after placement of the final restoration.

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Functional responses of immediately loaded implants

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Objectives: The aim of this study starting in June 2001 is to determine the functional and sensory response of immediately loaded single-tooth implants in the posterior region of the jaws.

Methods: In the healed sites Ankylos® (Friadent GmbH, Hanau/Germany) implants are placed. A provisional crown was screwed at the same day after surgery with an occlusion in maximum intercuspation. After six weeks implants are restored with a permanent crown. Periotest® measurements and periapical radiographs with a customized right-angle holder have been taken at baseline and 3, 6 and 12 months postoperatively. Sensory perception thresholds of the implants were evaluated with metal foils in different thicknesses at every recall session.

Results: Up to now 26 patients have been treated. 13 implants replace first molars and 13 premolars. 12 implants have been inserted in the maxilla, 14 in the mandible. The implant length ranges from 9.5 mm to 14.0 mm, with diameters of 3.5 mm to 5.5 mm.The mean change in cortical bone level after 12 months is + 0.03 mm.Increasing density of peri-implant bone has been detected after six and twelve months. Only minor differences in Periotest® measurements occurred, starting with primary stability from average baseline of -4. Sensory perception thresholds of perceived thickness presented values of 50 to 80 microns after placement and 10 to 20 microns after 3 months.

Conclusions: The marginal bone level from the time of implant placement can be preserved. Loading of the implants seems to support an early and significant degree of sensory perception.

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Ex-vivo bone strains around apically-free vs -lifted implants in posterior maxilla

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Objective: Endeavors regarding to explore biomechanical considerations following osseointegration of oral implants in maxillary posterior region with reduced bone quantity are scarce. The purpose of this study was, therefore, to evaluate comparatively *ex-vivo* bone tissue strains around appically-free vs -lifted osseointegre-simulated implants in posterior maxilla.

Materials and methods: Experiments were performed on four hybrid models constituted from fresh-frozen human cadavers. Experimental parameters included (i) to define the bone quality around implants and (ii) to test cortical bone deformations under static loading sequences. Installation torque values and implant stability quotients were quantified to express bone quality in implant placement sites. Microstrains on buccal and sinus floor cortical bone around two splinted crowns supported by 7 mm distanced apically-free implants were recorded to quantify bone tissue deformations experienced under centrally and laterally applied axial load of 100 and 150 N. Same loading sequences were also applied upon completion of artificial sinus floor lifting procedure with autogenous bone including a binding medium of acrylic resin.

Results: Microstrains on buccal cortical bone around apically-lifted implants were slightly lower than of those apically-free. Increase in strains on sinus floor cortical bone was evident following sinus lift simulation process. Strain levels significantly elevated under lateral axial loading in comparison to central axial loading as well an similar increase in magnitude of applied load.

Conclusion: Appically bone graft support around osseointegre-simulated implants in maxillary posterior region having native bone not less than 8 mm under sinus floor did not result in an efficient decrease on buccal cortical bone deformations.

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Immediate Loading of Implant-Supported Overdentures with Ball Attachment Connection

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Purpose: This study reports on the first longitudinal results (12–30 months) of immediate loading of implant-support Overdenture with ball attachment connection placed in the anterior mandible.

Materials and methods: 10 Patients (4 male, 6 female) participated in the study. 6 patients were completely edentulous. 4 patients had teeth 6–11 in the maxilla, with removable partial dentures. All patients were completely edentulous in the mandible. Prior to surgery, the final Overdenture was fabricated. Three implants (Zimmer Dental, Tapered Screw-Vent Carlsbad CA) were placed in the anterior mandible. 2 of the 3 implants were immediately loaded. Immediately after surgery, the overdenture was connected to the implants with two-ball attachments. The plastic apparatus for retention was not placed into the housing. Instead, the housings were filled with Impregum™ impression material in order to provide retention as well as to reduce forces in the initial phase of loading. After 3 months the plastic cap was connected. Panoramic x-rays were taken after the surgery as well as after 6 months of loading; every year after the first year of loading, bone support was measured from the implant and the crestal bone.

Results: Of the 28 implants placed, only 1 failed; the failure occurred in a patient checked at a 12-month follow-up visit. This patient also showed signs of bone loss (1 mm) in another implant. Two other patients checked at 12 months showed no signs of complication or bone loss. Other patients in the study, with follow-up visits ranging from 18 months (2 patients), 24 months (4 patients), and 30 months (1 patient), showed no signs of complications or bone loss, with the exception of 1 patient (follow up at 30 months) showing signs of 1 mm of bone loss in one of only two implants placed. The one failed (and subsequently replaced) implant for total implants placed represents a success rate of 96.4%. The minimal bone loss (1 mm) in two sites represents a success rate of 92.8%.

Conclusion: The report concludes that an innovative use of Impregum™ impression material, for immediate loading of implant-support Overdenture with ball attachment connection placed in the anterior mandible to reduce occlusal forces during the first several weeks of initial prosthetic use.

97 | Poster – Topic Technical and Biological Complications

Immunohistochemical evaluation of the peri-implant soft tissues around titanium and zirconium oxide healing caps

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Objective: A correlation between plaque accumulation and progressive bone loss around implants has been reported in experimental and clinical studies. Different adhesion affinities of bacteria have been reported for different materials. The aim of the present study in man was to conduct a comparative immunohistochemical evaluation of the peri-implant soft tissues surrounding titanium and zirconium oxide healing caps.

Methods: Five patients, 3 males and 2 females (age 30 to 66 years, mean age 49 years) participated in this study implants were. Healing caps, made by c.p. titanium and zirconium oxide, were inserted on implants left to heal in a non-submerged (one-stage) mode.

Results: A higher prevalence and extension of the inflammatory infiltrate, and microvessel density values were found around the titanium specimens. A higher intensity of NOS1, NOS3 and VEGF was found mostly in the titanium samples, while a lower intensity of NOS1, NOS3 and VEGF was mostly found in the zirconium oxide specimens.

Conclusions: The tissues around the titanium healing caps seemed to undergo a higher rate of reparative processes, most probably correlated with the higher inflammation processes observed in these tissues. A higher expression of the intensity of NOS1 and NOS3 could be, on the other hand, correlated with the higher amount of bacteria reported around the titanium samples.

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Reliability of spiral tomography on the alveolar crest in implant dentistry

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Purpose: Assessment of the bone site should be routinely performed by radiologic diagnostics. To gain information about ridge width and height, conventional tomography was applied as the preimplantologic diagnostics in the last few years. To assess bone volume via tomograms, detection of the alveolar crest is important. This study is aimed to evaluate the reliability of measurements in spiral tomography through assessing the visibility of the alveolar crest and the measurements between the alveolar crest and other anatomic structures.

Materials and methods: 110 spiral tomograms of the jaws were taken by Scanora x-ray unit from the patients. The visibility of the alveolar crests was estimated by 3 observers and classified as clearly visible, questionable visibility, or not visible. 3 observers measured the distance between the alveolar crest and the reference points of anatomic structures. The measurements were repeated 2 weeks later.

Results: 52.9% of alveolar crests on upper jaws and 61.5% of alveolar crests on lower jaws were visible. The interobserver and intraobserver agreements on the visibility were low. The mean ranges of the measurements were 1.39 mm (SD = 1.37 mm) on maxilla and 1.03 mm (SD = 1.01 mm) on mandible in the interobserver evaluation. The interobserver variance was greater than the intraobserver variance in the measurements of distance.

Conclusion: Spiral tomography showed a relatively low reliability in the visibility and measurements of the alveolar crest even though might has given additional information about the bone width and the relation to anatomic structures such as alveolar canal or sinus floor.

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Early ITI implant failures. Results from a 10-year experience in private practice

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Introduction: The predictability of dental implants has been extensively documented; however, the topic of early failure has rarely been addressed, especially in private practice. This clinical study documents the occurrence of early failures recorded over a 10-year period with 2021 ITI implants in private practice.

Material and methods: Between January 1995 and 2005, 874 patients (37.7% males, 62.3% females) were treated with 2021 ITI implants. The mandible/maxilla distribution was 1048/973, 55.6% were < 11 mm, and 77.7% were Ø4.1 mm; 370 (18.3%) were placed in type IV bone. Smokers, medically compromised patients and bruxers received respectively 20.8%, 17.1%, and 20.3% of implants. 6.8% (137) were involded in an immediate loading protocol. Early failure was defined as a failure occurring before insertion of the final prosthesis.

Results: 18 (0.9%) implants were identified as early failures. Average patient age was 62.4 years, average time in situ was 1.9 months, 45.4% of failed implants were < 11 mm and 44.4% were placed in type IV bone. Of these failures, 33.3% were placed in smokers, 72.2% in bruxing patients, 33.3% in medically compromised patients and 55.5% were located under transitory removable prosthesis. One failed implant was immediately loaded and 3 implants were removed because of sensitive disorders.

Discussion & Conclusion: The occurrence of early failures for ITI implants was low (0.9%) as previously reported. However, several risk factors could be identified. They were: bruxism, medically compromised patients, provisional removable prosthesis, type IV bone and smoking.

100 | Poster – Topic Technical and Biological Complications

Systematic review of survival and complications of implant supported FPDs

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Objectives of this systematic review was to assess the 5 and 10-year survival of implant supported and combined tooth-implant supported FPDs and the incidence of biological and technical complications.

Methods: Medline search supplemented by manual searching was conducted to identify prospective and retrospective cohort studies on FPDs with a mean follow-up time of at least 5 years. Patients had to have been examined clinically at the follow-up

visit. Failure rates were analyzed using random-effects Poisson regression.

Results: From a total of 3844 titles and 560 abstracts, 176 articles were selected for full-text analysis, and 26 studies met the inclusion criteria. Meta-analysis of these studies indicated a survival of implants in implant supported FPDs of 95.4% (95% CI: 93.9% – 96.5%) after 5 and 92.8% (95% CI: 90.0% – 94.8%) after 10 years. The survival of implants in combined tooth-implant supported FPDs was significantly lower, or 90.1% (95 % C.I.: 82.4% – 94.5%) after 5, and 82.1% (95 % C.I.: 55.8% – 93.6%) after 10 years.

The estimated survival rate of implant supported FPDs was 95.0% (95 % C.I.: 92.2% – 96.8%) after 5 and 86.7% (95% CI: 82.8% – 89.8%) after 10 years of function. Compared to estimated survival rate of combined tooth-implant supported FPDs of 94.1% (95 % C.I.: 90.2% - 96.5%) after 5, and 77.8% (95 % C.I.: 66.4%–85.7%) after 10 years.

Conclusion: Survival rates of both implants and reconstructions in combined tooth-implant supported FPDs were lower than those reported for solely implant supported FPDs. Hence, planning of prosthetic rehabilitation may preferentially include solely implant supported FPDs.

101 | Poster – Topic Technical and Biological Complications

Is the implantological treatment in patients with renal osteodystrophy possible?

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The modern dental implantology as well as the kidney-replacement therapy allows for the implantological treatment of the patients suffering renal osteodystrophy. The aim of the study was to determine the possibility of implantological treatment in case of patients with renal osteodystrophy using analysis of densitometric, histo-radio-morphological and biochemical parameters. The study was performed on 88 patients (average age 45 years (+/– 10 years) treated by hemodialysis (44) and allogenic kidney transplantation (44). Studies consists of:

1. mathematical Fourier's analysis on X-rays pictures, polarizing microscopy and densitometry of the jawbones.
2. implants simulation using implantological template
3. jawbone mineral qualitative analysis using EPR (electron paramagnetic resonance) methodology,
4. evaluation of biochemical markers of bone metabolism (DpD, Osteocalcin, Fa, PTHr-) in serum using ELISA.

Statistical analysis was performed using multiple regression and correlation tests. The results show decreased quantity and quality of jawbone tissue in renal osteodystrophy. Nevertheless, these changes were not contra-indication to implantological treatment. Kidney transplantation stabilized higher bone turnover after hemodialysotherapy. 4 patients (8%) were excluded because of the poor quality of bone and 3 patients (6%) because of the viral contamination with the Human Papilloma Virus). In conclusion, results of our studies show that 85% patients suffering stable renal osteodystrophy can be treated by the by trans-mucosal dental implants (i.e., Nobel Direct). Nevertheless, taking into account all specific circumstances (immunosuppresion, high risk of infection etc.) it is necessary to establish special diagnostic and therapeutical algorithm regulating implantological procedures in this group of patients.

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On the bone response around submerged, unloaded implants inserted in poor bone sites

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Objective: The aim of the present study was a histological and histomorphometrical analysis of the bone response to submerged implants inserted in posterior areas of the human jaws and retrieved, for different causes, after healing periods varying from 6 weeks to 12 months. An important parameter that influences the long-term success of oral implants is the bone quality of the implant bed. Posterior areas of the jaws have been avoided in implant dentistry due to their poor bone quality, higher chewing forces and presumed higher implant failure rates.

Methods: Eight submerged and unloaded implants that had been retrieved for different causes after different healing periods were evaluated in the present study. Three implants had been removed for inadequate patient adaptation, two for inability of the implant to meet changed prosthetic needs, one for not optimal position from esthetic and hygiene aspects, and the last two for pain and dysesthesia.

Results: It was found, in all implants, newly formed peri-implant bone even after shorter healing periods. The bone-implant contact percentage varied from 30% to 96%.

Conclusions: We documented osseointegration of implants with a rough surface even after an insertion period of less than 2 months, both in the mandible and in the maxilla. From these results we can, probably, extrapolate the fact that these implants might be loaded after 2 months of healing, even when inserted in soft bone.

103 | Poster – Topic Technical and Biological Complications

Critical defect size for radiographic detection of intra-bony defects

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Objectives: Since intra-bony defects (remaining cysts) might jeopardize the outcome of implant surgery, an optimal bony quality evaluation is mandatory.

Material and methods: In 16 pieces (bone and soft tissues) from upper and lower cadaver jaws, a series of defects had been created with progressively increasing size (first within the

spongious bone, than involving one cortex, than both cortices and finally a perforation of the cortex). From each respective defect analogue and digital intra-oral radiographs were taken, the latter processed via a periodontal filter (Vistascan®, Dürr Dental, Germany) and afterwards presented in black-white and in colour. As such, from each piece of bone, 3 sets of 7 to 8 images (different defect sizes) had been prepared (analogue, digital colour / black-white). Eight observers were asked to rank each set of radiographs (presented in a random order), from smallest to largest defect.

Results: None of the clinicians were able to identify the defects, as long as the junctional area was not damaged. Nevertheless, for bony pieces with a homogeneous structure (e.g. dense lower jaw, very undense cortex in upper jaw) the defect was often already detected before the junctional area was reached. In general digital coloured images allowed a slightly better interpretation than the black-white images, the latter being similar to the conventional images.

Conclusion: These observations indicate that intra-oral radiographs are not very reliable for the evaluation of bone lesions. For longitudinal evaluations of bone healing, colour digital images can be recommended.

104 | Poster – Topic Tissue Augmentation

Preliminary results of de-novo-bone-formation by receptor engineering using PepGen P15

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Modern implantology involves the application and optimization of bone engineering biomaterials and scaffolds to achieve predictability in quality and quantity of the regeneration result and to avoid the high morbidity factor of the present gold standard. The complete and authentic regeneration of bony structures using overdosages of single mitogenes (PRP, Growth factors) or morphogenes (BMP) is costly and often leads to unsatisfactory results.

Collagen I is an extracellular matrix protein with multiple main binding domains for osteogenic progenitor cells and therefore plays a crucial role in osteogenesis.

PepGen P15 is an engineered collagen I binding domain for potential osteoblasts and is able to multiply the complete regeneration cascade.

In this study, de-novo-bone formation in 26 sinus floor elevations was investigated using a mixture of 70% BioOss® (Geistlich, Inc., Switzerland) and 30% PepGen P15® (Dentsply Friadent, Germany) in 23 patients. 42 cores were taken after 6, 9 and 12 months during implantation. They were histomorphometrically investigated. The results were compared to the bone regeneration results in sinus floor elevations when BioOss® was used alone.

Data revealed that de-novo-bone formation was enhanced by 85% using PepGen P15® as an bone activating ingredient.

The paper elucidates the principles of receptor engineering as a new method in bone regeneration and presents the first histodynamic and histomorphometric results of this new technology in sinus floor elevations. The future potential of individual bone regeneration will be discussed.

105 | Poster – Topic Tissue Augmentation

Angiogenesis observed in newly generated bone

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Objective: We previously published the importance of a device for mineralized bone augmentation in a rabbit experimental model. In the early stage of healing, new tissues did not fill the occlusive space, but mineralized bone formed and tended to climb along the inner wall of the device. While blood supply is one of the critical factors for successful bone augmentation, few studies have observed angiogenesis in augmented bone. Therefore, this study observed angiogenesis in new bone.

Methods: The right and left calvarial bones were exposed in six adult male Japanese white rabbits; the cortical bone was penetrated; and custom-made hemispherical titanium caps were placed in each. The cap on the right was filled with granulated β-tricalcium phosphate. After 1 month for healing, the right and left common carotid arteries were injected with MICROFIL® compound, which was cured to form a three-dimensional cast of the vasculature, to observe new blood vessels in the augmented bone.

Results: New blood vessels entered the space beyond the existing calvarial bone. Angiogenesis occurred to a similar extent with and without granulated β-tricalcium phosphate. Moreover, angiogenesis was observed in a histological study.

Conclusion: The results demonstrate that angiogenesis can be observed in hard tissue, before the preparation of histological specimens.

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Options and limits of crestal sinus grafting approach in implantology

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The aim of this study was to determine whether crestal sinus grafting approach is a predictable solution to different vertical bone defects situations.

89 implants (Zimmer dental, Carlsbad USA) associated with crestal approach were placed in 41 patients, divided in two major groups: a first group (A = 50 implants) with simultaneous implant placement, and a second group (39 implants) with delayed placement: grafting material was either particles (group B: 21 implants) or block (group C: 18 implants). Simultaneous implant placement depends on bone quantity and quality. Residual bone height in the

different groups varied from 2 to 7 mm (mean = 4.7 mm). Deproteinized bovine bone (Geistlich, Switzerland) was used in all cases. Radiographic control (peri-apical, panoramic, dentascan) the same day, 1, 3, 6 months, 1, 2 years later enabled us to analyze the bone loss, based on the implant length. Crestal and apical bone remodeling, and implant survival rate were evaluated.

2 years later, no statistically significant difference in the 3 groups (cumulative implant survival rate similar = 97 %): peri-implant and apical bone loss (14.6%) were similar, despite a significant difference concerning bone graft success rate: A = 95%, B = 98%, C = 91%.

Despite the permanent use of both lateral and crestal approaches in sinus grafting, crestal approach gives evidence of a high success solution to different bone deficiency situations, with many advantages: atraumatic, one site surgery, less membrane risk, and the possibility to associate horizontal expansion when necessary. Bone loss measured within the graft and around the implants was similar in the different groups.

107 | Poster – Topic Tissue Augmentation

Experimental research of the horizontal bone augmentation by distraction osteogenesis

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Purpose: The horizontal bone augmentation for a narrow alveolar ridge is a necessary and indispensable for implant placement. The bone grafting and the guided bone regeneration technique are generally selected. Most reports of the alveolar distraction osteogenesis are the vertical distraction, however there are few reports as for the horizontal distraction. We compared the horizontal alveolar distraction with the bone grafting in dogs.

Materials and methods: Five beagle dogs were used in this experiment. After teeth extraction and buccal corticotomy of the premolar region of the mandible, the horizontal atrophic models of the alveolar ridge were made. The distraction device (Alveo-Wider) was inserted to the right side. After a 7-day waiting period, alveolar ridge was expanded 0.4œ/day and the amount of total widening was 4.0. Two months after distraction, the dental implant (ASTRA TECH) was placed. The left side was augmented by the bone grafting and placed implant simultaneously. Three months after the implant placement, we evaluated the clinical, radiographical and histoligical findings.

Result: The distraction side, the amount of the bone augmentation was 2.7 on the average, and that of the bone grafting side was 1.7. CT-value and the ratio of direct implant-bone contact of the distracted region were higher than those of the bone grafting region.

Conclusion: Horizontal alveolar ridge distraction could be a beneficial technique in the placement of implants in the narrow alveolar ridge in the dogs.

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The Influence of Decortication on Alveolar Ridge Augmentation

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The aim of this study is to evaluate if decortication of the cortical bone plate enhance the bone augmentation on edentulous alveolar ridge. 15 pathogen-free New Zeland White rabbits were used for this purpose. Under general anesthesia using xylazine 7 mg/kg, acepromazine 1 mg/kg, ketamine 40 mg/kg a skin incision was made on medial sides of the tibias. 6x8x1 mm monocortical blocks of bone were removed with using surgical reciprocating saw under irrigation with sterile saline. In order to allow postoperative stability and avoid tibial fractures 4 hole 1,5 mm titanium miniplates were used for stabilization of tibias. Skin incisions were made to the mandibles of the rabbits and the cortical bone grafts harvested from the tibias were fixed to the corpus of the right mandibles with 1.0 titanium miniscrews after decortication (8 standart holes) of the mandible. Bone grafts were fixed without cortical bone perforation to the left mandibles. After 6 weeks , the rabbits were sacrified , titanium screws were removed and the corpus of the mandibles were extracted. The specimens were evaluated histologically and histomorfometric analysis was performed. Paired t test is used to analyze the differences between the three groups.

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Osseointegration in sinus floor augmentation with coagulum or autogenous bone

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Maxillary sinus floor augmentation (MSFA) became routine procedure in implant dentistry. Several grafting materials are in use with this purpose, i.e. autogenous; homogenous; heterogenous; allogenous. A clinical study described MSFA by simply elevating the Schneiderien membrane (Sm), without adjunctive therapy (*Lundgren et al, Clin Impl Dent Rel Res, 2004; 6: 165–72*). This study aimed at comparing the effectiveness of the use of coagulum with and without adjunctive autogenous bone in MSFA. Four *capuchin* monkeys had all upper premolars and 1st molar extracted bilaterally. Four months later the animals underwent MSFA surgery using the window technique. The right sinus was left to heal spontaneously, whilst the left sinus was filled with autogenous bone graft. The Sm was kept elevated by insertion of two implants (machined and oxidized, Brånemark System™) in both sinuses. Implant stability was assessed through resonance frequency analysis (RFA,

Osstell™) at installation and at sacrifice. The animals were sacrificed 6 months after MSFA for histology and histometry (bone-implant contact - BIC and bone area in threads - BA). The results showed no difference between coagulum and bone graft sites regarding RFA, BIC and BA. As to BIC, the oxidized implants exhibited improved integration compared with machined ones. Oxidized implants showed higher BA compared to machined in bone grafts.

Conclusion: Coagulum seems not differing from bone graft in all parameters evaluated since a space beneath the Sm is provided by implants insertion. The use of oxidized implants are recommended in similar cases as described in this study.

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Advantage of partial thickness flap for implant surgery:Reports of cases

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Purpose: Periosteum contains the, vascular, cellular elements necessary for the maintenance of normal bone function and repair. The aim of this clinical trial is to present various applications of periosteum preserved flap in implant surgery.

Methods: Case1: Partial thickness flaps were reflected. Periosteum attached narrow ridge was splitted with series of chisel and prepared by osteotome and then implants were installed. After 4 months, fixed provisionalization was done, 4 months later upper full arch fixed prosthetics was placed. Case 2:Buccal partial thickness flap was raised and meticulous splitting ridge and Three implants were placed. Case 3: Initial incision was made palatally from the crest and the partial thickness flap was reflected to the outside of sinus floor level. Then full thickness flap was raised for lateral window opening. After bone graft, flap was repositioned apically for increasing the keratinized gingiva. About 4–6 months later, flapless implants were placed.

Results: The periosteum and connective tissue can retain the fractured or splitted ridge. 2. Traditional and this technique have similar indication. 3. Low bone resorption due to periosteum preserve. 4. In the 3rd case, Apical positioned flap is possible due to remaining tissue retained for periosteal suturing. This protocol has some advantages to preserve the crestal bone viability and positive effect on regeneration of grafted bone. It is simple, easy and minimum invasive technique and has less complication.

Conclusion: The most important advantage lies in the early revascularization, which promotes as well, the healing and the osteogenesis. Further experimental and clinical study is necessary to evaluate the longitudinal results.

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Crest widening by distraction, an alternative technique to bone augmentation

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Aim: To introduce a new device and technique to widen a narrow alveolar crest prior to implantation.

Materials and methods: A 4-armed distractor was used to widen a narrow alveolar crest. Under local anesthesia, 3 mucoperiostal incisions were performed; One along the crestal ridge and two vertical cuts at the anterior and posterior buccal aspects. Through these cuts, bone cuts were made using a reciprocating scalpel saw to the depth of half of the crest thickness without stripping the mucoperiostum. The distractor was inserted into the crestal bone cut by tapping on the device. Distraction was begun 7 days post-op by rotating the activating screw 1/2 a full turn twice a day. Each 1/2 turn distracted the buccal bone flap by 0.2 mm.Further distraction was performed by the patients at home, 1/2 a turn twice a day. The distractor was removed when adequate width of crest was achieved. Implants were inserted at the same session or 7–14 days later.

Results: The study group consisted of 8 patients who suffered from a narrow alveolar crest in the 14–16, 11–21, 32–42, 34–37 and 44–47 regions. The amount of widening ranged from 4–6 mm.Distraction periods ranged from 10–16 days. Latency period was 5–7 days. 6 implants were inserted immediately after the removal of the distractors in the first 2 cases.

19 implants were inserted 4–5 weeks post-op. No complication was observed during the distraction period or with any of the implants. Prosthetic treatment of the implants was completed 3–4 months after implantation. No complication was observed 18–24 months after prosthetic treatment. Slight neck exposure occurred in one case where the periostium was stripped.

Conclusions: Crest widening by distraction may be a better and faster alternative in the case of a narrow alveolar crest with sufficient crestal height. The technique can be easily used in the private office. A long term and multi center trial is needed.

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Modulate the horizontal dimension - bonemanagement tools to compensate horizontal bone deficits locally

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1. Split-Control

In cases of horizontal alveolar ridge resorption Split-Control enables the surgeon to gently expand local bone (spreading function). In alveolar ridges of sufficient horizontal dimension the same system

facilitates primary implant stability by condensing cancellous bone (condensing function). The consecutive use of a series of non-ablative screw-type thread formers allows for a bone preserving and risk reduced bone-preparation.

Results: From 1994 to 2003 145 patients received 457 implants after preliminary use of Split-Control. 19 patients and 59 implants respectively were classified failure. Both patient-based and implant-based cumulative survival rate amounted 87,1% after 9 years.

Conclusion: Split-Control is an universal tool kit that allows for standardized bone preparation prior to implant insertion and may be combined with all current implant system. Non-ablative bone-condensing and bone-spreading respectively account for an increase in primary implant stability.

2. Horizontal-Control

In cases of advanced horizontal alveolar ridge resorption Horizontal-Control is a set of instruments that effects maximal bone-spreading by minimal-invasive means. The bed for implantation is amended in axial direction (prosthetic driven implantology) while nutrition of bone is maintained.

Results: Since 1999, 86 cases of alveolar extension plastic have been carried out using Horizontal-Control. 3 of 86 implants were lost. After 4 years the cumulative implant survival rate amounted 96,52%.

Conclusion: Horizontal-Control is a tool kit to successfully spread the alveolar ridge of the horizontally resorbed mandible in a controlled manner. It guarantees a better nutritive supply of the implant bed. A combination with Split-Control is suitable.

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Crestal approach in sinus lift surgery

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This study evaluates, on the basis of clinical and radiological evidence, the efficacy of the Future Site Development (FSD) procedure, first described by Summers in 1994, in sinus lift surgery in the atrophic posterior maxilla. The surgical technique used, modified from the original procedure in the diameter of the osteotomes, no use of trephine bur and the use of resorbable membranes (Bio-Gide®, Geistlich) to stabilize the bone graft, results less invasive to soft and hard tissues than the traditional lateral window technique. It should likewise allow greater osteoinduction given the maintenance of intact bone walls around the osteotomy site and the grafting of autogenous bone pushed forward by the tip of the osteotome.

Seven non-smoking patients ranging in age from 37–66 (average 48 years), with a posterior maxilla bone height from 1.5–3 mm to 3–7 mm (average 3.9 mm), were treated with the modified FSD technique using deproteinized bovine bone (Bio-Oss®, Geistlich) as a grafting material.

The sinus mucosa was elevated by an osteotome by up to at least 7.7 to 11.4 mm, with no sinus membrane breaking or postoperative complications. After 6–8 months 9 implants were successfully positioned in 5 patients (100% after 12–18 months).

The crestal approach can be considered a convenient alternative to the lateral window technique in 2-stage sinus lift surgery in 3–4 mm vertical residual alveolar bone, particularly when anatomical difficulties limit the success of the lateral approach.

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Homologous frozen bone: alternative grafting material in sinus lift

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Purpose: The search for an ideal grafting material in alternative to autologous bone, to augment the posterior atrophic maxilla, brought us consider the use of homologous frozen bone at $-80^{\circ}C$ (HFB). The aim of this study was to evaluate the effectiveness of HFB as grafting material in the patients that did not accept bone harvesting from the anterior iliac crest.

Materials and methods: The HFB, supplied by the Tissues Bank of Veneto, was investigated for the following agents: HIV, HCV, HBV, HTLV I/II, Treponema, Toxoplasmosis, CMV, Mycobacterium, antifungal agents, aerobic and anaerobic bacteria. From November 2003 to March 2004, we performed 25 sinus lifts with bone block technique; 20 implants were inserted in the same operative stage, 40 implants were placed 4 months after reconstruction. Each patient was studied with Dentscan immediately after surgery and 4 months later to evaluate the degree of bone resorption; bone biopsies were performed at 4–6–12 months.

Results: All grafts have taken without adverse side effects. The 64% of grafts did not show any difference in dimensions after 4 months, the remainder showed low resorption (11,7% height, 12,3% length, 12,9% width). 95% of immediate implants resulted osseointegrated versus the 100% of delayed implants. The histology confirmed gradual bone formation till 80% of bone at 12 months.

Conclusion: The homologous frozen bone, though not osteogenic, contains BMPs and shows osteoinductive and osteoconductive properties. Sinus augmentation with HFB is an excellent alternative to others grafting biomaterials.

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A volumetric analysis of different bone grafts in sinus augmentation

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Purpose: The sinus floor augmentation has become a routine treatment for the edentulous posterior maxilla. The aim of this retrospective study was to evaluate the volumetric changes of grafts after sinus augmentation.

Materials and methods: Autogenous bone was used in 8 patients and 8 patients were treated with BioOss or Algipore. In a second-stage 6 month after, a total of 58 Frialit-2 or Xive implants were placed. A computed tomography scan (Somatom® plus 4, Siemens AG) was taken within 6 month post grafting and one dental scan after implant placement with a minimum interval of 6 month. The volumetric evaluation was performed by independent researchers using appropriate software (Somaris® Sinet Magic View, Siemens AG).

Results: A total of 23 sinuses were augmented in 16 patients. The mean volume of the graft post augmentation was 2,97 (1,40 ml to 5,56 ml). The respective mean volume after implant placement amounted to 2,32 (0,92 ml to 4,46 ml). The comparison of both measurements revealed a significant decrease of grafted area in 21 sinus sites. In 2 sinuses the volumes of grafting materials showed a slightly increase in volume.

Discussion and conclusion: The short-term results of this retrospective study showed that different materials can be used for sinus grafting. Within the limits of our study a radiografic volume reconstruction of augmented area could be demonstrated being a possible approach to assess quantitative long term changes of the regenerated area. Further prospective studies should be conducted to evaluate the volumetric changes of different bone grafts.

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Maxillary sinus bone grafting with injectable bone substitutes in Sheep

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Introduction: The aim of this study was to assess the safety and the efficacy of two composite biomaterials made of biphasic calcium phosphate granules and the fibrinogen- and thrombin components of a fibrin sealant for sinus bone grafting in sheep prior to dental implant placement. Their osteoconductive properties were compared to a corticocancellous autogenous bone graft .

Materials and methods:

■ PART A: Sinus grafting

Twelve adult sheep (24 maxillary sinuses) divided in three groups underwent maxillary sinus grafting. Six months after the first surgery, 38 dental implants were laterally placed in the grafted sinuses. At the time of second surgery at 6 months, bone biopsies were taken from each group and analysed by Light Microscopy and Scanning Electron Microscopy. Quantitative image analyses in SEM were also performed.

■ PART B: Follow-up Study

After a total time of 9 months from the first surgery, the animals were sacrificed. Bone samples were analysed with the same methods as in Part A. Implant stability was evaluated using Radio Frequency Analysis.

Results: No clinical adverse effects of the composites were detected in the immediate postoperative periods of Part A and B.

Histological analysis showed new bone formation in all sinuses and the amount of bone was comparable (20–21%) in all groups after 6 months as well as after 9 months (34–35%). Direct contact between bone and dental implant surface confirmed implant osseointegration after 3 months. Implant stability assessed by RFA at 9 months (Part B) was slightly higher in the biomaterials groups than in the autograft group (82%, 75% versus 71%).

Conclusion: The biomaterials were safe to use and showed osteoconductive properties in sinus augmentation procedures in sheep, leading to an equal amount of bone compared to the autograft group.

Acknowledgments: Biomatlante, Baxter BioSciences BioSurgery Straumann AG, and RNTS 2002 from French Ministery of Industry to support this study.

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Sinus Lift with autologous bone graft harvested with bone scraper

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Purpose: In the procedure of sinus floor elevation, proposed by Tatum and published by Boyne and James, autogenous bone, bone substitutes or a mixture of both have been used. Autogenous bone is considered the gold standard due to the fact that remodeling takes place without any immunologic resistance. Donor sites for autogenous bone are generally the iliac crest, oral cavity and tibia.

We report our experience in the search of the lower morbidity in the harvest of autogenous bone for bone regeneration procedures.

Materials and methods: We evaluated the results obtained in 40 sinus lift procedures with the use of autologous bone grafts obtained from oral cavity. A total of 65 nt 3i dental implants were placed in a two stage procedure. The grafts were harvested using a bone scraper device (Autogenous Bone Grafting Instrument). All sinus were filled with a mixture of autologous bone and bovine hydroxyapatite. Platelet rich plasma was also used to sustain bone placement.

Results: In all cases new bone formation was confirmed radiologically and implant placement was performed successfully. The analysis of a sample obtained by biopsy revealed the presence of mature bone. No healing problems were observed in any case.

Conclusion: The use of bone grafts obtained from oral cavity by means of a bone scraper device (Autogenous Bone Grafting Instrument) showed a good clinical response with very low morbidity rates. This procedure has the advantage of providing autogenous bone without the need of an extra surgical approach.

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The periosteum attached onlay bone graft for ridge augmentation: Reports of cases

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Purpose: Periosteum contains the vascular, as well as the cellular elements necessary for the maintenance of normal bone function and repair. The aim of this clinical trial is to present clinical applications of periosteum attached onlay block bone(PAOBB) graft for deficiencies.

Methods: The partial thickness flap was raised and bone was harvested preserving the periosteum and connective tissue in Mx. tuberosity, The PAOBB was fixed with screw in recipient bed. Case1 Mx. anterior narrow ridge and PAOBB graft and delayed central incisor implant. Case2 Mx. molar area and PAOBB vertical graft and delayed implant. Case3 Mx. molar area and PAOBB vertical graft. Case4 Mx. anterior narrow ridge and PAOBB horizontal graft to improve the aesthetics.

Results: The grafted bone was well suited to the placement of implant and improved the aethetics especially in the maxillary anterior area. Advantage. 1.No membrane is needed, 2.Require less healing time and more safe than traditional graft without periosteum. .3.The dehiscence may not lead to fialure. 4.Low risk and less complication, Disadvantage: 1.Meticulous technique is need to harvest and fixation. 2.Limitation of indication and size. 3.Poor contouring and adaptation.

Conclusion: This technique could be effective in the small alveolar defect. The most important advantage lies in the early revascularization. which promotes as well, the healing and the osteogenesis in the region. However, further longitudinal experimental, clinical evaluation of results are required to determine the optimal indication, surgical procedure, size of augmentation, and timing of implant.

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Histologic study of sinus grafting with Bio-Oss for implant placement

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Purpose: The purpose of this study was to evaluate the histologic results of 20 sinus grafting with BioOss for implant placement.

Materials and Methods: Unilateral sinus augmentation was performed in 20 patients with 3–5 mm of alveolar crestal bone height in the posterior maxilla prior to grafting. The sinuses were grafted with BioOss only. Informed consent was obtained from all patients.

Results: The 20 patients in this study included 9 women and 11 men ranging in age between 21 and 81 years, with a mean age of 53.1 years. In cases when initial implant stability was obtained, sinus floor elevation and implant placement can be accomplished simultaneously.

Conclusions: The findings of the present study support the use of Bio-Oss as a bone substitute in maxillary sinus augmentation procedures.

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Development of an experimental model for the evaluation of periosteal distraction osteogenesis

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Periostal Distraction Osteogenesis (PDO) could represent a conservative approach that might avoid limitations of proposed techniques for alveolar bone augmentation.

The goal of this project is to demonstrate the possibility of bone formation by PDO. Two pilot evaluations were performed in the School of Veterinary Medicine of the University of Caldas (Colombia).

The first evaluation on calvarial bone of 12 rabbits showed the possibility of bone formation by periostal distraction. For two different distraction rates (0.25 mm per day or 0.5 mm per day), the evaluation demonstrated superior bone formation in the group with the slower rate. The frequent displacement of the screws used as distraction devices, conducted to the development of a specific periostal distraction device. A second trial of alveolar distraction was performed in 4 dogs with a specifically designed distraction device; it demonstrated the capacity and stability of this device. However results in bone augmentation were difficult to analyze due to exposure of the distraction device leading to inflammatory infiltration of the augmented sites. These problems confirmed the difficulty of oral procedures for alveolar bone augmentation by distraction in animals.

The results of these studies are encouraging as they reveal the possibility of bone osteogenesis by periosteal distraction. They indicate that the placement of periostal distraction device on calvarial bone in rabbits could be a valuable model to document the possibility of bone formation by periostal distraction. The utilization of this technique for ridge augmentation in patients could be subsequently proposed in clinical trials.

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Modulate the vertical dimension

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Bonemanagement tools to compensate vertical bone deficits locally

1. Balloon-Lift –Control

The balloon-lift-control (by Prof. Benner, Dr. Bauer, Dr. Heuckmann, Munich) is a new device to augment the sinus-floor. With

the calibrated and precise tools it is possible to provide the opening of the corticalis in a controlled manner. The balloon-system allows to lift the Schneider-membrane carefully and securely. A contrast x-ray control of the lifted volume is easy to achieve.

Results: Since 2001 23 sinuslifts are performed with alloplastic bone material. 37 implants were incorporated, three implants lost during this period. The survival rate was 87.8 %.

Conclusion: This new technique allows a precise minimal-invasive sinus-floor elevation and can replace the lateral sinus –floor augmentation.

2. Vertical Control

Distraction device (by Dr. Cierny, Dr. Fuchs. Zürich) for the predictable alveolar osteogenesis by determinable plains and predefined three-dimensional direction with vital bone as a base for oral implantation. The smaller design and fixation is an advantage. The vector is guaranteed through parallel plains.

Results: In the period 2001 till 2003 16 cases of alveolar distraction osteogenesis were carried out (nine in the maxilla and seven in the mandible). 27 implants were incorporated; 2 implants were lost during healing phase. The survival rate was 92,6%.

Conclusion: With this small device an augmentation of the anterior segment of the maxilla and the distal segment of the mandible in severely resorbed alveolar ridge cases can be achieved and a proper bed for incorporation of dental implants can be installed.

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Sinus lift with Simultaneous Implant Placement in an Atrophic Maxilla

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Objectives: The objectives of this study were to evaluate the clinical results of ITI SLA implants placed simultaneously with the bone added osteotome sinus floor elevation (BAOSFE) procedure in patients with 3 to 5 mm of residual alveolar bone height in an atrophic posterior maxilla, and to radiographically assess the change in the graft height during the initial healing period.

Materials and Methods: Eight patients with 3 to 5 mm of residual alveolar bone height in an atrophic posterior maxilla received the BAOSFE procedure with simultaneous placement of eleven ITI SLA implants. Minimum of three panoramic radiographs were taken from each patient. A panoramic radiograph was taken before surgery, immediately after the placement of the implants, and 6 months after the surgery. The survival rate according to the two implant systems was determined. The radiographic changes in the graft height were also calculated with respect to the implant with a known length and original sinus height.

Results: The implant survival rate was 100% (11/11 implants) for the ITI SLA implants after a mean follow-up period of 12 months. During the initial healing period of 6 months, the mean reduction of the grafted bone height occurred 0.55 mm (6.34%) at the ITI SLA implants.

Conclusion: The simultaneous placement of the ITI SLA implant using the BAOSFE procedure is a feasible treatment option for patients with atrophic posterior maxilla.

Acknowledgements: This study was supported by a grant from the Korean Health 21 R&D Project, Ministry of Health & Welfare, Republic of Korea (03-PJ1-PG1-CH08-0001).

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Successful one-stage sinuslifting with particulated bone mineral- long term results

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a. Objective: The aim of the present study was to investigate and evaluate the clinical efficiency of the sinus floor augmentation technique with particulated bone substitution material and simultaneous implant insertion.

b. Materials and methods: One stage sinus floor augmentation with particulated bovine bone mineral (BioOss) is practised in our clinic since 1994 as a matter of routine. It is chosen in cases in which the remaining vertical bone height in the posterior maxilla accounts for at least 4 mm.In order to offer an assessment for this surgical procedure an internal collective of 161 sinus floor elevations was analysed.

c. Results: With respect to claimed inclusion criteria it was possible to examine 158 sinus floor augmentations with simultaneous insertion of 302 Ankylos implants in 134 patients showing reduced vertical bone volume in the posterior maxilla. Mean follow-up accounts for 71,6 (11–116) months. At the time point of follow-up examination 300 implants were osseointegrated and stable, thereof seven showed cervical reduced but constant bone conditions. A success rate of 97% was calculated.

d. Conclusion: The results of this investigation point out that sinus floor augmentation utilising bone substitution material with high porosity and simultaneous implant insertion is a reliable therapy option in patients showing reduced vertical bone volume in the posterior maxilla.

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The periosteum attached onlay bone graft for ridge augmentation: Reports of cases

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Purpose: Periosteum contains the vascular, as well as the cellular elements necessary for the maintenance of normal bone function and repair. The aim of this clinical trial is to present clinical applications of periosteum attached onlay block bone(PAOBB) graft for deficiencies.

Methods: The partial thickness flap was raised and bone was harvested preserving the periosteum and connective tissue in Mx. tuberosity, The PAOBB was fixed with screw in recipient bed. Case1 Mx. anterior narrow ridge and PAOBB graft and delayed central incisor implant. Case2 Mx. molar area and PAOBB vertical graft and delayed implant. Case3 Mx. molar area and PAOBB vertical graft. Case4 Mx. anterior narrow ridge and PAOBB horizontal graft to improve the aesthetics.

Results: The grafted bone was well suited to the placement of implant and improved the aethetics especially in the maxillary anterior area. Advantage. 1.No membrane is needed, 2.Require less healing time and more safe than traditional graft without periosteum. .3.The dehiscence may not lead to fialure. 4.Low risk and less complication, Disadvantage: 1.Meticulous technique is need to harvest and fixation. 2.Limitation of indication and size. 3.Poor contouring and adaptation.

Conclusion: This technique could be effective in the small alveolar defect. The most important advantage lies in the early revascularization. which promotes as well, the healing and the osteogenesis in the region. However, further longitudinal experimental, clinical evaluation of results are required to determine the optimal indication, surgical procedure, size of augmentation, and timing of implant.

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Vertical ridge augmentation: an experimental model in dogs

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Aim of this study was to evaluate the effects of GTR on vertical ridge augmentation (VRA) of chronic defects treated with titanium implants and a titanium reinforced e-PTFE membrane (W.L. Gore, Flagstaff, AZ). In addition a dog model for the study of VRA around partially inserted implants is described.

18 titanium dental implants were placed superior to a previously modified mandibular alveolar process in three mongrel dogs. Each animal received three implants per side inserted to a depth of approximately 5 mm, resulting in a supracrestal bone defect of 4.5 mm to 6 mm.

The 12 test implants were covered by a reinforced e-PTFE membrane. The space under the membrane was filled with peripheral venous blood from the animal to prevent an empty space from developing and the flaps were sutured. The 6 control implants received no membrane.

Histologic and histomorphometric analyses performed after six months of healing revealed that the membrane group exhibited a significantly greater mean percentage of bone fill than the control group. 11 sites demonstrated uneventful healing and the clinical evaluation of one test site showed evidence of complete regeneration of the vertical bone defect. The occurrence of dehiscence correlated to one test site, and the membrane was removed after 18 days.

This study demonstrates the potential of coronal bone growth of the alveolar bone in protected space around titanium implants with exposed threads when placed in the dog. In addition, this experimental model may prove useful for future studies on different procedures to enhance bone formation.

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Autogenous bone graft in bone regeneration following immediate implant placement

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The purpose of this study was to evaluate the effectiveness of autogenous bone graft in treatment of osseous defects adjacent to titanium implants placed into immediate extraction sockets. Twelve patients scheduled for tooth replacement with dental implants participated in this study. Eighteen titanium screw-shaped fixtures were immediately placed following tooth extraction. The autogenous bone graft was used to fill the remaining osseous defects. Clinical measurements were taken at six sites around each implant using calibrated periodontal probe and included changes in mean values of implant bone level (IBL), bone defect depth (BDD) and bone defect width (BDW).After six months, the second stage surgery was preformed to allow abutment installation. No fixture losses were recorded and all implants were stable at the follow-ups. At re-entry, all clinical parameters resulted in significant improvements ($p < 0.001$) in decreasing of implant bone level, mean bone defect depth and more gain in bone defect width. The results of this study indicated that the use of autogenous bone is safe and an effective modality in treatment of bone defects around immediate implant placement.

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Placement of non-submerged implants simultaneously with sinus augmentation with bovine HA

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Objectives: The presence of pneumatized sinuses in the posterior maxilla often impairs implant placement. A sinus lifting procedure can reliably augment the bone height, the highest success rates having been reported if 2-stage implants are placed 6–9 months later. Our aim was to retrospectively evaluate the clinical reliability of a shortened approach where 1-stage, non-submerged implants are placed simultaneously with the sinus augmentation procedure.

Experimental methods: A sample of 41 consecutive patients (14 men and 27 women, 40–82 y old), with a residual bone height under the sinus ranging from 3 to 8 mm were treated from 1999 to 2004. A total of 110 implants were placed simultaneously with the augmentation of 53 sinuses: an oval window (about 10/8 mm) was created on the buccal bone wall by means of a diamond bur and reflected internally with the Schneiderian membrane. Bovine HA (BioOss®), rehydrated with a solution of 100 μg to 1 mg/ml doxycycline, was used as a space filler. A resorbable membrane (Biogide®) was placed on the buccal window before suturing. Healing or final abutments were immediately placed and the final loading with fixed prosthesis was

performed 0–10 months later. The outcome was evaluated 1 to 64 months after loading.

Results: Two implants had to be submerged because of a lack of primary stability. No sinusitis was noted. Only two implants were lost before final loading due to excessive pressure of a provisional complete denture, leading to a 98.2% survival rate.

Conclusions: Sub-antral bone regeneration with bovine hydroxyapatite as a space filler is a highly effective and safe procedure allowing high success rates of implants placed in the posterior maxilla. If the amount of remaining bone is sufficient to ensure primary stability, implant placement can be performed simultaneously with sinus lifting, and even in a non-submerged fashion. This allows to significantly reduce the number of surgeries and the delay before prosthetic rehabilitation.

128 | Poster – Topic Tissue Augmentation

Elimination of Latency Period in Transport Alveolar Distraction

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Intraoral distraction is being used widely in maxillofacial surgery to avoid from the scars and bad appearence of the extraoral distraction devices. However the rod of the distractor may interfere with the occlusion or may cause mucosal irritation during or after distraction. Latency period could be eliminated in transport alveolar distraction by miniplate insertion to apertura piriformis and stabilizing the distracted segment to this plate.

In this presentation after the insertion of a distraction device to anterior maxilla for transport alveolar distraction in an alveolar cleft the distactor was removed and the distracted segment was stabilized to the miniplate which was inserted during the distraction device insertion. By this simple method the metal hardware is removed following the distraction period without waiting at least two months for consolidation.

129 | Poster – Topic Tissue Engineering

Effect of Fibrin-Fibronectin Sealing System as a Carrier for rhBMP-4

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Objectives: The purpose of this study was to evaluate the possibility of the fibrin-fibronectin sealing system(FFSS) as a carrier system for rhBMP-4 and the osteogenic effect of FFSS in a rat calvarial defect model.

Materials and methods: An 8-mm, calvarial, critical-sized osteotomy defect was created in each of 30 male Sprague-Dawley rats. Three groups of 10 animals in each received either rhBMP-4 (0.025 mg/ml) in an FFSS carrier, FFSS only, or negative surgical control. Rats were sacrificed either 2 (10rats) or 8 (10rats) weeks after surgery. Results were evaluated histomorphometrically.

Results: The surgical implantation of rhBMP-4/FFSS resulted in enhanced local bone formation at both 2 and 8 weeks. New bone formation was also evident in FFSS group. However, the amount of defect closure, new bone area, and bone density were significantly greater in the rhBMP-4/FFSS group relative to FFSS group($P < 0.05$). At 8 weeks, the quantity of the new bone was greater than that observed at 2 weeks and the specimens showed a more advanced stage of remodeling and consolidation in both group($P < 0.05$).

Conclusions: The results of the present study indicated that FFSS has an bone formative activity and that may be employed as a candidate as a delivery system for BMPs.

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Effects of rhBMP-2, 4 and 7 on Bone Formation in Rat Calvarial Defects

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Background: The aim of this study was to evaluate and compare the osteogenic potential of rhBMP-2, 4 and 7 delivered using an absorbable collagen sponge(ACS) in a critical sized rat calvarial defect model.

Materials and methods: Eight-millimeter calvarial critical sized defects were created in thirty male Sprague-Dawley rats. Animals were divided into 3 groups of 10 animals each. Defects were treated with 0.025/rhBMP-2/ACS, rhBMP-4/ACS, or rhBMP-7/ACS. Rats were sacrificed either 2 (5rats) or 8 (5rats) weeks after surgery. Results were evaluated histologically, histomorphometrically and immunohistometrically.

Results: All the rhBMPs used in this study resulted in enhanced bone formation at both 2 and 8 weeks. The amount of defect closure, new bone area and bone density were similar in the three groups at each time point ($P > 0.05$). In terms of bone density and new bone area, there were statistically significant differences between 2 and 8 weeks in all groups ($P < 0.05$). Two-way ANOVA revealed that only time had influenced on the results ($P < 0.05$). Irrespective of types of rhBMPs, the positive immunoreactions of osteopontin and osteocalcin were evident near the newly formed bone and in some of the cells included within it.

Conclusions: Within the selected rhBMPs types used, there appears to be no specific differences in their osteogenic potential.

All the rhBMPs used in this study may be considered effective factors for inducing bone formation.

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Evaluation of Factors Affecting Bone-Implant Integration using Micro-Computed Tomography

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Surface roughness is known to affect load-bearing strength of implants. However, the underlying mechanisms are not completely understood. This study aimed at investigating potential effects of bone-to-implant contact (BIC) and mechanical interlocking on the stability of titanium implants using a newly established assessment system that combines non-destructive micro-computed tomography (μCT) and the biomechanical push-in test. Cylindrical implants with either a machined or a dual acid-etched (DAE) surface were placed into the distal femurs of Sprague Dawley rats. At weeks 2 and 4, the femur-implant specimens were harvested, scanned in a desktop μCT and the BIC was calculated. The implants were then loaded axially using a universal mechanical testing machine and the breakage force was recorded as push-in value. Machined and DAE implants embedded in histology-quality resin served as a reference control. Two-way ANOVA followed by the Mann Whitney U test was used for statistical analysis. BIC showed no surface- or time-dependent differences. The push-in values of DAE implants were 4 times greater at week 2 and 3 times greater at week 4 than those of the machined implants. When the implants were embedded in the resin with implant-resin contact rate of nearly 100%, DAE implants showed only 2 times greater push-in values than the machined implants ($p < .05$). It may therefore be concluded that bone-implant contact and interlocking can not fully explain surface roughness-related increase of titanium implant anchorage and the hypothesis may be raised that biological mechanisms may play important roles of this matter.

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Sinus grafting with autogenous bone cells. A prospective clinical study.

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Aim: to study vertical bone and graft height following sinus grafting with autogenous bone cells (ABC) and bovine bone mineral (BBM).

Material and methods: Sixteen sinuses of nine patients were operated between 2003 and 2005. Four weeks prior sinus grafting bone biopsies from the iliac crest and 150 ml autogenous blood from peripherial vein of each patient were harvested and sent to the lab (CO.DON, Teltow, Germany) to expand ABC. Sinus floor elevation was performed with the lateral window technique. Each sinus were grafted with ABC and BBM. After a healing period of six months implants were placed. The implants were uncovered another six months and gingiva former were connected. After soft tissue healing the prosthetic restaurations were incorporated. Dental-CT scans were made after sinus grafting (T1) and following implant placement (T2). Vertical bone and graft height (mean in mm ± SD) was measured on dental-CTs for each time points.

Results: Vertical bone height was at $T1 = 2{,}28 \pm 2{,}37$ ($n = 16$), at $T2 = 0{,}50 \pm 0{,}77$ ($n = 9$). Vertical graft height was at $T1 = 11{,}36 \pm 1{,}96$ ($n = 16$) and at $T2 = 11{,}38 \pm 2{,}84$ ($n = 9$).

Discussion: Vertical bone and graft heigth are one of the factors to determine clinically the success of sinus grafting procedure. In the present study, the graft was sufficient to support implants. This preliminary results suggest that implant placement following sinus grafting with ABC and BBM in atrophic maxilla might be successfull.

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Three-year experiences with autogenous bioengineered bone in sinus grafting

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Introduction: Sinus grafting with autogenous bone in the atrophic maxilla for implant placement is still the gold standard. However, minimally invasive periost harvesting for breeding Bioseed - Oral bone excludes complications possible after harvest of autogenous bone. Our study shows three-year experiences with autogenous Bioseed - Oral bone in sinus grafting.

Material and Methods: We grafted 10 sinuses with Bioseed - Oral bone in 6 female patients (mean age 57.8 years; Cawood-Howell-Class V-VI). Altogether, 14 Astra Tech implants (length 8–13 mm, diameter 3.5 – 4.5 mm) were placed in the augmented sites. Seven implants were inserted simultaneously (group I, alveolar ridge 3 mm) with the sinus grafting procedure, seven 3 months after grafting (group II, alveolar ridge < 3 mm). After a 3-month healing period all implants were provided with permanent restaurations. Clinical and X-ray controls were obtained after surgery or upon suture removal, further X-ray controls after insertion of the prosthetic supraconstruction and after 6, 12, 24 and 36 months.

Results: Only one implant (group II) was lost after 2 months (survival rate 92.85%), the others are still in function. There were no signs of inflammation at the harvest- or the sinus graft sites. Implant placement after sinus grafting with Bioseed - Oral bone with a high primary stability (insertion torque 25 Ncm) was possible in all cases (group II). Conclusion: Sinus grafting

with Bioseed - Oral bone and a 3-month healing period, the minimally invasive harvesting method avoiding complications, represents a predictable and successful treatment in the atrophic maxilla.

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(20) Interforaminal peri-implant bone loss around machined and roughened screw-type implants

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Objectives: Marginal peri-implant bone height around machined and grit-blasted acid-etched mandibular interforaminal implants was evaluated radiologically after functional loading for 3 years to 7 years in this retrospective study.

Materials and methods: 51 patients with 4 interforaminal implants were included in this study. Of these, 36 (70.6%) with a total of 144 screw-type implants (72 machined MKII® implants and 72 grit-blasted acid-etched Frios® implants) were available for follow-up studies. Interforaminal marginal bone loss was evaluated by extraoral Scanora® scans. In addition, predictive factors such as patient age and gender, nicotine abuse, implant position, implant life, site of measurement and bone loss at surgery were recorded. Analysis of covariance for repeated measurements was used for statistical analysis. Between-group differences were expressed as least square means (LSM) ± standard errors (SEM).

Results: Sand-blasted acid-etched (SE; LSM 2.4 ± 0.23 mm) implants showed significantly less marginal bone loss than machined (MS; LSM 1.64 ± 0.27 mm; $p = .0422$) implants. Peri-implant bone loss was more pronounced around the more anterior positioned implants than around the more posterior positioned implants. This difference was highly significant at $p = .0001$.

Conclusion: Bone loss around acid-etched and sandblasted implants was found to be significantly higher for MS implants in comparison to SE implants in this retrospective radiologic evaluation. Nicotine abuse did not seem to have a significantly negative effect on peri-implant bone loss around interforaminal mandibular implants.

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Attachment parameters in splinted and unsplinted implant 10 years in situ

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Introduction: In the edentulous mandible, splinted and unsplinted implants are routinely used for overdenture stabilization. The aim of this investigation was to compare the long-term outcome of both treatment options in respect of attachment level and bone loss.

Materials and methods: 28 patients with 80 interforaminal implants which had been functioning for more than ten years were investigated mesially and distally. 14 patients were treated using 36 single standing attachments (72 sites) with non-rigid telescopic attachments. A matching group of another 14 patients with 44 bar-splinted implants (88 sites) was established. The attachment level (AL) resulted as the sum of probing depth (PD) and the distance from the implant shoulder to the peri-implant mucosa (DIM). Digital panoramic radiographs were utilized to evaluate the peri-implant bone loss. The Welsh's t-test served for comparison of the two groups, and Pearson's correlation coefficients were calculated for AL and bone loss.

Results: In unsplinted implants, the mean values of AL ($p = 0.021$) and bone loss ($p = 0.001$) were 3.24 and 1.37 mm as compared to 2.81 and 0.67 mm in splinted implants. There was a close correlation between AL and bone loss for both unsplinted and splinted implants ($p < 0.001$).

Conclusions: The differences between unsplinted telescopic and bar-splinted implants indicate that over time the attachment selection may influence both peri-implant hard and soft tissues. Despite adequate long-term performance with either system, the use of unsplinted implants might be advantageous in terms of preservation of attachment parameters. In both systems, the clinical attachment level offers reliable information on bone loss.

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Implant Prognosis Predicted by Histology of the Implant Covering Mucosa.

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The objective of this study was to correlate histologic findings of the implant covering mucosa with the long-term prognosis of osseointegrated implants.

267 implants (Frialit 2 Type 45–03xx, Friadent) placed in 134 patients were exposed using the punch technique (Biopsy Punch, Stiefel) after an inconspicuous integration period of 3–6 months, mucosa samples covering the fixtures were examined histologically. Gingivaformers (Type 45-14xx, Friadent) were placed for 20 ± 6 days and following that, standard abutments (Type 45-21xx, Friadent) and temporary crowns were attached. 19 ± 6 weeks after implant uncovering, permanent prostheses were employed. Up to 89 months after implant placement, following periimplant findings were ascertained prospectively: (a) pocket depth, (b) clinical attachment level, and (c) radiographic findings. According to these clinical findings the implants were assigned to 5 classes: (0) control without pathologic findings ($n = 146$); (1) pathologic findings in one group ($n = 55$), (2) in two groups ($n = 31$), (3) in three groups ($n = 25$), and (4) implant loss ($n = 10$). Histologic findings were compared statistically (ANOVA) for all classes.

Close correlation existed between clinical periimplant and histologic findings of the previously taken mucosa samples: In group 3 and 4, a significant increase was seen for eosinophils ($p = 0.000$), lymphocytes ($p = 0.011$), macrophages ($p = 0.000$), plasma cells ($p = 0.001$), foreign body giant cells ($p = 0.003$), osteoblasts ($p = 0.000$) and osteocytes ($p = 0.000$). Histology revealed confirmation of an allergic reaction against implantation material in altogether 9 cases.

Histological examination of the mucosa taken at uncovering of the fixture early indicates an unfavourable prognosis or possible loss of osseointegrated implants.

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Immediate Functional Loading of Double Acid-etched Surface Titanium Implants: 1 to 6 year results.

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Starting with a couple of implants placed in the mandible and immediately loaded with an overdenture, the concept of immediate loading evolved to loading multiple implants in both arches.

In this prospective investigation 41 consecutive patients have been treated with 343 double acid-etched threaded implants since May 1998. Seven mandibular and fifteen maxillary cases received screw-retained provisional prostheses the day of surgery. Fifteen mandibular and twelve maxillary cases were immediately loaded 24 to 48 hours after surgery with the final screw-retained metal-ceramic or metal-resin prostheses. All 217 maxillary implants and 126 mandibular implants were utilized for immediate loading and were followed for a minimum of 12 months to a maximum of 81 months. Follow up consisted of both clinical and radiographic examination and RFA measurements

The cumulative success rate obtained was 99.42% (only two mandibular implants were considered failures). The bone level was measured from the first bone to implant contact point every year. The average radiographic bone level change was 0.56 mm at the 12th month, 0.76 mm at the 24th month, 0.84 mm at the 36th month, 0.82 mm at the 48th month, 0.83 at the 60th month and 0.94 at the 72nd month. There was no implant mobility or peri-implant radiolucency. When RFA was performed, only two implants results with an ISQ lower than 50 ($n = 201$).

It is concluded that a high success rate can be achieved when double acid-etched microtextured implants are immediately loaded with full arch prostheses in the maxilla and the mandible.

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Retrospective Evaluation of Postoperative Complications of 397 Sinus grafts.

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In the posterior maxilla the residual bone volume very often is not sufficient for implant placement and consecutive implant supported prosthetic treatment. Thus the technique of sinus grafting utilizing the lateral window technique has to be applied. The objective of this retrospective study was to evaluate frequency and type of post-operative complications and their influence upon treatment outcome.

In the last ten years 869 implants in 397 sinus graft procedures have have been placed. All patients are in an at least once-a year recall routine. 62 complications involving 77 implants were subsumized in 6 different groups and 3 degrees of severity. There were 31 sites with implant failures, 4 buccal implant exposures, 15 dehiscences of oral mucosa with and without loss of augmentation material or membrane/implant exposure, 3 acute po. Infections, 9 considerable reductions of augmentation volume and 2 cases of acute late sinusitis with empyema. This means a complication rate of 15.6%. In 34 (8.6%) cases treatment plan was not affected. 20 (5%) made necessary a modification of the treatment plan and in just 8 cases (2% of all) implant supported prostheses could not be achieved.

Despite a relatively high incidence of postoperative complications, the treatment objective of implant-supported rehabilitation of the posterior maxilla could be achieved in 97.2% including changes of the treatment plan in 8.2%. Within the limits of a retrospective study the present investigation showed implants placed in combination with sinus augmentation to function successfully during an observation period of 10 years.

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5-year study of the Clinical Effectiveness of the Ankylos Implant

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The Ankylos implant exhibits several important clinical features – 1) a tapered abutment connection to eliminate the ''micro-gap'' with bacteria and food debri, 2) a progressive thread design – both reduce inflammation, crestal bone loss and improve survival. ''Effectiveness Studies'' evaluate these factors as well as differences in patients and the skill of dentist.

Objective: Assess variations in survival, stability, and crestal bone response in an independent ''effectiveness'' study – 1,500 implants, 500 patients, 800 restorations and 80 dental providers – over a 5-year period.

Methods: 30 VA (USA) dental clinics were used. Investigators were trained and standardized in implant placement and scientific evaluation methods. X-rays (bone loss) were evaluated

using proportional measurements. Basic statistical methods (means, 95% confidence intervals) were used to report results.
Results: Mean ''overall survival'' was 98% (100% survival at 16 centers, 95–99% at 7; 90–95% at 3; and less that 90% at 4 centers); implant length, diameter and bone density influenced survival; implant stability ranged from -3.5 to -2.0 PTVs depending on bone density; crestal bone loss varied at each center, but mean overall loss was less than 0.2 mm/year.
Conclusions: 1) This study demonstrated that variations in treatment centers (patients, technical skills, experience, etc) had only a slight influence on survival, crestal bone loss and stability of this implant, 2) the effectiveness of this implant design for use in all implant-prostheses treatments, is highly acceptable. Supported by Veterans Administration (USA) and Dentsply-Friadent Germany.

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Rehabilitation of severely atrophic jaws for implant placement: a 1–8 years follow-up study.

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Aim: Aim of this retrospective study was to present the outcomes of implants placement in severely atrophic jaws, treated with guided bone regeneration, after 1 to 8 years of function.
Material and method: 112 partially or totally edentulous patients, with severe bone atrophy in maxilla and/or mandible participated in the study (65 male and 47 female, aged of 26–78 years old). In all cases, regenerative procedures were used for bone augmentation prior to implant placement, in 157 surgical sites. As graft materials were used: a) only autologous bone (33 cases), b) autologous bone in combination with platelet-rich plasma (52 cases), and c) autologous bone in combination with allograft (72 cases). As barrier membranes were used: a) titanium reinforced non-resorbable e-PTFE membrane (24 cases), b) non-resorbable e-PTFE membrane (102 cases), and c) resorbable collagen membrane (31 cases). In total, 496 implants were placed in the sites of bone regeneration after 4–12 months. Conventional implant-supported fixed bridges were placed in 78 patients; while in 34 patients implant-supported removable dentures were used. All patients had a detailed clinical and radiographic examination every 6–12 months.
Results: The main results of the study are: 1) Adequate bone volume was clinically observed in all cases. 116 interventions were performed in the maxilla and 41 in the mandible ($p = 0.083$), and concerned: a) horizontal augmentation (71 cases), b) vertical augmentation (14 cases), c) vertical augmentation in combination with sinus floor elevation (62 cases), d) two-dimensional reconstruction (8 cases), and e) subnasal elevation (2 cases) ($p < 0.001$). The increase of bone in horizontal dimension was 3.7–7.1 mm, in vertical dimension 2.8–4.2 mm and in sinus augmentation 4.1–8.6 mm. 2) Regarding the regenerative procedures, in 89 cases no complications were observed. Complications existed in 68 cases ($p = 0.083$). Out of these: 59 concerned exposure of barrier membrane, 7 infection of barrier membrane and 2 superficial infection of the graft ($p = 0.017$). 3) Out of 496 placed implants, 4 failed to osseointegrate. After the prosthetic loading, 15 implants lost due to peri-implantitis and 6 were broken.
Conclusions: a) guided bone regeneration is a predictable method with high success rates, even in severely compromised jaws, b) in the majority of cases, they were not observed complications that led to failure the intervention, c) the total rate of implant success was 99.19%, while the rate of implant survival was 95.73%.

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5-year study on periodontal tissue healing following tooth autotransplantation

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Aim: to study the periodontal tissue of autotransplanted teeth.
Materials and methods: 65 patients (female: 82,72%, male: 17,28%), age between 13 and 54 years (average 20,33 years), with 81 transplanted teeth were treated during a six year period by transplantation of autologous teeth. The contralateral tooth was took as control tooth for investigation.

The teeth were examined at least 5 years after surgical treatment for periodontal pocket depth (PD), bleeding on probing (BOP). A survival rate after 5 years was also evaluated. PD were measured with a Hu-Friedy-CP 12 Periodontometer, mesial, distal, buccal and ligual. PD higher than 3 mm were considered as pathology depths (Lindhe 1999). BOP was evaluated with 0 = bleeding, 1 = no bleeding (Lindhe 1999).
Results: The survival rate after 5 years was 88,89%. 95% of the transplanted teeth had physiological pocket depths (< 3 mm). In 97,69% the contralateral teeth had physiological pocket depths (< 3 mm). 49 transplanted teeth (75,38%) had no bleeding on probing. 50 control teeth (76,92%) had no bleeding on probing.
Discussion: In the present study no differences were found between the autotransplanted teeth and their contralateral examinated teeth regarding periodontal parameters. The autotransplanted teeth had a high survival rate as also reported in other studies (Galanter et Minami 1968, Andreasen 1990 et 1993, Terheyden et al. 1995). In summary, autotransplantation is a successful treatment option for the replacement of lost natural teeth.

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Soft tissue healing of autotransplantated teeth after 5 years

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Aim: to evaluate the soft tissue of autotransplatated teeth.
Materials and methods: 81 autotransplanted teeth (tx) and 81

contralateral control teeth (tc), were included. Attached gingiva (AT) and papilla height (PH) were investigated. The patients satisfaction was also evaluated.

AT was examinated (− 1 = reduced, 0 = normal, 1 = hyperplasic) (Lindhe 1999, Newman 2002). For PH the mesial and distal papilla were investigated (0 = no papilla present, 1 = reduced to 50%, 2 = normal to 100%, 3 = hyperplastic papilla) (Jemt 1997, Chang 1999). The patients satisfaction was evaluated (0 = no, 1 = yes).

Results: AT had 0 value in 69,23% (tx) and in 72,31% (tc) of the cases. Value -1 was found at 24,62% (tx) vs. 16,92% (tc), value 1 was 6,15% (tx) vs. 10,77% (tc), respectively. PH had 2 value in 46,15% (tx) and in 70,77% (tc). PH value 0 = 6,15% (tx) vs. 0% (tc), value 1 = 47,69% (tx) vs. 29,23% (tc), and value 3 = 0% (tx) vs. 0% (tc). By the investigation of the patients' opinion a very satisfied response was recorded in 98,46% of the cases.

Discussion: The greatest differences between the transplanted teeth and the control teeth were in the investigation of PH. A different anatomic morphology of the autotransplanted tooth compared to the first original tooth might explain the variation. Taken together, the morphology of the soft tissue is very similar between tx and tc.

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Immediate and delayed implants: long term results

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Aim: Following the loss of a natural tooth, the mucogingival complex begins to collapse. The immediate placement of endosseous dental implants can prevent o reduce the extent of this collapse. This paper reports on the clinical success of 527 immediate implants.

Materials and methods: Between January 1994 and November 2002, 309 immediate implants and 218 delayed implants were placed in 247 patients to restore missing teeth.

Three different Implant System were used (42 Branemark Implants; 207 Straumann Implants and 278 Ankylos Implants). Bone augmentation procedures, such as guided bone regeneration alone or in combination with graft materials, or use of graft materials alone, were combined with immediate implant placement. After conventional healing period all implants were osseo-integrated from clinical and radiographic point of view and fixed restorations were inserted. In different time intervals all implants were submitted to a clinical and radiographic control.

Results: 12 patients with a total of 19 implants were not present to recall. During a total observation period of 4,7 years (range 2–10 years), 20 implants were removed and the cumulative survival rate was 96%. The majority part of implants presented healthy peri-implant soft tissue conditions, showing low values of clinical parameters.

Conclusion: Immediate implants have high survival rate which are similar to those associated with conventional implant placement. Technical and prosthetic complications can have a negative influence on the patient's confort. The internal-tapered implant-abutment connection can have a positive influence on the healing and long term stability of peri-implant soft and hard tissues.

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Site-specific inflammation and bone loss in four-implant bar constructions

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Introduction: Splinted bar constructions on four interforaminal implants are widely used for overdenture stabilization in the edentulous mandible. The objective of this investigation was to compare the long-term outcome of central and lateral implants in respect of inflammation and bone loss.

Materials and methods: A total of 60 implants was investigated in 15 patients with four-implant bar constructions after more than 10 years in function. Central and lateral implants were evaluated mesially and distally (C-m, C-d, L-m, L-d). The impact of inflammation on bone loss was determined using a Composite Inflammation Score (CIS) on the basis of four inflammatory parameters: modified Plaque Index (mPI), modified Bleeding Index (mBI), Sulcus Fluid Flow Rate (SFFR) and Keratinized Mucosa (KM). Digital panoramic radiographs were utilized to evaluate the peri-implant bone loss. Independent two sample t-tests served for multiple comparisons of the four sites in terms of CIS and bone loss.

Results: CIS revealed the highest values in the inner space between central and lateral implants (C-d: 2.60, L-m: 2.37) as compared to the outer sites (C-m: 2.33, L-d: 1.97). Bone loss was greater around central (C-d: 1.42 mm, C-d: 1.64 mm) than lateral implants (L-m: 1.25, L-d: 1.03).

Conclusions: Though neither comparison reached the level of significance ($p < 0.05$), there appears to be a site-specific inflammation between central and lateral implants indicating a niche effect. Increased bone loss around the central implants might be induced by biomechanical stress (Wismeijer et al. 1999). The higher inflammation at the niche sites may superimpose this effect on bone loss.

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A 10-year follow up with Astra Tech implants

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The present retrospective long-term trial statistically evaluates 1,999 Astra Tech implants placed in 607 patients following the Kaplan Meier procedure. Additionally, proximal and distal bone apposition and resorption in 40 patients with implants in situ since for least 10 years were examined radiologically, digitalized using Friacom-Dental Office Software, and subsequently evaluated. In

order to verify bone level alterations, the distance between referencing point and marginal bone level was measured.

The median observation period was 50.6 months. The survival rate after five years, remaining unchanged till the end of the observation period (>10 years), was 97%.

The radiological examination of the marginal bone level of 40 patients (163 implants) with implants in situ for at least 10 years showed a mean bone loss of 0.4 mm (SD 0.7 mm).

The outcome of the present study confirms very good long-term results with the Astra Tech implant system in terms of implant survival rate and marginal bone level. Furthermore, the marginal bone level with a median bone resorption rate of 0.4 mm, observed over a 10-year period, represents a special clinical success.

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A 6- to 12-years study of implants placed in grafted maxilla

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Objectives: The aim of this study was to determine the long-term survival rate of dental implants placed after Le Fort 1 osteotomy and interpositional bone grafts.

Experimental Methods: Twelve patients with extremely resorbed maxillae were subjected to osteotomy and interposition of bone grafts harvested from the iliac crest. After 4–5 months the implants were inserted (from a minimum of 7 up to 11). Implant were surgically exposed 6–7 months later. Ten patients received fixed proshesis and two received overdentures. Clinical and radiographical examinations (periapical, panoramic radiograph) of the bone grafts and implants and satisfaction of the patients (aesthetics, masticatory function, overall teatment) were evaluated in all cases.

Results: Out of 104 implants inserted, 11 were lost during the entire follow up period for a cumulative survival rate of 89.5 %. Failures mostly occurred during the first year of function (7 out of 11). The mean marginal peri-implant bone loss was 1.6 +/− 1.3 mesial and 1.5 +/− 1.3 distal measured on periapical radiography.

Conclusions: Le Fort 1 osteotomy combined with interpositional bone grafts and later placement of dental implants demonstrated predictable long-term results. All the patients treated were able to maintain the removable or fixed prosthesis at 6- or 12-years.

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Long-term retrospective analysis of MIS internal hex implants.

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Objectives: The aim of this study was to retrospectively evaluate the success rate of internal hex endosseoss implants (MIS implants) after long-term function and to construct a multivariate correlation model between formerly proposed predictors of bone loss (i.e. time, smoking habits, cantilevered prosthetic etc) and bone loss.

Methods: Patients from a private practice were recalled for clinical and radiographic followup. Data from patients' files, which had completed 36 months of followup, was collected to include information about health status, habits, implant and prosthetic variables. Radigraphic bone loss around the implants was measured using a magnifying loupe, and was used to calculate the actual bone loss.

Results: 190 implants from 46 patients had more than 3 years of follow-up time. Of these implants, 5 implants failed at the first phase (3% early loss), and another 4 lost through time of function (2% late loss) exhibiting an overall success rate of 95% through an average of 5.3 years. The average number of exposed threads was found to be 0.83, exhibiting calculated mean annual bone loss of 0.2 mm/year. No correlation was found between the time of service and crestal bone loss. Beside smoking habits ($p = 0.04$) none of the suspected variables had statisticaly significant interaction with the amount of bone loss.

Conclusions: The results of the present study confirm that MIS internal hex implants exhibited an overall success rate of 95% in a long-term follow-up period. Except for smoking habits, none of the other suspected variables were found to influence crestal bone loss.

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Two attachment systems for implant-supported mandibular overdenture. Clinical study

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The objective of the investigation was to compare, in a randomized clinical study, two types of stress-breaking retention for mandibular overdentures (ball anchors and magnets) with the use of ITI Straumann dental implant system.

Materials and methods: 20 patients (12 females, 8 males), mean age 65,5 years, fully mandibular edentulous were enrolled in the study.

Each patient received 2 × 10 mm (10 patients) and 12 mm (10 patients) screw-type ITI implants (Straumann, Waldenburg, Switzerland) Ø4.1 mm, with SLA surface, in the canine region of the mandible.

After 6 weeks healing period implants were loaded and the patients were randomly assigned to one of two groups (10 patients each):

- ball anchors
- magnets

New mandibular overdenture with metal reinforcement was made.

Parameters assessed at 6 and 12 months: gingiva-score, plaque-score, calculus, bleeding-score, probing, implant stability – Osstell Mentor (RFA), prosthesis retention and maintenance, radiographic outcome, soft-tissue complications and patient satisfaction.

Results: After 1-year follow-up period: no implant failure, the plaque accumulation was higher for magnet then for ball group, ISQ (Osstell Mentor) value – not significant difference between 6 mo and 1 year measurements. Low retention forces at the magnet group were observed. Patient satisfaction is high at both groups.

Conclusions: No significant difference between the two retention systems after 1 year.

The two-implants-retained overdenture reduce stress on patients and tissues, it is a less time-consuming treatment modality, less expensive and becomes a true alternative to fixed prostheses.

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Initial report of a 3-year multi-centre study on NobelDirect implants

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Introduction: The NobelDirect NP, RP & WP implants (Nobel Biocare AB, Sweden), i.e. implant and transmucosal abutment manufactured in one piece, are followed in a 3-year clinical multi-centre study. The abutment part is preparable enabling an individualized borderline of the preparation to exactly follow the anatomy of the soft tissue margin without violating the soft tissue seal.

Materials and methods: Five clinics have placed 108 NobelDirect implants in 65 patients. Thirty-nine of the implants were placed in the maxilla and 69 of the implants were placed in the mandible. Thirty of the implants were placed in extraction sites. Surgical techniques included both flap and flapless surgery. Approximately 50% of the implants were subjected to immediate functional loading. At 13 implant sites bone grafting had been performed and 1 site was subjected to a soft tissue graft.

Results: At placement, 42 implants were prepared intra-orally for the provisional restorations. Fifty-eight of the 65 patients have received their permanent prosthetic restorations and 47 patients (77 implants) have been followed for 6 months. The reported patient assessments of function and esthetic of the permanent restorations all scored from good to excellent. For the follow-up visits at 3 and 6 months, the registered percentages of sites with no visible plaque and normal peri-implant mucosa increased with longer follow-up time. One implant failure occurred before the 3-month follow-up. This implant had a reported questionable stability at placement. No patient withdrawal has occured.

Conclusion: The initial follow-up result of NobelDirect implants from this multi-centre study demonstrates 99,1% cumulative implant survival rate and favourable treatment outcome.

The study is supported by Nobel Biocare.

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Soft tissue around functionally loaded implants without oral hygiene

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The purpose of this study was to determine the Peri-implant Soft Tissue Level (PSL) and Peri-implant Bone Level (PBL) of dental implants with different designs and surface modifications after functional loading without oral hygiene. Three types of dental implants were placed in the posterior jaws of adult baboons, three of the same design per quadrant, and fitted with fixed partial dentures. After 1.5 years of functional loading and plaque accumulation all implants showed severe peri-implant mucositis and comparatively low PBL. A histomorphometric evaluation of the Sulcus Depth (SD), the dimension of the Junctional Epithelium (JE) and the Connective Tissue Contact (CTC) resulted in no significant differences between the three implant designs, neither in the maxilla nor in the mandible ($p > .05$). The sum of SD, JE, and CTC forming the PSL was nearly the same in the maxilla (CpTi: 3.5 mm 2.9/4.1 Confidence Interval (CI); TPS: 3.5 mm 2.9/4.2 CI; GBAE: 3.2 mm 2.7/3.9 CI) and in the mandible (CpTi: 3.2 mm 2.6/3.8 CI; TPS: 3.2 mm 2.6/3.8 CI; GBAE: 3.2 mm 2.7/3.9 CI; $p > .05$). There was no difference in PBL around the three implant designs (maxilla: CpTi: 0.9 mm 0.5/1.6 CI; TPS: 0.9 mm 0.5/1.5CI; GBAE: 0.9 mm 0.5/1.6 CI; mandible: CpTi: 0.8 mm 0.5/1.2 CI; TPS: 0.6 mm 0.4/0.9 CI; GBAE: 0.7 mm 0.5/1.1 CI; $p > .05$). Overall, the data presented did not show any significant differences in peri-implant soft tissue conditions in baboons. Moreover, plaque accumulation and propagation of peri-implant mucositis after 1.5 years of functional loading was not influenced by implant design and surface modifications in baboons.

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Effect of microthread on the maintenance of marginal bone level

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The success of dental implant therapy in esthetic aspect, relies mainly upon the presence and maintenance of the bone adjacent to

the implant since the preservation of bone support is essential for the pink esthetics. Therefore, there have been many efforts to reduce the marginal bone loss by modifying the implant design, and microthread is one of them. The purpose of this study is to evaluate the long-term effect of microthread on the maintenance of marginal bone level.

Subjects of this study were selected from patients who had implant surgeries at the department of Periodontology at Yongdong Severance Hospital from January, 2001 through June, 2001. In these patients, Astra Tech Single Tooth Implant (ATST) with microthread and Astra Tech TiOblast Implant (ATTB) without microthread were installed adjacent to each other within the same partially edentulous sites in turn. After the second surgery, bridge was delivered.

Radiographs were taken at baseline(bridge delivery) and 1-year, 2-year, 3-year follow-ups

Changes in bone level between two systems are significantly different ($p < 0.05$).

Also, comparing the bone loss changes for each interval between two systems, ATST showed significantly lower crestal bone loss ($p < 0.05$) than ATTB.

Marginal bone loss of ATST was stabilized after the first year, but ATTB reached a steady state after the second year

In conclusion, the microthread might be effective on maintaining and stabilizing the marginal bone loss against loading.

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Host response to titanium evaluated in an oral human model

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Objective: Recent reports have questioned if metal sensitivity may arise from exposure to titanium. The objective of this study was to histologically evaluate non-perforated mucosa covering submerged maxillary titanium implants with regard to induced tissue reactions.

Methods: Thirteen patients, 21–69 years of age, without previous implants were included. After initial examination, the bone crest areas destined for dental implant placement were exposed and threaded external hex (NobelBiocare, Sweden) inserted. Prior to wound closure, a full mucosal tissue slice was biopsied from the edge of the mucoperiosteal flap (baseline). The patients were monitored monthly for 6 months. At abutment connection, biopsies were taken by a 6 mm punch, altogether 26 specimens. Tissue reactions were analyzed by coded histometric analysis at 4 different levels including ratios of inflammatory cells (IC)/epithelial cells, IC/fibroblasts, as well as number of metal particles.

Results: The stained sections portrayed gingival tissue with intact oral epithelium and connective tissue with variable accumulation of IC. Experimental biopsies demonstrated mineralized areas and metal particles of different sizes. Analysis of variance revealed a higher IC/fibroblast ratio for level 3 at baseline compared with level 3 at 6 months ($p < 0.01$). Furthermore, a significant decrease in IC/fibroblast ratio was observed between level 2 and 3, and 2 and 4 at 6 months ($p < 0.001$). The connective tissue level facing the cover screw contained the highest number of metal particles ($p < 0.01$).

Conclusions: Metal sensitivity reactions to titanium implants were not disclosed. All 6-month biopsies were polluted by metal particles.

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Osteopromotive peptide enhanced new bone formation on dental implants

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The purpose of this study was to investigate that surface treatment of dental implants with osteopromotive peptide could increase new bone formantion in beagle dog. Novel osteopromotive peptides (15 amino acids) driven from active domain of bone morphogenetic protein-2 were prepared and conjugated to the surface of dental implant made by titanium (surface treated through resorbable blast media). After anesthesia, periodontal flap was elevated and 3rd and 4th premolar was extracted in beagle dogs (4 beagle dogs weighing about 12 kg). Bone defect was prepared mesiodistally by round bur with engine. Defect size was $3 \times 4 \times 3\,mm^3$. Experimental dental implants (3.3 mm in diameter and 8.5 mm in length, surface treated by the peptide) were installed at the furcation site of 3rd premolar and mesial root sockets of 4th premolar of right mandible, and control dental implants (no treatment) were installed at the same location of left mandible. All implants were submerged with no bone graft and no membrane. The animals were sacrificed after 3 and 5 weeks. Undecalcified ground sections were prepared and histologic and histomorphometric analysis was done through optical microscope. In histologic examinations, there was more new bone formation in experimental group than control group. And, bone healing, maturation was more rapid in experimental group than control group. In histomorphometric examination, there was a significant difference between experimental group and control group in newly formed area ($P < 0.05$). Dental implants treated by osteopromotive peptide could increase new bone formation significantly.

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The effect of bioactive surface on implant stability during healing

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Purpose: Assessment of the primary and secondary stability of dental implants during healing by resonance frequency analysis (RFA).

Materials and Methods: 18 screw shaped, titanium dental implants (3.7 mm × 10 mm) divided into control group (M – 9 machined implants) and test group (B – 9 bioactive alkali treated implants Impladent STI-Bio, LASAK, Ltd., Prague) were inserted without pre-tapping in the tibiae of three Beagle dogs. Every animal received three implants from each group. Implant stability quotient (ISQ) was measured at weeks 0, 1, 3, 9, 12 using Osstell instrument (Integration Diagnostics AB, Gothenburg). The animals were sacrificed after 2, 5 and 12 weeks and bone-implant contact was evaluated histomorphometrically.

Results: The mean primary stability (ISQp) was similar for both groups: ISQp(M) = 74.5 ± 3.0; ISQp(B) = 74.0 ± 2.4 ($p = 0.78$). In the B group there were no statistically significant changes in the implant stability at weeks 0, 1, 3, 9 and 12 ($p > 0.05$) and the bone-implant contact increased to 50, 60 and 68% at 2, 5 and 12 weeks respectively. Implants from the M group showed statistically significant stability decrease dISQ of −2.5 ($p = 0.04$), −6.5 ($p = 0.009$) and −7.8 ($p = 0.008$) after 1, 3 and 9 weeks respectively. The stability decrease was not significant after 12 weeks (dISQ = −0.5; $p = 0.74$).

Net contribution of the bioactive surface to the implant stability increase was estimated at 1.70 ISQ/week within the first 3 weeks and 0.58 ISQ/week within the next 6 weeks.

Conclusion: Results indicate that the surface treatment of STI-Bio implants prevents the ISQ decrease, observed in control group within the first 9 weeks of healing.

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SEM Evaluation of Macro and Micro-structure of Three Types Threaded Plasma Sprayed HA-Coated Dental Implants

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Hydroxyapatite (HA) coating on titanium based implants has been shown to significantly enhance early wound healing, level of bone apposition and osteoconduction. Direct bonding of bone to the metal substrate is envisioned after resorption of HA and bone remodeling. This is expected due to the chemical similarity of synthetic HA to bone mineral. A variety of HA-coated implant designs incorporating surface macrostructure (topography, roughness, etc.) and microstructure (crystallinity, porosity and microroughness) level are available commercially. **The Objective** of this study was to characterize the macro and microstructure of three-plasma spray coated commercial three implant designs.

Material and method: HA-coated implants, 3I implant (3I, implant innovation Inc.), Calcitek (Sulzer Calcitek Inc.) and Steri-Oss (Steri-Oss Inc.) were evaluated. Scanning electron microscope (JEOL, Model JSM 5400) was used to observe surface and cross sectional macro and microstructure and recorded. Coating thickness from various locations were measured from micrographs. Hardness measurements were performed on sectioned samples, using a hardness testing machine (Tukon hardness tester). Geometry relating to implant design was measured using a Nikon Profile Projector (Nikon, V12 Projector).

Result: SEM observation revealed significant differences in macro and microstructures. Significant differences in thickness of plasma sprayed HA coating were noted both as a function of implant type and location in the non-symmetrical geometry of the thread regions. There was a morphological difference in the microstructure of the metal.

Conclusion: Plasma sprayed HA on threaded implant shows significant difference in coating thickness. Macrostructure has an effect on the coating thickness. Qualitative differences due to difference in processing parameters were also identified in the HA coating.

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Investigation of collagen membranes by means of Confocal Laser Scanning Microscopy

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The aim of the present study was to investigate surface properties of various collagen membranes by means of confocal laser scanning microscopy (CLSM).

Six commercially available collagen membranes [BioGide® (BG), TutoDent® (TD), BioSorb® (BS), BioCollagen® (BC), BioMend® (BM), Ossix® (OS)] and one flexible bone tissue membrane [Osteoplant Cortical Flex® (OCF)] were selected based upon known differences in preparative techniques as described by manufacturers. Membranes were examined dry by CLSM with an air objective and 3-D surface images were reconstructed from individual x-y CLSM scans.

BG and TD membranes, so called 'bi-layer' collagen membranes, exhibited a similar layered structure with a porous side comprised of non-uniformly dispersed collagen fibers, of variable dimensions and a smooth opposite side with wavy texture. The BC, BM, OS membranes showed uniform ultrastructure on opposite sides of the membrane. The BC membrane, a type I collagen prepared without any reported chemical processing, had a rough surface texture. BM membranes, a type I collagen membrane cross linked by glutaraldehyde, resembled the BC membrane in surface topography and ultrastructure, however with more compact and

smoother texture. OS membrane, a type I collagen cross linked with an enzymatic process, showed a very smooth surface and a wave like pattern. The CLSM examination of BS revealed the presence of two different surface ultrastructures on one side of the membrane: smooth and porous with compact collagen fibers. The OCF flexible bone tissue exhibited compact, rough and porous structure.

Significant differences in surface structure were found between all investigated membranes when visualized in 3D image reconstructions of CLSM. Differences in surface ultrastructure may play important roles in the biological response of membranes in clinical applications including critical clinical properties such as resorption time, kinetics of cell attachment, membrane penetration and degradation processes. CLSM is a non destructive technique which can be applied to native materials without fixation and may provide useful ultrastructural characterization to biological materials like collagen membranes.

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Biocompatibility of Ti-8Ta-3Nb alloy in Primary Rat Calvarial Cells

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Objective: Titanium(Ti) and its alloys(Ti-6Al-4V,Ti-6Al-7Nb) are widely used as orthopedic and dental implant materials. However when implanted into human body, these materials are problematic because release of elements such as aluminium, vanadium, may lead to toxicity and mutagenicity. Ti-8Ta-3Nb alloy was recently developed in our lab and proved to have excellent mechanical and anti-corrosive properties. The purpose of this study was to evaluate the biocompatibility of Ti-8Ta-3Nb alloy on rat calvarial cells.

Methods: Cells were obtained from Sprague-Dawley fetal rat calvaria by sequential collagenase digestion. Grade-II titanium(Ti) disks or Ti-8Ta-3Nb alloy disks (15 mm in diameter by 1 mm in thickness) were placed in 12-well plate. To investigate cell proliferation, cells were seeded and allowed to attach onto Ti or Ti-8Ta-3Nb dishes. Cells on Ti-6Al-4V disk were served as positive control. Cell proliferation was estimated by MTT-assay at day 3 and 5, and monitored by SEM at day 3. ALP activity was measured spectro-photometrically at day 7. Data were analyzed by ANOVA followed by Duncan's comparison analysis.

Results: The mean proliferated cell numbers on Ti and Ti-8Ta-3Nb alloy were significantly higher than on Ti-6Al-4V alloy ($p < 0.0001$). SEM data showed that cells grown on both Ti and Ti-8Ta-3Nb surface, presented flat, elongated spindle-like morphology, while cells on Ti-6Al-4V alloy were flat, but some cells were round. As compared to positive control, cells on Ti and Ti-8Ta-3Nb alloy exhibited significantly higher ALP activity at day 7 ($p < 0.0001$).

Conclusion: In comparison to Ti-6Al-4V alloy, Ti and Ti-8Ta-3Nb alloy promoted rat calvarial cell proliferation and enhanced alkaline phosphatase activity.

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Transmission electron microscopy study of a synthetic cell binding peptide in maxillary sinus augmentation

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Objective: PepGen P-15 is a combination natural anorganic bovine-derived hydroxyapatite matrix (ABM) coupled with a synthetic cell-binding peptide (P-15). This material has been reported to enhance bone formation in periodontal osseous defects and bone regenerative procedures.

Methods: Three specimens were retrieved 18 months after a sinus lifting procedure using PepGen P-15. These specimens were treated to be observed under light microscopy and transmission electron microscopy.

Results: Light microscopy showed that most of the particles were surrounded by newly formed bone. In some areas osteoid matrix was present. No acute inflammatory infiltrate was present. In transmission electron microscopy, all phases of bone formation (osteoid matrix, woven bone, lamellar bone) were observed in the newly formed bone around the biomaterial particles. In some regions this newly formed bone seemed to present interdigitations connecting to or entering into the particle surface.

Conclusions: This is, according to our knowledge, the first report presenting data on transmission electron microscopy of PepGen P-15 used in a sinus augmentation procedure in man. Our results confirm previous reports on the clinical effectiveness of this material.

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Genetic effects of anorganic bovine bone (Bio-Oss®) on osteoblast-like MG63 cells

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Objectives: Bio-Oss® (Geistlich, Wolhusen, Switzerland) is composed by anorganic bovine bone and is widely used in several boe regneration procedures in oral surgery. How this biomaterial alters osteoblast gene expression to promote bone

formation is poorly understood. We therefore attempted to address this question by using microarray techniques to identify genes that are differentially regulated in osteoblasts exposed to Bio-Oss.

Methods: By using DNA microarrays containing 20,000 genes, we identified in osteoblast-like cells line (MG-63) cultured with Bio-Oss® several genes which expression was significantly up and down-regulated.

Results: The differentially expressed genes cover a broad range of functional activities: (a) signaling transduction, (b) transcription, (c) cell cycle regulation, (d) vescicular transport, (e) apoptosis and (f) immunity. These results could explain the reported bioaffinity of Bio-Oss® to host animals, its biological affinity to osteogenic clls and its capability to stimulate osteoblastic diffeentiaton.

Conclusions: The data reported are, to our knowledge, the first genetic portrait of Bio-Oss® effects. They can be relevant to our improved understanding of the molecular mechanism underlying bone regenerative procedurs and as a model for comparing other materials with similar clinical effects.

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Effect of Implant Design on the Height of InterImplant Bone

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The long term result of Astra tech implant system (A) and Brånemark implant system (B) has been well established. However, there are several differences in those systems. Several studies reported that compared to system (B), system (A) seemed to have lesser amount of marginal bone resorption 3 years after implant surgery.

Recently, effect of inter implant distance on the height of inter implant bone crest was studied. They have shown that in case of inter implant distance lesser than 3 mm, it appears to have tendency of more crestal bone resorption. This probably due to the effect of lateral component of bone resorption.

The purpose of this presentation is to find out the differences of system (A) and (B) in the respect of implant distance and the height of inter-implant bone crest.

52 patients, 81 sites with multiple implants were utilized. (47 sites for Astra system, 34 sites for Brånemark system). Radiographs were taken at 1st surgery and baseline (bridge delivery) and 1-year, 2-year follow-ups. Measurements were taken on the vertical crestal bone loss (c) and the inter-implant distance (d).

The result here showed that Astra system had a tendency of lesser inter implant crestal bone resorption in case of close inter-implant distance (less than 3 mm). However, there appeared to be no difference in the inter-implant distance more than 3 mm.

Astra implants might be a better system in preserving the inter-implant crestal bone, in case of placing implants closer than 3 mm.

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Treatment of titanium implants with H_2SO_4/H_2O_2 improves contact osteogenesis

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It has recently been reported that controlled chemical oxidation of Ti with H_2SO_4/H_2O_2 significantly influences early stages of in vitro osteogenesis (de Oliveira & Nanci, Biomaterials, 25:403–413, 2004). The aim of this study was to evaluate whether this chemical treatment can also influence in vivo bone formation.

Titanium implants (Branemark System, MKIII, Nobel Biocare, Sweden) were etched with H_2SO_4/H_2O_2 for 4 hours at room temperature. Mandibular premolars were extracted in 8 dogs and, after 3 months, 3 treated and 3 untreated implants were placed in each animal. At 3 and 8 weeks post-implantation, the animals were sacrificed, and the implants with surrounding bone were harvested, fixed with formaldehyde and processed for embedding in LR White. Sections of bone with the implants, about 20 µm thick, were prepared, stained with Stevenel's blue and Alizarin red, and analyzed histomorphometrically for percentage of bone-to-implant contact and of bone area between threads. The data was analyzed statistically using two-way ANOVA.

Treated implants exhibited significantly more ($p < .05$) bone-to-implant contact than control, untreated ones both at 3 (68.1% vs. 27.9%) and 8 weeks (69.5% vs. 14.8%) post-implantation. However, there was no difference in the area occupied by bone between threads. Histological analysis confirmed that, in most cases, new bone in contact with the implant formed in a direction away from it.

In conclusion, these data indicate that controlled chemical oxidation of Ti implants significantly enhances contact osteogenesis and suggest that this treatment may have a benefit for early loading of implants.

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Semados® single-tooth implants: a prospective, randomised study to investigate the influence of several parameters on the peri-implant bone level

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Objectives: The aim of the presented study was to document the influence of different parameters on the peri-implant bone level. Beside the question, whether the level of the junction between rough and machined implant surface has an influence on the peri-implant bone level, it was investigated, to what extend the proportion between implant- and restoration-length as well as the factor, wether only a single or several implants in line, affect the peri-implant bone level.

Materials and Methods: Altogether 100 Semados-Implants were inserted in 59 patients, of which 33 were female, aged between

18 and 69 years. 50 implants had a standard surface configuration with a machined implant neck of about 1 mm width. The machined cervical part of the other 50 implants was extended to a width of 3 mm (2–3 windings were as machined). The choice of the implant type was randomized, a two-stage surgery protocoll was chosen.

Results: Of the 100 implants inserted only one was lost during the early healing phase, the remaining implants were investigated over a period of up to 36 months. In the here presented study neither the junction level between rough and machined surface nor the proportion between implant and restoration length showed an influence on the peri-implant bone level. The cervical bone level within the standard-implant group increased from average − 1.6 mm at the time of insertion of the suprastructure to − 1.15 after 36 month, in the test-implant group cervical bone level changed from − 1,75 mm to − 1,49 mm within the same time period, although this was not statistically significant. In both groups no progredient bone resorption was observed over the period of investigation.

Among the implants, which were inserted to replace more than one tooth in line, an increased peri-implant bone resorption was observed, compared to those implants, which were inserted to replace only one single tooth.

Conclusion: In the here presented study the Semados-Implant showed a high survival rate over the time of investigation. An influence of the surface configuration or the proportion between implant and restoration length on the peri-implant bone level was not detected. The bone level around the implant neck improved within 36 month.

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Osteoblast behaviour on grit-blasted & acid-etched surfaces of different microstructure.

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Objective: The behaviour of migrated osteoblasts was compared on grit-blasted & acid-etched FRIALIT® implants (smooth secondary microstructure; FDPS), identically grit-blasted FRIALIT® implants with acid-etched FRIADENT® plus surface (porous microstructure; FP), ANKYLOS® implants (original grit blasted; AO) and identically grit-blasted ANKYLOS® implants with FRIADENT® plus surface (AP).

Methods: Three implants of each type were placed in contact with rat calvarial bone fragments in nylon pockets in non-mineralising medium (nmm) for 2 and 4 weeks. An additional 3 implants were maintained in mineralisation-permitting medium (mm) for 4 weeks. Tissue developed on the implant surface was analysed by SEM and energy dispersive X-ray spectroscopy.

Results: After 2-weeks osteoblasts formed islands of interconnected cells radiating from (detached) bone fragments on all surfaces. On FDPS cells spanned grit-blasting cavities but formed close contact with the smooth microstructure. On AO, AP and FP cells attached to peaks in the microstructure, forming a more three-dimensional network. Collagen-like ~ 50 nm diameter fibres were present between and beneath cell layers. After 4 weeks in nmm, fused (~ 200 nm) collagen-like fibres were seen beneath detached bone fragments. In mm Ca and P-containing deposits appeared as 1μm diameter spherical bodies and larger (~ 10 μm) nodules associated with collagen within cell layers and closely adherent to the material surface on FDPS.

Conclusions: Collagen fibre maturation and mineralisation occur on surfaces of both smooth and rough secondary microstructure but mineral is deposited within the less closely adherent and more three-dimensional ecm that forms on the rougher microstructure surfaces. This study was supported by DENTSPLY Friadent.

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Growth behavior of human osteoblasts on different implant surfaces

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Objectives: The objective of this in vitro study was to compare the growth behavior of healthy human osteoblasts on 5 different surface structures of cylindrical titanium and zirconia specimen.

Material and methods: 5 different surface structures (Ti: polished, machined and machined + ethched (Cell plus®), ZiO: polished and machined) of titanium and zirconia specimen were investigated. Human osteoblasts (ATCC No.:CRL-11372) were cultivated on the specimen for 5 days under stationary and dynamic conditions. The number of cells representing the proliferation behavior was counted daily using a Laser scanning microscope. The cells' morphology was analysed using a scanning electron microscope after 3 days of cell cultivation on the specimen.

Results: The results of the polished titanium and zirconia surface were used as a reference and placed to 100% compared to the other surfaces. Most cells were counted on the Zirconia machined surface and the Cell plus surface without a significant difference during the whole period of investigation. A statistically significant lower amount of cells was found on the machined titanium surface, both under stationary and dynamic conditions. The analysis of the morphology revealed well formed cells with greater numbers of processes on both zirconia surfaces compared to the titanium surfaces.

Conclusion: The machined zirconia surface seems to be at least equally compatible to human bone cells as standard titanium surfaces.

Supported by **FRIADENT, Mannheim**.

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Quantification of human fibroblasts on different implant surfaces

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Objectives: The objective of this in vitro study was to compare the growth behavior of healthy human fibroblasts on 5 different surface structures of cylindrical titanium and zirconia specimen.

Material and methods: 5 different surface structures (Ti: polished, machined and machined + acid ethched (Cell plus®), ZiO: polished and machined) of cylindrical titanium and zirconia specimen were investigated. Human fibroblastst (Detroit 551, ATCC No.: CCL-110) were cultivated on the specimen for 5 days under stationary conditions. The number of cells representing the proliferation behavior was counted daily using a Laser scanning microscope. The cells' morphology was analysed using a scanning electron microscope after 3 days of cell cultivation on the specimen.

Results: The results of the polished titanium and zirconia surface were used as a reference and placed to 100% compared to the other surfaces. Most cells were counted on the Cell plus surface and the machined Zirconia surface without a significant difference during the whole period of investigation. A weak statistically significant lower amount of cells was found on the machined titanium surface. The analysis of the cells' morphology revealed well formed cells on both the zirconia and the titanium surfaces.

Conclusion: The quantification and the morphological analysis of human fibroblasts on the different specimen reveals a similar soft tissue compatibility of the machined zirconia surface as standard titanium surfaces used for dental implants.

Supported by **Friadent Mannheim**

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Chemical EDX analyis of different surface modified implant systems

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The main used processes of modification of the implant surface are: machining, sandblasting, etching and oxiding. They have the purpose to reduce the times of the osseointegration and to improve its quality. The aim of this study was to investigate how these processes macroscopically (at 5 μ depth) modify the implant surface and its chemical composition. The originality of this investigation was that all the implants were tested as manufactured for *clinical use*.

Ten of the major used implant systems were the object of this study: they were divided by the surface treatment in: **Machined**: Mk III Branemark; **Sandblasted**: Ankylos, Silhouette and Galant (experimental fixture); **Etched**: Osseotite, Mac System, MK 4 (experimental fixture), ITI; **Oxided**: Ti Unite, Pilot . Each fixture was analyzed by SEM (Leo 420) at 50x and 5000x at 15 KV of scanning power. The EDX analysis (Energy Dispersion X-ray analysis) was considered to study eventual inclusion of material left from the processes of surface modification, cleaning and decontamination. The EDX analysis scans the implant surface at a 5μ of depth and is performed during SEM observations using a specific micro tip that identify the chemical elements.

The results from SEM analysis shown macroscopical residuals of aluminum oxide on the SLA surface and some oil spots on the machined surface.

The results from the EDX analysis are below summarized:

- Sandblasted surfaces showed particles of Alumina
- Oxided surfaces showed very high peaks of O_2
- Etched surfaces showed only Titanium peaks
- Machined surfaces showed low peaks of O_2

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Physical and chemical characterisation of bone regeneration materials based on TCP

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Purpose: The purpose of this study was to determine basic physical and chemical properties including phase purity of bone regeneration materials based on β-tri calcium phosphate.

Materials and Methods: Three commercially available materials were investigated: BioResorb (B) (Oraltronics, Germany), Cerasorb (C) (Curasan, Germany) and Poresorb-TCP (P) (Lasak, Czech Republic). X-ray diffraction was used to determine the phase composition. The chemical composition was analyzed by X-ray fluorescence analysis. The microstructure was observed by scanning electron microscope. Specific surface area and porosity was determined by krypton adsorption (BET) and mercury porosimetry. Changes of pH values during exposure in a static physiological solution at 37 ± 0.5°C were evaluated.

Results: X-rays diffraction detected β-tri calcium phosphate as a single crystalline phase in samples C and P. Two phases – α and β-tri calcium phosphate were detected in the sample B. Based on the chemical composition analysis the theoretical phase purity was calculated to 99.4% and 99.0% in the C and P sample. Specific surface area of samples B, P and C was 0.78, 0.18 and 0.17 [$m^2.g^{-1}$] respectively. Total porosity was 60% (B), 35% (P) and 30% (C). The change in pH value during the interaction with solution was 1.4 and 1.2 in case of P and C samples respectively and significantly higher pH increase (2.9) was detected in sample B.

Conclusion: Single crystalline phase was detected in two of three samples evaluated. The presence of more reactive α-TCP phase in the third sample could cause the higher pH increase after the exposure in solution.

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Peri-implant bone organization under immediate loading state: collagen fibers orientation and mineral density analyses.

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Objectives: The mechanical properties of bone are greatly influenced by the percentages of organic and mineral constituents. Immediate loading of dental implants is an important topic in implant dentistry. Nevertheless, the information about the mineral content on a microscopic scale in peri-implant bone after immediate loading is scarce. The aim of this work was to analyze the bone mineral density and the collagen fiber orientation in the bone around immediately loaded dental implants.

Methods: Four immediately loaded titanium dental implants with a micro-structured surface were placed in the mandible of 5 mini pigs. A total of 20 implants were placed. All implants were immediately loaded. After a 4 months healing period all implants were retrieved. Histomorphometry was performed using a circularly polarized light microscope. Backscattered electron imaging (BSE) for measuring microscopic mineral content variations in peri-implant bone was used.

Results: In the peri-implant bone it was possible to see collagen fibers, which were oriented in a more transverse way near the implants (112453 ± 4605 pixels²) while an high quantity of secondary osteons was detected in bone away from the implant surface. The degree of mineralization of peri-implant bone (PB) was of 137 ± 19 grey level while in the bone 5 mm far from implant surface (NB) was of 125 ± 26 grey level. This difference was statistically different $P < .001$.

Conclusion: In this study it was found that bone around immediately loaded implants showed an high degree of osseointegration, a peri-implant bone matrix rich of transverse collagen fibers and a mineralization density significantly higher than bone distant from the implant surface.

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Preferred Collagen Fiber Orientation in the Human Peri-Implant Bone After Short and Long-Term Loading

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Objectives: There is evidence that the amount of transverse collagen fiber orientation in bone is influenced by mechanical stress or strains. We hypothesized that the bone functional strain due to immediate loading or long-term functional leading correlate well with the collagen fiber organization. This study investigates the birefringence in human bone near dental implants after short and long-term periods of loading, to evaluate the area fraction related to the transverse collagen fiber orientation in bone matrix, using circularly polarized light (CPL).

Methods: Two osseointegrated dental implants inserted in the maxilla. One was immediately loaded and retrieved after four months of loading (short-term) and the other was immediately loaded and retrieved after twelve years (long-term). The birefringence measurements were performed on each of the 2 central sections obtained from each implant after detecting a total of 68 digitized images acquired at 50 × by a software image analysis.

Results: The bone implant contact (BIC) next to the short-term loaded implant was of 67,9% ± 9,5 (mean ± SD) while the BIC in the long-term loaded implant was of 74,6% ± 11,2 (mean ± SD). The area fraction of the peri-implant bone relating to the transverse collagen fiber was of 4,7% ± 1,2 (mean ± SD) for the long-term loaded implant, while for the short-term loaded implant the area fraction extension was of 2,7% ± 1,4 (mean ± SD). The BIC difference between the two groups was not statistically different $P = 0{,}145$. The CPL measurements indicated that the bone fraction area's difference was also not statistically significant ($P = 0.241$).

Conclusions: In the bone near both dental implants no significant differences were found in the amount of the transverse collagen fibers. The immediate loading seems to determine the collagen fibers orientation.

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In vitro assessment of radiological bone density changes in the mandible

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Aims: to validate a software to dedicated assessment of bone density changes.

Methods: 14 bone cylinders of 5.2–22.0 mm long were taken with a trephine bur with a respective Ø of 4.4 and 8.0 mm from formalin-fixed edentulous human mandibles. Standard radiographs were made from baseline bone specimens and bony cylinders using a Prostyle-Intra® (Planmeca) with 70 kV, 20 s and 8 mA and a digital phosphorplate system (VistaScan®, Dürr Dental). The set-up included an aluminium stepwedge, placed next to the bone specimens. A dedicated software OSTEOP (Nackaerts et al. 2005) was used to assess bone density of the cylinders and establish the density change in the radiographs of the mandible after cylinders removal. The software expresses the density in aluminium equivalents (Al-eqs). The real density of the cylinders was measured by mass determination and volume assessment applying the Archimedes principle.

Results: The test-retest reliability of the bone density assessment was excellent, (coefficient of variation for OSTEOP < 5%). A correlation was found between the Al-eqs and the physical bone density. The change in radiological bone density after cylinder removal was detected by subtraction of the baseline and follow-up radiographs.

Conclusions: *In vitro* measurements of bone density using a dedicated software for digital radiography and the Al-eqs assessment may provide reliable information regarding the physical bone characteristics.

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Effect of cyclic loading on zirconium abutment screw loosening

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Introduction: Improved material characteristics, complying with clinicians' and patients' increased demands for highly esthetic results, have contributed significantly to the development of a new generation of ceramic (Y-TZP) zirconium-dioxide abutments.

Material and method: The purpose of this study was to determine the torque required to unfasten the retaining screw prior and after applying cyclic loading to the titanium implant / ceramic abutment assembly (FRIADENT® CERCON®, DENTSPLY Friadent, Mannheim, Germany). All implants were embedded into an elastic material (EpoFix, Stuers, Ballerup, Danmark) having a Young's modulus of zirconium oxide of 210 GPa.The top of the implant extended 3 mm above the level of the surrounding material in order to create a worst case situation of crestal bone resorption. Cyclic loading tests (CLT) were carried out by means of a servohydraulic dynamic testing machine (Instron 8872, Instron, Canton, MA, USA) at loads between 100 and 450 Newton up to 5 millions of loading cycles. The torque values required to unfasten the retaining screws were determined using a Tohnichi torque gauge (Tohnichi America Corporation, Northbrook, IL, USA).

Results: The mean value of the toque required to unfasten the abutment retaining screws after tightening (initial) was 20.86 Ncm ± 1.07 and respectively 19.71 Ncm ± 1.11 after loading with up to 5 millions of cycles. These values revealed no significant difference, i.e. screw loosening did not occur. In addition to the protocol stipulated by the standards it was verified that zirconium implant abutments have a tight fit in the titanium implant after several millions of loading cycles.

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The bone microvascular pattern around loaded dental implants

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Objectives: The load application influence the bone matrix organization. The relationship between bone and vessels network organization is still unknown. The aim of this study was to investigate the three-dimensional vascular architecture of the peri-implant bone after loading.

Methods: A total of 10 implants with sandblasted and acid-etched surface (Bone System, Milano, Italy) were placed in the mandible of a beagle dog. Three months later the implants were connected and loaded. The dog was killed after 12 months. The specimens were embedded and processed for SEM analysis.

Results: after one year of loading a very intricate vessel network could be seen around implants. The vessels were round in shape with a lot of anastomoses with mesh-like appearance. They ran circularly around the dental implant. In the bone the majority of the vessels appeared to ran parallel to the mandibular canal.

Conclusions: after a one year loading period the peri-implant bone vasculature looks like a mesh that surrounds the implants; at the cervical level these blood vessels are more thick.

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Configuration of Optimal Tightening Torque Dental Implant System using Fatigue Test

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This in vitro study configured optimal tightening torque on 3 different implant system. This study used Osstem Implant Systems of 3 systems (External Butt Joint-Safe Abutment System(BJS), 8° internal Conical Joint-ComOcta Abutment(CJC), 11° internal Conical Joint-Transfer Abutment(CJT)). Each Systems were divided equally five into 3 Tightening Torque(TT) Groups A(20 Ncm), B(30 Ncm) and C(40 Ncm). Each assembly were loaded with the use of a cyclic loading device with 10 ~ 250N at 30° angles with a frequency of 2 Hz.A target of 1.0*106 cycles was defined. Removal torque(RT) was recorded before and after loading and the difference was calculated. Initial screw efficiency (RT/TT) is (RJS:87%, CJC:82%,

Table 1. Results (Abstract 173)

	BJS			CJC			CJT		
	Initial	After 1.0E6 Cycles	Difference	Initial	After 1.0E6 Cycles	Difference	Initial	After 1.0E6 Cycles	Difference
Group A (20 Ncm)	17,2	13	4,2	16,8	12,7	4,1	15,3	11,7	3,6
Group B (30 Ncm)	27,2	25,1	2,4	25,5	24,3	1,2	24,7	24,1	0,6
Group C (40 Ncm)	34,1	25,7	8,4	33,8	27,4	6,4	33,1	28,7	4,4

CJT:80%). At all systems, Group A and C exhibited a significant difference in the removal torque difference values compared Group B.

Group A is low preload, so maybe happen micro-movement. Group C is high preload , so maybe happen plastic deformation. As a test results, Optimal tightening torque values are 30 Ncm.

Results: See Table 1, p. lxxvi

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Effect of joint design on static and dynamic strength

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The aim of this study is to evaluate compressive and fatigue strengths of different joint designs. In this study four Osstem(Korea) Implant assemblies were used, External Butt Joint-Safe Abutment System(BJS), External Butt Joint-Cemented Abutment System(BJC), 11° internal Conical Joint-Transfer Abutment(CJT) and 11° internal Conical Joint-Convertible Abutment(CJC). Compressive and fatigue strength of four groups were evaluated according to specified test (ISO/FDIS-14801). Tightening torque of each assembly was 30 Ncm. The Result of compressive strength was verified by one-way ANOVA and Turkey Test. From the compressive loading test (n = 5), the mean strengths of 1153.2 ± 39.0N(BJC), 1392.1 ± 52.6N(BJS), 1016.2 ± 116.4N(CJT), 1109.6 ± 82.6N(CJC) were obtained. BJS showed significantly higher compressive strength compared other (P < 0.001). Fatigue endurance, which indicates that the implant system can withstand the applied load for minimum 5 million cycles without failure, was found to be 300N(BJC), 360N(BJS), 530N(CJT) and 780N(CJC) of force.

Table 1. Results (Abstract 175)

		BJS			CJC			CJT		
		Initial	Postload	Difference value	Initial	Postload	Difference value	Initial	Postload	Difference value
Group A (20Ncm)	Means	17.2	13	4.2	16.8	12.7	4.1	15.3	11.7	3.6
	SD	0.85	0.81	0.77	1.15	1	1.38	0.9	0.8	0.53
Group B (30 Ncm)	Means	27.5	25.1	2.4	25.5	24.3	1.2	24.7	24.1	0.6
	SD	0.69	1.1	0.5	1.1	1.47	0.44	1.49	1.47	0.43
Group C (40 NCm)	Means	34.1	25.7	8.4	33.8	27.4	6.4	33.1	28.7	28.7
	SD	1.08	2.08	1.47	1.34	1.5	1.19	1.16	2.18	1.94

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The effect of tightening Torque on reliability of joint stability

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The aim of this study is to investigate the effect of tightening torque influences on a screw loosening. In this study, we used three Osstem (Korea) Implant assemblies, External Butt Joint-Safe Abutment System(BJS), 8° internal Conical Joint-ComOcta Abutment(CJC) and 11 internal Conical Joint-Transfer Abutment(CJT). Each assembly was divided equally five into 3 Tightening Torque(TT) Groups, Group A(20 Ncm), Group B(30 Ncm) and Group C(40 Ncm). Each assembly was loaded with cyclic loading device (10–250N, 30, 2 Hz). A target of 1.0*106 cycles was defined. Removal torque(RT) was recorded before and after loading. Different value of RT was analyzed with two-way ANOVA test and Turkey test. Initial screw efficiencies (RT/TT) are RJS:87%, CJC:82% and CJT:80%. Group B showed better stability than Group A and Group C (p < 0.001). CJT with 30 Ncm showed best stability compared with the other (P < 0.001).

Results: See Table 1 below.