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The fate of dental implants in a patient receiving IV zoledronic acid treatment

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Background: Bisphosphonates (BP) are potent inhibitors of bone resorption and mainly used for the treatment of metastatic bone disease and osteoporosis. Patients especially on IV BP therapy may subsequently develop osteonecrosis of the jaw, recently labelled as bisphosphonate osteonecrosis of jaw (BRONJ). Most of the BRONJ cases reported in literature show a strong correlation with dental pathologies, dental extractions, and/or oral surgical procedures. There is limited information in the literature on BRONJ associated with dental implants. General consideration is that patients with a medical history of oral BPs longer than 3 years should be considered as risky and patients on IV BPs should be taken as contraindicated for implant therapy.

Aim/Hypothesis: This case presents the course of dental implants placed in the mandible of a patient receiving Zoledronic acid as a part of his anticancer treatments. Dental implants were evaluated using clinical, radiographic, and histopathological findings.

Material and methods: A 55-year-old male patient presented our clinic with failed implants in the lower anterior region. The medical history revealed prostate cancer history and current receiving zoledronate (Zometa[®], 4 mg IV/month) for the last 2 years. The patient stated his dental surgeon ignored his cancer history/medical treatment and placed five dental implants in the mandible. The dental implant surgical procedure was reported to be uneventful and after 3 months of healing period, fixed restorations were fabricated. The patient stated two of his implants became loose after 2 months of functioning and these implants were removed surgically with some of the surrounding bone. Patient presented to our clinic with non-healing bone defect at the anterior mandible. Exposed necrotic bone was present at the implant removed site and a around neighboring implant. The rest of the implants seemed clinically and radiographically healthy.

Results: Cone beam tomography imaging was used to determine the extent of necrotic bone. The patient was prescribed antibiotics and chlorhexidine preoperatively; with cautious surgery approach bony spicules and exposed bone were removed to ease soft tissue closure. Removed bone specimens were evaluated histologically. Histopathological evaluation revealed necrotic bone with bacterial colonization. The

surgery site showed delayed healing. The patient is followed by monthly visits to monitor healing course and the fate of his other implants.

Conclusions and clinical implications: Case reports provide limited evidence for clinical practices. However, when clinical trials are not feasible or present case experiences affect the interpretation of current knowledge. The findings of this case report endorse the current approach stating that dental implant surgery should be avoided for patients receiving IV BP therapy.

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Vegetal extracts used as alternative for periimplantitis treatment

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Background: Vegetal (plant) extracts used as ecological alternative to conventional anti-infectious treatments in oral implantology has many advantages and the most important is a very low occurrence of side effects. In superior plants were found numerous antiseptic substances that prevents or destroy the growth of microorganisms. These natural substances show antimicrobial activity and have an action similar to antibiotics.

Aim/Hypothesis: The purpose of this study is to highlight the antimicrobial activity of some vegetal (plant) extracts in order to treat periimplantitis.

Material and methods: During 2011–2013, microbial samples were taken from a total of 16 patients with periimplantitis. There were isolated 35 microbial aerobic strains and 35 anaerobic, also. After that, the samples were kept and transported in sterile medium (RTM – reduced transport medium) in the laboratory in order to sow on specific environments. Then, some Gram stained smears were isolated. As ecological antimicrobial alternatives were used three extracts: sivestru pine extract (*Pinus sylvestris*), extract of Atlas cedar (*Cedrus atlantica*) and petigrain extract (*Bigaradier citrus aurantium*) (the testing was carried out individually or in combinations of the 3 extracts). The antimicrobial testing was performed by conventional methods.

Results: Among all the extracts tested individually, *Pinus sylvestris* extract was found to be most effective. Regarding combinations, *Cedrus atlantica* and *Bigaradier citrus aurantium* extracts presented the most pronounced effect on microbial growth inhibition.

Conclusions and clinical implications: These results suggest the possibility of using these vegetable (plant) extracts for periimplantitis therapy, as a new antimicrobial ecological strategy, which may represent an alternative to conventional treatment with antibiotics.

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Complications in accelerated single implant placement and loading – biological reintegration

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Background: Clinical complications during accelerated implant protocols are not uncommon and vary from reduction in implant stability to complete loss of osseointegration and that of implant. Clinical cases demonstrate that implant stability reduction does not necessarily lead to implant loss. Excess loading has been cited as a reason for the failure of dental implants or bone loss post-osseointegration. In early loaded implants osseointegration is not complete but implant stability can be satisfactory for restoration. Despite of adequate implant stability, after early loading significant stability dip can occur, but if recognized early enough it does not necessarily affect the final treatment outcome.

Aim/Hypothesis: The goal of the present documentations is to demonstrate the clinical manifestations of early loaded implant complications as well as possibilities of osseous and soft tissue reintegration.

Material and methods: Four cases of early loaded single tooth implants placed in maxilla are presented where implants were loaded 6 weeks after placement. Implant mobility 3–6 weeks after crown placement was the only sign of pathology, no plaque or periimplant tissue inflammation was present. In all four cases the crowns were replaced by temporaries with no occlusal contacts and patients followed strict maintenance instructions and regular 2-week check-ups. After 6 months the temporaries were removed, ISQ measurement performed and values over ISQ 75 were determined so definitive crowns were made again. Another 6 months after definitive crowns placement new ISQ measurement confirmed stability increase of 15–22%. Soft tissue stability was evaluated clinically and by using standardized photographs.

Results: Osseous and soft tissue reintegration was achieved after removal of functional occlusal loading from implants demonstrating mobility. No inflammation was determined in periimplant tissue and no plaque accumulation was present during the healing period.

Conclusions and clinical implications: The four cases documentations and presentation demonstrated significant stability dip after early functional loading, but without the bacterial induced peri-implant tissue inflammation. With absence of functional occlusal loading the biological implant reintegration occurred in four cases specific for the absence of plaque related

inflammation. It seems that early loading in some cases can be considered overloading and treated as such. The explanation of the process cannot be done in clinical trials but rather through case reporting of clinical complications.

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Biological and prosthetic complications in full-arch fixed prosthesis supported by four implants: a 9-years follow-up retrospective study

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Background: Fixed full-arch rehabilitations with cantilever extensions supported by upright and tilted implants were evaluated as predictable procedures with considerable success and survival rates. However the incidence and the management of complications has to be considered an important aspect to assess its effectiveness.

Aim/Hypothesis: The aims of this retrospective study were to evaluate the treatment outcome of immediately loaded full-arch fixed bridges anchored to both tilted and axially placed implants in the edentulous maxilla and mandible to evaluate the incidence of biological and technical complications.

Material and methods: Ninety-five patients (51 women and 44 men) were included in the study. Each patient received a full-arch fixed bridge supported by two axial implants and two distal tilted implants (Nobel Biocare Speedy® and Nobel Biocare Branemark®) following the All-on-Four® technique. Sixty-one mandibles and 34 maxillae were rehabilitated. All patients received a temporary acrylic prosthesis within 48 h of surgery and a definitive prosthesis after 3 months of loading for mandibular and 6 months for maxillary rehabilitations. Patients were scheduled for follow-up at 6, 12, 18, and 24 months, and yearly up to 9 years. At each follow-up plaque level and bleeding scores were assessed and every complication was recorded.

Results: The overall follow-up range was 12 to 109 months (mean 54.7 months). One implant failure was recorded to date, leading to a cumulative implant survival rate of 99.7%. Biological complications were documented consisting in alveolar mucositis in 26 patients (27.37% patients), peri-implantitis in nine patients (9.47% patients), and temporo-mandibular joint pain in three patients (3.16% patients). The most common technical complications were the fracture or detachment of one or multiple acrylic teeth that occurred in 24 patients (25.26% patients), minor acrylic fractures in 11 patients (11.58% patients), wear of the abutment connection screw thread in three patients (3.16% patients), fracture of prosthetic screw in three patients (3.16% patients) and fracture of the titanium bar in one patient (1.05% patients). Hygienic

problems were recorded in 46 patients (48.42% patients). No patients' dissatisfactions were recorded.

Conclusions and clinical implications: The high cumulative implant survival rate indicates that this technique could be considered a viable treatment option. The use of an effective recall program is important to early intercept biological complications avoiding their evolution to more serious situations. From a prosthetic point of view a way to reduce the minor technical complications' rate should be considered.

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Comparative study of survival and complication rates between external and internal type implant systems

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Background: Dental implants treatment became a predictable procedure for restoring fully or partially edentulous ridge. The implant systems were divided into external system and internal system by implant/abutment connection type. However, comparative study between these two implant systems in terms of survival rate and complication was rare.

Aim/Hypothesis: The aim of this study was to compare the survival rate, biological and technical complications of two different implant systems retrospectively.

Material and methods: In total, 1074 patients who received implant (1539 external type implants in 527 patients, 1209 internal type implants in 547 patients) for fixed prostheses were enrolled in this retrospective study. Average observed period was 3.1 years (range from 0.1 to 6.0 years) for external type and 3.4 years (range from 0.1 to 6.2 years) for internal type. Kaplan-Meier analysis with the cumulative survival rate was calculated, and biological and technical complications were evaluated.

Results: The 6-year cumulative survival rates of implant were 97.4% and 94.1% for the external and internal type, respectively. The difference was not statistically significant. During the observation period, 16 implants were lost in the molar region, whereas 10 implants were lost in incisor and premolar region in patient who received external type implant. In patient who received internal type implant, 22 implants were lost in the molar region, whereas only three implants were lost in incisor and premolar region. The most frequent complication over observation period was soft tissue complication in internal type (8.1%) and external type (10.4%) ($P = 0.05$). In technical complication, most common complication was loosening or fracture of the abutment or screw in internal type (6.9%) and external type (3.1%) ($P < 0.001$). Other technical complication rates (chipping of the veneering material, loss of retention of the crown, loss of access hole restoration, implant

fracture, fracture of crown or frame) were similar between two implant types.

Conclusions and clinical implications: In this retrospective study, both implant types resulted in high survival rates. Soft tissue complication tended to occur more in external type than internal type implant. In technical complication, loosening or fracture of the abutment or screw occurred more frequently in internal type than external type.

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An impression technique for implants placed in high proximity and angulation

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Background: When implants are placed in high proximity and/or with severe angulation to each other, a precise impression is often difficult to be obtained with conventional impression techniques. Contact interferences between impression copings can make implants impression a difficult task.

Aim/Hypothesis: The purpose of this poster is to present a clinical case where two implants were placed in close proximity in the maxilla and an alternative impression technique was used to overcome this problem.

Material and methods: A 60 years old female patient was referred to our clinic for prosthetic rehabilitation of the already placed implants. Two implants were placed in sites #13 and #14 and in close proximity to each other. Impression copings could not be inserted at the same time on both implants. Initially an impression of implant #13 was taken and a cast was made. An acrylic jig was constructed on the cast engaging the two teeth anterior to the implants and allowing some space for the impression coping on implant in site #14. The jig was transferred intraorally and the impression coping was engaged to the jig with acrylic resin. An implant analog was attached on the impression coping. A part of the cast corresponding to the implant at site #14 was removed. The jig -impression coping – implant analog assembly was transferred back to the cast and secured in place with some sticky wax. Care must be given for the implant analog not to have any contact with the cast. The cast was boxed with wax and poured in stone. Custom abutments were constructed on the newly developed altered cast. Since this is not a totally accurate procedure, a verification jig should be constructed to check the abutments' position intraorally.

Results: Two custom abutments were fabricated on the final cast. After verifying their position intraorally using an acrylic resin jig a metal ceramic restoration was constructed.

Conclusions and clinical implications: The presented alternative impression technique offers an easy method for making accurate impressions of implants placed in close proximity and angulation.

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Frequency of complications in unsplinted implant restorations in the terminal gap situations – a retrospective study

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Background: Implant-supported restorations can either be restored splinted or unsplinted.

Aim/Hypothesis: However, literature still is controversial which restoration procedure should be recommended to avoid clinical as well as technical complications.

Material and methods: This study is based on 144 patients who were treated at the Department of Oral Surgery, School of Dentistry, in Graz between 2000 and 2010 with terminal unsplinted implant restorations. Forty-three patients with 60 implants were retrospectively investigated concerning: implant loss, bleeding on probing, probing depth, implant mobility as well as prosthetic complications. Furthermore radiographs in right-angle technique were performed in each case.

Results: The survival rate of the implants was 100%, probing depths varied from 2 to 6 mm. Prosthetic complications included crown-loosening (16%) as well as chipping (4%). Radiological data will be presented.

Conclusions and clinical implications: Compared to recent studies in the literature there was no significant higher complications rate between splinted and unsplinted restorations.

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Dramatic osteonecrosis of the jaw associated with oral bisphosphonates treatment after implant removal: a case report

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Background: Osteoporosis affects millions of patients and oral administration of bisphosphonates represents first-line therapy. Bisphosphonates-related Osteonecrosis of the jaws (BRONJ) is mostly related with high dose of aminobisphosphonates provided intravenously for oncological reasons with an

incidence between 1% and 10%. The incidence of BRONJ associated with oral aminobisphosphonates for the management of osteoporosis or Paget's disease of bone is between 0.001% and 0.01%.

Aim/Hypothesis: This report documents a case of BRONJ after dental implant removal in an osteoporotic patient treated with oral nBPs: alendronate and then risedronate for a total treatment time of 15 years.

Material and methods: An 83-years-old patient with no significant systemic disease underwent implant removal in the region of the first lower molar in 2010 because of a peri-implant infection. The surgical procedure was uneventful. In June 2011, the patient was referred to the department of periodontology and Oral Surgery (University of Liège, Belgium) with a wide bone sequestration of the left lower jaw. A panoramic radiograph showed an increased bone marrow density with bone sequestration. Biopsy excluded malignancy. Since then, the patient underwent several courses of antibiotics and conservative therapy, without relief of symptoms.

Results: In 2 years, the patient has lost 13 teeth in the mandible; the osteonecrosis has disseminated to the entire jaw and the left mandible condyle. The patient has lost hearing on the left side and she is, physically and psychologically, extremely affected. The solution of an hemimandibulectomy and reconstruction with fibula flap was rejected by surgeons because of the age of the patient.

Conclusions and clinical implications: Despite the low risk of BRONJ occurrence after implant surgery in oral nBP users, the fate of dental implants in these patients remains uncertain. Therefore patients at risk must be given a full explanation of the potential risks of implant failure and BRONJ development. Moreover, the prescribers of oral nBP should be aware of the potential dramatic secondary effect, even though it is very rare. Further investigation should be done in order to determine risk factors of ONJ development for oral nBPs treatments. The relatively small incidence of ONJ associated with oral nBPs makes understanding real risk challenging.

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Microbiological study using PCR and culture methods in peri-implantitis

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Background: Peri-implantitis is the most frequent reason of failure of osseointegrated implants after 5 years in function.

The prevalence according is in between 12% and 43% after 10 years. Peri-implantitis has been associated with Gram – bacteria similar to periodontitis. Other pathogens such as enteric bacteria, *Staphylococcus aureus*, *Pseudomonas aeruginosa* or *Candida spp* have also been associated.

Aim/Hypothesis: (1) Assess the bacterial etiology of peri-implantitis in a Spanish population. (2) Study the differences between teeth and implants. (3) Influence of smoking on the peri-implantitis microbiota.

Material and methods: Thirty-three partially edentulous subjects (22 women, 11 men), aged 32 to 90 years, having one or more implants with peri-implantitis were included. Periimplantitis was defined as: – Presence of bleeding on probing and/or suppuration. – Radiographic images of marginal bone loss >1.8 mm after 1 year in function. The inclusion criteria were: (i) partially edentulous patients with at least one implant diagnosed of periimplantitis, (ii) no antibiotic therapy 6 months prior clinical examination. According to this definition, a total of 48 implants were diagnosed as suffering from periimplantitis. In each individual, subgingival bacteria samples were obtained from infected implants and teeth, using sterile paper points. Periodontopathogens (*Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia* and *Treponema denticola*) were detected by multiplex-PCR using 16S rDNA. Samples, in reduced transport medium, were cultured for opportunistic pathogens (*Staphylococcus aureus*, enteric bacteria, *Pseudomonas* and yeasts).

Results: *Porphyromonas gingivalis* and *Tannerella forsythia* were recovered in 31 and 34 samples respectively. *Treponema denticola* and *Prevotella intermedia* in 18 and 10 samples, respectively. Opportunistic microorganisms such as *Pseudomonas aeruginosa*, *Candida albicans* and *Staphylococcus aureus* were recovered 7, 2 and 1 samples respectively. Comparison between implant and teeth samples: Similar results were found with regards to periodontopathic bacterias, although with slightly higher results in implants samples. Opportunistic microorganisms were only studied in implant samples Impact of smoking status on microbiological findings: 10 of 48 periimplantitis samples corresponded to smoker subjects. In the smoker group, the rates for *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola* and *Prevotella intermedia* were found in 66%, 86%, 53% and 20% of the samples respectively. Opportunistic microorganisms such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* were found in 3 and 1 samples respectively. In the non-smoker group, the rates were lower for all the periodontopathic bacteria. *Pseudomonas aeruginosa* and *Candida albicans* were found in 4 and 3 samples respectively.

Conclusions and clinical implications: (1) Implant surface could be colonized with pathogens different from periodontal bacterias, opportunistic pathogens such as *P aeruginosa* and *C albicans* could be associated to failed implants. *Porphyromonas gingivalis* and *Tannerella Forsythia* were the most prevalent bacteria found. (2) Smokers showed higher rates of periodontopathic bacteria.

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Epithelialized gingival grafting to increase the width of keratinized mucosa around dental implants: a case report

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Background: There are various methods of increasing the width of keratinized mucosa around dental implants. However, there is no consensus regarding the relationship between the width of keratinized mucosa and the health of peri-implant tissues, but clinicians prefer to provide enough keratinized mucosa around dental implants for long-term implant maintenance. The absence of adequate keratinized mucosa around implants supporting overdentures was associated with higher plaque accumulation, gingival inflammation, bleeding on probing, and mucosal recession.

Aim/Hypothesis: The aim of this case was to assess gingival growth around dental implants caused by local irritant and unadequate keratinized mucosa.

Material and methods: 60-year-old female, with an overdenture prosthesis female patient was applied to our clinic with complaints of gingival growth and bleeding. Treatment was planned that the use of a epithelialized gingival graft to increase the width of keratinized mucosa after gingivectomy.

Results: The proposed technique is a simple and time-effective technique for preserving and providing keratinized tissue around dental implants.

Conclusions and clinical implications: Oral hygiene can play a decisive role in the development of gingival enlargement. The Epithelialized gingival graft can be used to increase the width of keratinized mucosa around dental implants.

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Management of inferior alveolar nerve injury due to implant placement: a case report

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Background: Inferior alveolar nerve injury is not uncommon when placing implants in the mandible and can sometimes cause severe complications. The incidence of complications can be as high as 40% in implant surgery.

Aim/Hypothesis: This article presented a 55 years old female who accepted implant treatment over lower right edentulous molar area seeking solution for numbness after surgery.

Material and methods: This 55 years old female who had implant surgery in another dental clinic 10 days ago. This

patient had numbness after the surgery and was seeking a resolution for the problem. The area of numbness is distributed from lower lip to lower border of chin and right mouth angle to midline of lower lip. During intra-oral observation, a newly placed implant was found on lower right second molar edentulous ridge. The fixture was removed by forceps (No.151) and custom adaptor of wrench was made to reverse the implant.

Results: Bone healing was observed in 2 month recall CBCT image. The patient felt much better, whereas the numbness was still existed.

Conclusions and clinical implications: The initial result showed nerve sensation improved by removal of implant fixture. The long-term result of the nerve healing and regaining the normal sensation will be expected.

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Zirconia based reconstructions on implants followed for up to 5 years: a case series

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Background: Zirconia abutments on implants have been used preferably in esthetic sites. Still little information is available on fixed zirconia based prostheses supported by implants.

Aim/Hypothesis: The aim of this case series was to evaluate technical problems and failures of implant supported zirconia based restorations. The outcome was survival of frameworks and complications with the prostheses.

Material and methods: In a private clinical setting 113 consecutive patients (43 men, 69 women, average age 62.5 ± 13.4 years) received zirconia-based restoration on implants during a time period of 4 years. The prosthetic indications were single crowns (SC) and fixed partial prostheses (FPP) in the maxilla and mandible. One dentist performed all implant surgical procedures and prosthetic rehabilitation. All laboratory work was done by one master technician. The Procera technology was used to fabricate the frameworks and abutments, which were connected in direct contact to the implant shoulder. By means of a titanium-insert single crowns or abutments had an engaging screw retention while FPP were without engaging connection. The patients were followed with 2 or 3 scheduled annual visits. Data on fracture of frameworks, chipping of veneering ceramics and loss of retention were recorded. The data collection was performed by two independent investigators, not involved in the treatment of the patients.

Results: Two-hundred and fifty implants (all Nobelbiocare) supported 171 Zirconia based restorations, comprising 371 units (including pontics, cantilevers and 34 abutment). The minimum follow-up time was 2 years. 20 restorations were cemented on 34 zirconia abutments and 151 restorations were screw retained, directly at the implant level. The restorations consisted of 108 SC (66 maxilla, 42 mandible) and 63 FPP (40

maxilla, 23 mandible). The veneering material of the restorations was either Creation (35) or Cerabien (127) and Nobelrondo (9). One hundred and fifty-four (90%) of the restorations remained without any complications. Fracture of 3 frameworks (one SC, two FPP) was registered. Significant chipping resulted in a remake of 3 restorations (one SC, 2 FPP). Five loose screws had to be retightened, all in the first year after delivery of the restorations. Wear of the Zirconia material that was in direct contact with the implant shoulder was not observed on a macroscopic level.

Conclusions and clinical implications: It appears that the Zirconia framework fractures occurred due to incorrect handling and poor design. Extensive chipping was seen only with Nobelrondo ceramics. Although this case series represents a learning curve by the dentist and technician the results are satisfactory.

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New concepts or best practice – experience from 12,700 implants of the Frankfurt 20-years study

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Background: Scientific evidence is limited regarding the long-term (>10 years) outcomes of large enough numbers of implants (>500) to allow for reliable comparison of subgroups.

Aim/Hypothesis: The purpose of this study was to analyze the outcomes of implants placed in an active university clinic and followed for up to 20 years.

Material and methods: Data documenting the implant placement, prosthetic reconstruction, and annual follow-up of patients treated at Frankfurt University were extracted from an SQL database and patients' written records and evaluated statistically.

Results: Between April of 1991 and May of 2011, 12,737 ANKYLOS[®] implants were placed in 4206 patients for a variety of indications. The Kaplan-Meier cumulative survival rate (CSR) was 93.3% after 204 months. Most of the failures (198/1.6%) occurred during the first year after implant placement and before prosthetic reconstruction. A significantly higher ($P < 0.001$) number of implants placed in the mandible and in hard bone failed than those placed in the maxilla or in soft and normal bone. Female patients had significant higher CSRs (93.7% 204 months) than male patients (92.8% 204 months/ $P = 0.029$). The implants showed low rates of peri-implant bone loss after 204 months (Horizontal: ≤ 1 mm: 85.7%, vertical: ≤ 1 mm: 85.2%).

Conclusions and clinical implications: ANKYLOS[®] implants followed for up to 20 years have high CSRs and low rates of peri-implant bone loss.

Peri-Implantitis related to different surfaces at non-submerged titanium implants: 5-year clinical results from a retrospective study

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Background: Peri-implant diseases was defined as an inflammatory process in the mucosa around osseointegrated implants with bone loss. The detection of initial signs and the control of risk factors are essential to prevent further progression. The Consensus Report of the Sixth European Workshop on Periodontology listed the following non evidence-based risk factors: implant surface, poor metabolic control, alcohol consumption and genetic traits. Some types of rough-surfaced implants are available and because of the recent developments in surface alterations, the prevalence of peri-implantitis at implants with various surface characteristics has not been studied extensively.

Aim/Hypothesis: The aim of the present study was to evaluate the survival rate and incidence of peri-implantitis around non-submerged implants with different surfaces during 5 years.

Material and methods: In a 5-year period (2008–2012) 100 partially or totally edentulous patients received 350 Straumann tissue level implants (Institut Straumann, Switzerland) and 400 Best-Fit implants (GT-Medical, Madrid, Spain). Prosthetic loading of implants was delayed (2–6) months after placement. The patients were rehabilitated with either fixed or removable prostheses. The following clinical variables were recorded: Plaque index, access/ability for oral hygiene at implant site, bleeding/suppuration on probing, probing pocket depth and bone loss.

Results: All implants achieved successful osseointegration and were prosthetically loaded except 5 Straumann implants and 12 Best Fit Implants thus giving a 1.5% and 3% implant survival rate respectively. Assessing peri-implantitis yielded a similar variance in prevalence.

Conclusions and clinical implications: At 5 years follow-up non-submerged implants were demonstrated to be effective and were found to exhibit good outcomes in terms of peri-implant diseases.

Scanning electron microscopic observation of two cases of fractured implants, and their clinical implications

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Background: Reported cases of implant fractures are not rare. Fracture of implant fixtures is thought to be related to many factors, and its occurrence and development is not well known.

Aim/Hypothesis: Two fractured implant-fixtures were removed in a less-invasive manner and immediate recovery-installation performed at the same sites. The extirpated implant-fixtures were observed by use of a scanning electron microscope (SEM) in order to investigate the occurrence and development of each case.

Material and methods: The fractured implant-fixtures were solid screw-type implants of 12 mm length and either 3.75 mm or 4.0 mm in diameter. Immediately after the removal, implant-fixtures were newly-installed. Removal was performed in a less-invasive manner by the use of piezoelectric devices, trephine burs, and some fixture-remover devices. The extirpated specimens were fixed by a 10%-formalin solution, and observed using a SEM (Miniscope, Hitachi Hi-Tech).

Results: From a clinical perspectives, due to less-invasive fixture-removal, the new implants could be simultaneously installed into the same sites, and the treatment period was shorter than usual. With regards to ultrastructure, the implant of Case-I was fractured at the thinnest area beneath the crest module, and between the 1st and 3rd threads. Under lower magnification, fractures were observed in a parallel arrangement in the buccal and lingual areas, and in a step-like fashion in the mesial and distal areas. Under the higher magnification, the fractured surface displayed a rough texture with various deformities. Smooth shiny surface area was observed where fracture ends had made some intimate contact and rubbed together. Multiple and parallel fracture-lines were observed from the implant neck to the area of the 7th thread. This was thought to be the result of repeated destructive-forces in the bucco-lingual direction. In Case-II, findings indicated that the fracture started from the thinnest buccal and lingual areas, and advanced in a mesio-distal direction, separating at the ends of the mesio-distal portion.

Conclusions and clinical implications: From observation of the geometry, distribution, number, intensity, and shining spots of the fractured area, and after reference to the other clinical findings, it was concluded that fractures originated from the thinnest cervical portion of the implant, increased in number and fissure width in a longitudinal-direction, and finally separated at the mesial or distal ends. In consideration of

these findings, it can be seen that use of the small-diameter implants requires the careful consideration of the bucco-lingual jiggling forces.

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A systematic review of biological and technical complications of immediate loaded fixed implant rehabilitations for partially edentulous patients

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Background: Although immediate loading of dental implants may provide significant advantages for the patients as regards reduced treatment time and increased comfort, it is important to realize that potential complications may occur.

Aim/Hypothesis: To systematically review and assess prospective clinical studies reporting on complications associated with immediate loaded implants for fixed partial prosthesis in partially edentulous patients.

Material and methods: An electronic search was performed utilizing the databases of PubMed/MEDLINE, Embase and the Cochrane database. A total of 4496 publications were identified, of which 18 publications were included for final analysis. Data regarding biological and technical complications as well as the implant failure was extracted from these articles. Complication rates were also calculated.

Results: A total of 519 patients and 1104 implants were included in this study. A total of 22 implants were reported as failure (mean survival rate 98.0%). The mean duration of the interim prosthesis phase was 5.3 months (range 2 weeks to 12 months). The mean follow-up period was 25.2 months (range 12 to 96 months). The overall complication rate was 5.3%, of which 3.3% were biological and 2.0% were technical complications. The most frequent biological complication was asymptomatic lack of osseointegration (1.1%), followed by inflammation with discomfort or pain (1.0%). The most frequent technical complication was fracture of the provisional restoration (1.2%). During the interim prosthesis phase 3.8% of the total number of implants displayed complications, while the complication rate in the follow-up period was 1.5%. Of the 45 implants experiencing a complication, 22 failed, resulting in a high risk of failure post complication (48.9%). Notably, all the implants showing asymptomatic lack of osseo-

integration or disintegration resulted in a failure (Table 1). The mean time of implant failure was 5.1 months after implant placement.

Conclusions and clinical implications: Most complications and failures related to immediately loaded implants with fixed implant rehabilitations occurred in the interim prosthesis phase. In addition, nearly 50% of the complications resulted eventually in implant failure. An interim prosthesis phase with careful observation and management is therefore advised for successful implant treatment.

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Influence of lateral static overload on immediately restore implants in a canine model

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Background: The effects of prosthetic components misfitting or static lateral loading on immediate loading protocols are currently under research. A recent meta-analysis have concluded that is unclear the effects and benefits of loading force on implant-supported restorations.

Aim/Hypothesis: The aim of this study was to evaluate the effect of lateral static overload in immediately restored implants in the mandible of dogs.

Material and methods: In seven mongrel dogs, all premolars and the first molars were extracted bilaterally in the mandible. Two months after the extractions, six implants were placed in each animal, three on each side. Randomly, two implants per side were immediately restored with an orthodontic expansion device that promoted lateral static load and the third implant of each side, has remained submerged. These devices were hygienized daily with CHX 0.12%, during the 4 months of study, when the animals were sacrificed and biopsies removed for histometric study. Radiographies were made using positioners at the beginning and at the end of the study.

Results: Radiographically, there was a marginal bone loss of 3.68 mm ± 0.74 for the test group, 1.63 ± 0.2 for the control group and 0.45 ± 0.5 for the not loaded group. Histometrically, the percentage of bone implant/contact (BIC%) was 35.52 ± 7.32, for the test group, 63.16 ± 5.16 for the control group and 42.33 ± 2.14 for the not loaded group.

| Kinds of Complication | No. of Complications | No. of resolved | No. of Complications resulting in Implant Failure | % of Complications resulting in Implant Failure |
|---------------------------------------|----------------------|-----------------|---|---|
| Biological Complications | | | | |
| Asymptomatic Lack of Osseointegration | 12 | 0 | 12 | 100.0% |
| Inflammation with Edema or Pain | 11 | 6 | 5 | 45.5% |
| Disintegration | 3 | 0 | 3 | 100.0% |
| Peri-Implantitis | 6 | 5 | 1 | 16.7% |
| Technical Complications | | | | |
| Fracture of Provisional Restoration | 13 | 12 | 1 | 7.7% |
| Total | 45 | 23 | 22 | 48.9% |

Conclusions and clinical implications: The lateral static overload negatively increase the peri-implant bone loss in cases of immediate restoration with a 4 mm expansion.

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The effect of treated periodontitis on implant outcomes in partially dentate individuals

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Background: The history of periodontitis has been proposed as a risk indicator for peri-implantitis (Heitz-Mayfield, 2008). Recently, it has also been suggested that approximately 20% of patients receiving implants will develop peri-implantitis (Mombelli et al., 2012).

Aim/Hypothesis: To evaluate implant survival, success, bone loss and incidence of peri-implantitis in treated periodontitis subjects compared with patients without a history of periodontitis by updating a previous systematic review from our group (Ong et al., 2008).

Material and methods: The National Library of Medicine (MEDLINE) via OVID database and EMBASE were searched for publications (1965 – Nov 2012). A highly sensitive search strategy was developed, which used a combination of MeSH terms and text words. Prospective and retrospective longitudinal studies reporting on one or more primary outcomes with data of at least 6 months of loading were included. Screening methods and quality assurance were carried out independently and in duplicate. Disagreements were resolved by discussion and if necessary a third researcher was consulted.

Results: The search strategy resulted in 10,534 citations and finally 22 papers were included. The classification, type of treatment and definition of periodontitis varied between studies, complicating its comparison. In terms of bone level changes around implants and peri-implantitis, the studies showed heterogeneity in the definition and lack of standardization in the intervention characteristics and assessment of outcomes. Therefore, the results can only be regarded separately. The occurrence of peri-implantitis was reported in six studies. Bone loss was reported in 12 studies and was associated with the treated periodontitis group. Twelve out of 13 studies reporting on implant survival presented higher survival rate in patients without a history of periodontitis compared with the treated periodontitis group. Likewise, 5 out of 6 studies included data on implant success and reported better results in the non-periodontitis group. At the same time, the biological complications were significantly higher in the treated periodontitis group than the healthy group. It is important to mention that some of the included studies did not report on smoking habits and in some cases smokers were included as a mixed population. Therefore the effect of smoking on implant outcome cannot be excluded.

Conclusions and clinical implications: Within the limitations of the available evidence, patients treated for periodontal disease present a higher percentage of biological complications and a lower success rate than implants placed in healthy patients. However, the strength of evidence based on the study design, patient and intervention characteristics, and a lack of standard definition of outcome measurements such as baselines, and the follow-up time differences in the supportive periodontal treatment procedures makes it difficult to assert strong conclusions.

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Implant failures: retrospective longitudinal study during 15 years of clinical experience

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Background: Implant failures are nowadays considered an increasing clinical complication. Both the spread of these rehabilitative procedures to a wider and less specialized range of clinicians and the increase of implant procedures itself in the last 20 years contributed to the affirmation of this complication.

Aim/Hypothesis: Aim of this retrospective longitudinal study is to analyze those cases in which implant failures occurred. The Implant Department database was examined; common factors were collected and analyzed in order to identify those that could then be considered risk factors within an implant – rehabilitation.

Material and methods: All the 1260 patients treated in the past 15 years at the Implant Department, Ospedale Maggiore Policlinico, University of Milan were included in the study. The total number of fixtures inserted was 4667. Sixty-six patients experienced problems in terms of implant survival, for a total of 127 fixtures lost. Within this group several aspects were analyzed, including: implant survival timing, surgical phase in which the failure occurred, surgical protocol adopted, need for regenerative procedures, fixture features (shape, length and diameter), intra and post operative complications, implant position, loading protocol and prosthetic project, patient's age and sex.

Results: An Implant failure rate of 2.72% was calculated. 5.23% of the patients experienced problems in terms of implants survival. The surgical protocol and the presence of an adequate amount of native bone appear to be important aspects in the genesis of the complication. We found a higher percentage failure in that situation in which regenerative procedures were adopted, with an implant failure rate of 6.82%. Within the group of implant inserted in native bone this percentage was significantly lower and calculated in 1.02%. Post – extractive implants had a failure rate of 6.50%.

Conclusions and clinical implications: The need for regenerative procedures appears to be an important factor in the genesis of implant's failures. Data obtained from our analysis are comparable with those reported in many studies present in the literature and can lead to interesting conclusions from a clinical point of view.

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A novel standardized bone model for thermal evaluation of bone osteotomies with various irrigation methods

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Background: For avoiding dental implant failures due to mechanical and thermal injuries, previous investigations described various factors potentially affecting osseointegration, including different drilling parameters such as drilling speed, depth, load and conventional vs. alternative drilling, different drill modifications regarding drill design, geometry, sharpness and materials and various irrigation techniques. However, most of the previously published studies investigating these mechanical and thermal factors were performed on a huge variety of *in vivo* and *in vitro* bone specimens, with a dissimilar relationship between cortical and cancellous bone and a different thermal conductivity compared with clinical conditions in human bone.

Aim/Hypothesis: Based on a novel standardized bovine specimen, the aim of this study was to investigate thermal effects of different irrigation methods during intermittent and graduated drilling.

Material and methods: Temperature changes during implant osteotomies ($n = 320$) of 10 and 16 mm drilling depths with various irrigation methods were investigated on manufactured uniform bone samples providing homogenous cortical and cancellous areas and analogous thermal conductivity comparable to human bone. Automated sequences were performed with surgical twist drills of 2 mm \varnothing and conical drills of 3.5, 4.3 and 5 mm \varnothing . Real-time recording of temperature increase was done using two custom-built multichan-

nel thermoprobes with 14 temperature sensors at a predefined distance of 1 and 2 mm to the final osteotomy. The effects of drilling depth, drilling diameter and irrigation methods on temperature changes were investigated by a linear mixed model.

Results: Using this uniform bone specimen, the greatest temperature rise was observed without any coolant supply with 29.87°C, followed by external with 28.47°C and then internal with 25.86°C and combined irrigation with 25.68°C. Significant differences ($P = 0.0156$) between drill depths of 10 vs. 16 mm could be observed with all irrigation methods evaluated. With each of the irrigation methods, significantly higher temperature changes ($P < 0.0001$) during osteotomies could be observed between twist drills of 2 mm \varnothing and conical drills of 3.5, 4.3 and 5 mm \varnothing . During 10 and 16 mm drilling osteotomies, external irrigation showed significantly higher temperatures ($P < 0.05$) for all conical drills compared with internal or combined irrigation, respectively. Significantly lower temperatures ($P < 0.05$) could be detected with internal or combined irrigation for the use of conical drills with various diameters and drilling depths.

Conclusions and clinical implications: This fully standardized bone model provides optimized comparability for the evaluation of bone osteotomies and resulting temperature changes. As regards the efficiency of the various irrigation methods, it could be demonstrated that internal and combined irrigation appears to be more beneficial than external irrigation.

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Success rates of fixed partial reconstructions worn by teeth, implants and their combination

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Background: Along with the development of surgical techniques there has been expanding indications for dental implant placement, and consequently extended range of possibilities for the development of contemporary fixed prosthetic dentures (FPD) which include bridges on dental implants, teeth and their combination.

Aim/Hypothesis: The aim of this study is to assess the success of FPD on teeth, implants, and their combination by studying the incidence of biological and technical complications for the function period of 1–3 years (average 2.3 years).

Material and methods: Sixty partially edentulous patients provided with a fixed bridges in posterior areas of the maxilla and mandible. Bridges are two-unit, three-unit and four-unit without pontics. Bridges are worn by teeth, implants and their combination and the patients were divided into three groups. All implants were Astratech, screw shape, length of 9 to 13 mm. Both clinical and radiological examinations were done

which determined the incidence of biological and technical complications. Groups of variables were used to form three different index values which were compared using ANOVA. Multiple regression analysis was used to test the effect independent variables on the dependent variables.

Results: Index of biological complications (mucositis, periimplantitis, gingivitis, periodontitis and pulpitis) shows the highest value on bridges worn by teeth and the lowest on bridges worn by implants. Index of occlusal complications (occlusal concepts, parafunction, premature contacts) had the highest value on bridges worn by implants. Index of technical complications (implant or abutment breakage, screw loosening, bridge debonding, fracture of ceramics) has the highest value on bridges worn by combination of teeth and implants and the lowest value on bridges worn by implants. ANOVA found that there was no statistically significant difference in the incidence of biological and technical complications between groups. Multiple regression analysis tested the impact of clinical and radiological findings (bone resorption and bone density, occlusal factors, general health, oral hygiene) on the incidence of biological and technical complications. It showed that the greatest impact has bone resorption around the implant, except for bridges worn by teeth which were mostly affected by occlusal index.

Conclusions and clinical implications: The results of this study are consistent with the recent scientific literature. They indicate that, in the long term, the greatest impact on the success rate of FPD worn by implants and combination of teeth-implant have biological complications, and they are due to the expanded range of indications for implant-prosthetic treatment of patients, occurring in a growing percentage.

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Management of food impaction after implant prosthesis

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Background: Food impaction after implant prosthesis is a common complication among patients that receive implant treatment. This complication, if left untreated, may cause gingival swelling and bony resorption. In the end, it may shorten implant survival period or result in implant failure.

Aim/Hypothesis: Managing food impaction is an important task for an implant dentist. A good management of teeth contact area is a very important to achieve good outcome.

Material and methods: This article presents cases with chair side pictures to illustrate a simple way to overcome the complication of food impaction after implant prosthesis. Using patients chair side pictures; a simple way to overcome the complication will be illustrated.

Results: With this method, all of the patients who suffered from food impaction satisfied with the outcome.

Conclusions and clinical implications: Complications of food impaction or cracked porcelain crown after implant prosthesis can be resolved or repaired using the method illustrated in the article.

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Presence, location and course of mandibular incisive canal and inter-examiner variation: a spiral CT scan study

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Background: During osteotomies for implant placement mesial to the mental foramen, the mandibular interforaminal region is generally considered as a safe surgical area. However, the mandibular incisive canal carries a neurovascular bundle for innervation and vascular supply of the lower anterior dentition.

Aim/Hypothesis: The aim of the present study was to assess the spiral computed tomography (CT) scans for the presence/location, course and dimension of the incisive canal and also to analyze the potential inter-examiner differences regarding incisive canal related-measurements.

Material and methods: A total of 90 spiral CT scans were analyzed by three different observers (two oral radiologist and one periodontist) on predetermined sections by a CT specialist. Vertical and horizontal diameter of the incisive canal, the horizontal distance to the buccal and lingual borders, vertical distance to the teeth apices/crest of ridge and inferior border were measured on CT scan sections.

Results: There was a good level of agreement regarding incisive canal related measurements among the three observers. Incisive canal may be located in a large variety of distances and diameters. A trend of decrease in the vertical and buccolingual diameter was noted as the canal proceeded medially. Incisive canal was more buccally oriented in all regions and sloped apically towards midline. The prevalence of the anatomical landmarks bilaterally on spiral CT scan images was 100%, 99% for mandibular canal and mental foramen, respectively. Considering the CT specialist visibility ratings, the mandibular canal could be seen in all of the cases, but good visibility was present in only 67% of the cases ($n = 60$). The mental foramen was identified bilaterally in 89 cases with a good visibility ranking %100. All three observers' measurements did not differ significantly between left and the right sides ($P > 0.05$). Incisive canal prevalence according to the teeth positions was 55%, 78%, 90%, 95%, 3% for mandibular central, lateral incisor, canine, first and second premolar area, respectively.

Conclusions and clinical implications: When there is a high risk for potential neurovascular damage CT scan of the surgical site is essential to avoid any complications. Incisive canal may be located in a large variety of distances and diameters. Large interindividual varieties on measurements may suggest that when there is a high risk for potential neurovascular damage, it may be necessary to reach a consensus before performing any surgery. CT-Scans provide better visualization of the anatomical structures than conventional radiographs and improves safety of the procedures. A preoperative CT scan of the surgical site is essential for avoiding complications during surgery and post-surgical period, and a valuable to improve the safety of the procedures.

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Restorative solutions for compromised esthetic implant sites – a case series

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Background: Hard and soft tissue deficiency after tooth loss in the anterior maxilla describes a major challenge in implant supported reconstruction. Although various surgical procedures have been introduced, these are often limited in creating a natural appearance of implant restorations.

Aim/Hypothesis: The objective of this case series is to demonstrate restorative treatment concepts to handle horizontal and vertical tissue deficiencies around anterior maxillary implants.

Material and methods: Case 1: Periimplantitis and lack of keratinized mucosa in regio 13–23 5 years after placement involved implant removal, vestibuloplasty with free mucosal graft, implant re-insertion and a four-unit screw retained acrylic provisional plus pink artificial mucosa (composit) as 'try-in'. Definitive restoration was fabricated as a screw retained zirconia 'hybrid' bridge with ceramic veneering and artificial mucosa using pink composit. The objectives were natural incisal crown morphology and adequate lip support. Case 2: 9 years postoperatively implant site 11 appeared with apical displacement and fistula without suppuration. Treatment protocol consisted of crown removal, resubmergence and removable provisional, soft tissue grafting and reentry after 6 weeks. A provisional acrylic resin crown was inserted for soft tissue conditioning (8 weeks) followed by a customized zirconia abutment and zirconia crown as permanent restoration. the remaining soft tissue deficiency was treated with chair-side applied pink composit to recreate natural soft tissue contour, volume and crown length without jeopardizing oral hygiene. Case 3: 3 years postop implant sites 13,12,22,23 demonstrated compromised red and white esthet-

ics. After removal of implant 12 due to extensive bone loss and resubmerging of implants 22, 23 the provisional prosthetic solution implied two 3-unit tooth-implant supported acrylic resin bridges (13–11 and 21–23). Chairside adaption of pink composit imitates natural mucosal architecture and tooth axes, provides adequate lip support and facilitates easy access for oral hygiene.

Results: Prosthetic hybrid solutions using pink composit represent a minimal invasive approach for lost tissue replacement. Easy adjustability and repairability, reduced patient's discomfort due to less surgeries and a predictable natural outcome make this a viable treatment protocol in cases of loss of papilla, apical displacement, inadequate implant position and tissue deficiencies.

Conclusions and clinical implications: Proper treatment planning at early stages and the respective cooperation with lab-technology are important prerequisites for successful rehabilitation in compromised/demanding implant sites.

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Treatment of peri-implant mucositis using a resorbable chitosan brush – a pilot clinical study

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Background: Peri-implant mucositis has been demonstrated as a common condition around dental implants. A number of strategies for treatment of mucositis have been suggested but there is scarce data showing superior efficacy of any method. It has also been shown that long term mucositis may lead to loss of peri-implant attachment and it is consequently of importance to treat mucositis and to perform maintenance therapy at regular intervals. Use of non resorbable devices for debridement of implant surfaces may leave remnants of the device which may induce a foreign body reaction. A twisted brush with bristles made of chitosan, which is a very fast resorbable biopolymer was tested in this study.

Aim/Hypothesis: The aim of the present study was to examine the change in clinical outcome after treatment of peri-implant mucositis with a rotating chitosan brush.

Material and methods: This pilot study of 6 months duration included 13 patients diagnosed with peri-implant mucositis. The study had been approved by the regional research ethics committee. All clinical examinations were performed by two board-certified and calibrated periodontists. Treatment was performed by a separate board-certified periodontist. Debridement was executed with the brush used in a 2 : 1 dental polishing handpiece with a duration time of 3.5 min. After finished debridement the crevice was rinsed with sterile saline. Patients were recalled at 2, 4 weeks, 3 and 6 months. Radiographic analysis was performed at baseline

and at 6 months to exclude implants with progression of bone loss. Clinical examinations included probing pocket depth, modified sulcus bleeding index (mBI) and a modified bleeding on probing index (mBoP). Clinical parameters were compared between baseline, 2, 4 weeks and 6 months. A Mann-Whitney U test with the significance level set at 0.05 was used.

Results: Significant improvements in clinical parameters (PPD, mBI and mBoP) were demonstrated. No subjective

symptoms such as pain were reported by the patients. The brush penetrated well down in the mucosal crevice and the flexibility of the brush stem made it easy to access the approximal parts of the pockets.

Conclusions and clinical implications: A rotating chitosan brush seems to be a safe and efficient device for treatment of peri-implant mucositis. A randomized clinical trial has been initiated.