Scientific Highlights of the Month

Short overviews on recently published scientific evidence.

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A functionalized surface modification with vanadium nanoparticles of various valences against implant-associated bloodstream infection.

Study objective:
The aim of this study was to investigate the potential antimicrobial efficiency of these nano-VOx films and the interactions of human erythrocytes and bacteria (methicillin-resistant Staphylococcus aureus and Pseudomonas aeruginosa) with our samples in a novel cell-bacteria co-culture model.

Results and conclusions:
- Nano-VOx precipitated favorable antibacterial activity on both bacteria, especially on S. aureus, and this effect increased with higher vanadium valence.
- A possible mechanism accountable for these results might be elevated levels of vanadium-induced intracellular reactive oxygen species.
- The nano-VOx films were found to be able to kill prokaryotic cells but were not toxic to mammalian cells, holding the potential for the prevention of implant-related hematogenous infections.
- This work may provide new insights for biomedical applications of inorganic vanadium compounds and attract growing attention in this field.
- From the perspective of surface modification and functionalization, this study holds promise to avail the prophylaxis of bloodstream infections involving implantable biomedical devices.

Clin Implant Dent Relat Res. 2017 Apr 21

Immediate implant placement and restoration in the anterior maxilla: Tissue dimensional changes after 2-5 year follow up.
Arora H, Khzam N, Roberts D, Bruce WL, Ivanovski S.

Study objective:
This prospective study evaluated the mid-long term (2-5 years) tissue changes around immediately placed and restored implants in the anterior maxilla using flapless surgery and simultaneous hard tissue augmentation. Thirty AstraTech implants were immediately placed in 30 patients, followed by the delivery of an immediate provisional restoration on the same day.

Results and conclusions:
- All implants remained osseointegrated during the follow up period of 2-5 years (mean 47 ± 15 months).
- Twelve of the thirty patients completed the 5 year follow up. Radiographic evaluation revealed average gains in bone levels of 0.18 and 0.34 mm mesially and distally, respectively.
- Soft tissue evaluation showed a mean tissue loss of 0.05 ± 0.64 mm and 0.16 ± 0.63 mm at the mesial and distal papillae, respectively, while mid-facial mucosal recession was 0.29 ± 0.74 mm.
- A significant improvement in the Pink Esthetic Scores was seen at the final follow-up.
- In addition to a favorable implant success rate and peri-implant bony response, the soft tissue levels and overall aesthetics around single immediately placed and restored implants can also be maintained in the mid-long term.

For more information about this publication, please click HERE
Effect of coarse grinding, overglazing, and 2 polishing systems on the flexural strength, surface roughness, and phase transformation of yttrium-stabilized tetragonal zirconia.
Mohammadi-Bassir M, Jamshidian M, Rezvani MB, Babasafari M.

Study objective:
The aim of this in vitro study was to evaluate the effect of grinding and polishing procedures on the flexural strength, quality and quantity of surface roughness, topography, and phase transformation of a zirconia-based ceramic system. Bar-shaped yttrium-stabilized zirconium oxide specimens (20×4×2 mm) were used. The specimens were wet-polished and divided into 5 groups (n=10): standard polishing without any surface treatment (group SP); grinding with a diamond rotary instrument (group Gr); grinding with a diamond rotary instrument (DRI) and over-glazing (group Gl); grinding with a DRI and polishing with an intraoral zirconia polishing kit in a 2-step procedure (group BP); and grinding with a DRI and polishing with an intraoral polishing kit (group MP). The Ra and Rz surface roughness values (μm) were measured with a profilometer. One specimen of each group was subjected to x-ray diffraction (XRD) to estimate the monoclinic phase and evaluated using scanning electron microscopy (SEM) for surface topography. The 3-point flexural strength of the bars was measured in a universal testing machine at a crosshead speed of 0.5 mm/min. The mean flexural strength (MPa) and surface roughness values were calculated, and the results were analyzed using 1-way ANOVA and Tukey honest significant difference tests (α=.05).

Results and conclusions:
- Statistically significant differences were noted among the experimental groups for Ra, Rz (P<.001), and flexural strength values (P<.001). The highest Ra and Rz values were found in group Gr (P<.001) and the lowest in group Gl, which were significantly lower than the values in group Gr (P<.001).
- The 2 polishing systems (BP and MP) were not significantly different in terms of Ra and Rz values (P=.755 for Ra and P=.319 for Rz). The highest flexural strength was found in group Gr (283.35 ±49.85 MPa) without significant differences from those of MP and BP (P=.958 for BP and P=.404 for MP). The lowest flexural strength was found in Gl, which had no significant differences from those of the control group (P=1.000).
- In XRD the monoclinic phase was observed in Gr (26%), BP (24%), and MP (23%) groups. However, groups Gl and SP did not have any monoclinic phase. SEM showed deep unidirectional scratches after grinding that were smoothened by glazing and polishing.
- Roughness increased significantly after grinding, but polishing and glazing similarly diminished it. Glazing after grading significantly decreased the flexural strength values, but polishing did not.

For more information about this publication, please click HERE
Clinician assessments and patient perspectives of single-tooth implant restorations in the esthetic zone of the maxilla: A systematic review.
Arunyanak SP, Pollini A, Ntounis A, Morton D.

Study objective:
The aim of this systematic review was to identify differences in esthetic satisfaction between clinicians and patients when evaluating single-tooth implant-supported restorations. An electronic search of the Medline database and Cochrane Central Register of Controlled Trials (2000 to 2014) was performed. The search was supplemented by a manual search of specific journals. A quality assessment of full-text articles was performed according to Cochrane Collaboration’s tool and Newcastle-Ottawa scale for risk of bias assessment. Information regarding outcomes was collected and compared.

Results and conclusions:
- The clinicians identified a satisfactory outcome in 51% to 100% for periimplant soft tissue and 62% to 90% for implant restorations.
- Patients showed a mean range score of 43% to 93% for periimplant soft tissue and 81% to 96% for implant restorations.
- The visual analog scale score of the dentists was always lower than that of the patients.
- The review identified correlations between subjective and objective assessments for the Pink Esthetic Score (PES), the Papilla Index (PI), the Implant Crown Aesthetic Index (ICAI), and the modified (mod-ICAI) indices.
- Clinicians are more critical of esthetic outcomes than patients.
- A comprehensive and practical index should be developed to assess the esthetic outcomes for single-tooth implant restorations in the esthetic zone.

For more information about this publication, please click HERE.
Peri-implantitis Induced by Stainless Steel Ligature in Beagle Dogs.

Study objective:
The aim of this study was to develop a new method for a peri-implantitis model in beagle dogs in which a stainless steel ligature (SSL) was used independently. A total of 36 Straumann dental implants were placed in six beagle dogs 1 month after all mandibular premolars were extracted. After 3 months, SSLs were placed in a submarginal position on the implants to induce peri-implantitis and were not replaced during the 12-week tissue breakdown period. Inducing peri-implantitis in the beagles with an SSL is a rapid, effective, and simple method.

For more information about this publication, please click HERE

The influence of the emergence profile on the amount of undetected cement excess after delivery of cement-retained implant reconstructions.
Sancho-Puchades M, Cramer D, Özcan M, Sailer I, Jung RE, Hämmerle CH, Thoma DS

Study objective:
The aim of this study was to test whether or not one of two emergence profile designs (concave or convex) is superior to the other in terms of remaining cement following cementation of reconstructions on individualized abutments and careful cement removal. A central incisor with a single implant-supported reconstruction was selected as a model

Results and conclusions:
- Concave abutments presented significantly more cement remnants than CV abutments when the entire abutment area of the epimucosal margin groups was evaluated.
- A statistically significant increase in remnants was detected when the crown-abutment margin was located more submucosally for every abutment studied (0 mm vs. 1.5 mm: P < 0.000, 0 mm vs 3 mm: P < 0.000, 1.5 mm vs. 3 mm: P < 0.000).
- The buccal quadrant demonstrated the least, whereas the oral and interdental quadrants showed the greatest amount of cement excess.
- Concave emergence profile abutments and deep crown-abutment margin positions increased the risk of cement excess. Oral and interdental areas are more prone to cement remnants than other surface areas.

For more information about this publication, please click HERE
Early Complications of Immediate Loading in Edentulous Full-Arch Restorations: A Retrospective Analysis of 88 Cases.
Cercadillo-Ibarguren I, Sánchez-Torres A, Figueiredo R, Valmaseda-Castellón E.

Study objective:
The aim of this study was to describe the clinical outcomes and complications related to provisional prostheses after full-arch implant-supported rehabilitation by means of an immediate loading protocol. This retrospective cohort study included patients who were consecutively treated with full-arch implant-supported restorations with a minimum of four implants (Replace Select Tapered TiUnite, Nobel Biocare AB) per arch and conical abutments (multi-unit, Nobel Biocare AB) by means of an immediate loading protocol.

Results and conclusions:
 Within a 9-month period, 18 prostheses (16.8%) fractured (15 maxillary and 3 mandibular); in nine of these patients the opposing dentition was a full-arch, implant-supported restoration, and in the remaining nine patients, it was natural dentition. Six (1.1%) maxillary and three (0.5%) mandibular implants failed.
 A high implant survival rate is expected in the short term following this immediate loading protocol.
 Fracture of the provisional prosthesis is a common finding, affecting 17% of patients, and is significantly more prevalent in patients with bruxism and in maxillary prostheses.

For more information about this publication, please click HERE.

Evaluation of the osseointegration of dental implants coated with calcium carbonate: an animal study.

Study objective:
The purpose of this study was to investigate the effect of calcium carbonate-SA (CC-SA) implants on osseointegration in vivo. The surfaces of SA and CC-SA implants were characterised for surface morphology and surface chemistry. Subsequently, these two kinds of implants were implanted in the femoral condyles of rabbits.

Results and conclusions:
 Significantly higher values of bone-to-implant contact of the entire implant except the gap area (BIC_ALL) and the bone-to-implant contact of the gap area (BIC_GAP) were found in animals with the CC-SA implants than in those with the SA implants at 4 weeks.
 Higher values of total gap bone were found in those with the CC-SA implants than in those with the SA implants at 1, 2 and 4 weeks.
 The calcium carbonate coating can improve and accelerate the early ingrowth of bone and osseointegration at the early healing phase. This may reduce clinical healing times and thus improve implant success rates.

For more information about this publication, please click HERE.
Clinical Performance of Narrow-Diameter Titanium-Zirconium Implants: A Systematic Review.

Study objective:
The purpose of this systematic review was to determine the available data on clinical performance of Ti-Zr NDI. A literature search of all available clinical articles dealing with Ti-Zr NDI has been carried out. After including only prospective clinical trials, 14 papers were retrieved for thorough reviewing.

Results and conclusions:
Short-term results from preliminary clinical reports are quite promising, although the number of published studies and the follow-up periods are still insufficient to determine the real benefit of this hybrid material compared with titanium, especially when using NDI.

For more information about this publication, please click HERE.

Biological Evaluation of Implant Drill Made from Zirconium Dioxide.
Akiba Y, Eguchi K, Akiba N, Uoshima K.

Study objective:
The purpose of this study was to evaluate biological responses against a zirconia drill using a bone cavity healing model. Zirconia drills, stainless steel drills, and the drilled bone surface were observed by scanning electron microscopy (SEM), before and after cavity preparation in rats.

Results and conclusions:
- SEM images revealed that zirconia drills maintained sharpness even after 30 drilling procedures.
- The bone surface was smoother with the zirconia drill.
- Micro-CT images showed faster and earlier bone healing in the zirconia drill cavity.
- On H-E staining, at 7 days, the zirconia drill defect had a smaller blank lacunae area. At 14 days, the zirconia drill defect was filled with newly formed bone.
- The zirconia drill induces less damage during cavity preparation and is advantageous for bone healing.

For more information about this publication, please click HERE.
10 Keys for Successful Esthetic-Zone Single Immediate Implants.
Levine RA, Ganeles J, Gonzaga L, Kan JK, Randel , Evans CD, Chen ST.

The 10 keys for successful esthetic-zone single immediate implants encapsulate in an evidence based manner the treatment planning and replacement of single hopeless teeth in the maxillary anterior sextant. Based on the 10 keys, the management of an immediate implant in the esthetic zone is considered a complex SAC procedure. As described in this article, a complex SAC procedure requires careful patient selection and treatment planning, along with precise execution by skillful clinicians, to achieve successful results.

For more information about this publication, please click HERE

Primary Stability of Cylindrical and Conical Dental Implants in Relation to Insertion Torque-A Comparative Ex Vivo Evaluation.

Study objective:
The aim of this ex vivo study was to investigate the influence of different insertion torques on primary stability of a conical and a cylindrical implant system. MATERIALS AND METHODS: Thirty-two dental implants (Astra Tech OsseoSpeed 5.0 S × 11 mm cylindrical [n = 16] and 5.0 × 11 mm conical [n = 16]) were inserted with 20, 30, 40, and 45 N·cm into fresh porcine bone of mixed trabecular-cortical quality.

Results and conclusions:
- The highest ISQ (mean 78.25 ± 2.9) and pushout values (mean 675 N ± 5.8) were measured for the cylindrical implant after insertion using 30 N·cm. T
- The conical implant showed the highest primary stability by means of ISQ (mean 76.25 ± 2.2) and pushout force (mean 502.5 N ± 9.6) after an insertion torque of 40 N·cm.
- If more insertion force was used, primary stability was reduced in all cases.
- Different forms of an implant system need different insertion torques to obtain an optimal primary stability.

For more information about this publication, please click HERE
**Spectrophotometric analysis of fluorescent zirconia abutments compared to "conventional" zirconia abutments: A within subject controlled clinical trial.**
Thoma DS, Gamper FB, Sapata VM, Voce G, Hämerle CHF, Sailer I

**Study objective:**
The aim of this study was to test whether or not a fluorescent hybrid zirconia abutment offers superior esthetics compared to a non-fluorescent one-piece zirconia abutment based on spectrophotometric analysis. In 24 patients with 24 single-tooth implants, 2 types of reconstructions were fabricated: a directly veneered one-piece zirconia abutment/crown (control) and a directly veneered fluorescent hybrid zirconia abutment/crown (test).

**Results and conclusions:**
- Both types of reconstructions were similar in terms of esthetics.
- In cases with a mucosal thickness of <2 mm, the soft tissue discoloration compared to the natural gingiva was more pronounced for the fluorescent hybrid zirconia reconstructions.

For more information about this publication, please click [HERE](#).

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**Comparison of fracture strength and failure mode of different ceramic implant abutments.**
Elsayed A, Wille S, Al-Akhal M, Kern M.

**Study objective:**
The purpose of this in vitro study was to evaluate the fracture strength and failure mode of single-tooth implant restorations using ZrO2 and LaT abutments, and to compare them with titanium (Ti) abutments. Five different types of abutments, Ti; ZrO2 with no metal base; ZrO2 with a metal base (ZrT); LaT; and LaT combination abutment and crown (LcT) were assembled on 40 Ti implants and restored with LaT crowns.

**Results and conclusions:**
- Group ZrO2 revealed the lowest resistance to failure with a mean of 202 ±33 N.
- Groups ZrT, LaT, and LaC withstood higher forces without fracture or debonding of the ceramic superstructure, and failure was due to deformation of metal bases, with no statistically significant differences between these groups regarding the bending behavior.
- LaT abutments have the potential to withstand the physiological occlusal forces that occur in the anterior region and that ZrO2 abutments combined with Ti inserts have much higher fracture strength than pure ZrO2 abutments.

For more information about this publication, please click [HERE](#).
Managing complications resulting from limited prosthetic space with a monolithic, multichromatic CAD-CAM implant-retained overdenture: A dental technique.
Peng L, Chen L, Harris BT, Morton D, Lin WS.

Study objective:
This article proposes a 2-visit clinical protocol to manage prosthodontic complications resulting from limited prosthetic space, using a monolithic, multichromatic computer-aided design and computer-aided manufacturing (CAD-CAM) acrylic resin implant overdenture. The advantages and limitations of using this approach are outlined and discussed.

Micromorphological differences of the implant-abutment junction and in vitro load testing for three different titanium abutments on Straumann tissue level implants.
Mattheos N, Larsson C, Ma L, Fokas G, Chronopoulos V, Janda M

Study objective:
The aim of this study was to investigate the micromorphological differences among three commercially available titanium abutments on Straumann implants. Furthermore, the possible impact of functional loading on the micromorphology and potential complications was investigated with the use of in vitro testing.

Results and conclusions:
- Major morphological differences were identified between the three units, as well as differences in the extent of tight contact in all areas examined.
- Despite the morphological differences, the 2M cycles of loading via in vitro test did not result in any noticeable complications although some changes in the micromorphology were observed.
- The examined implant-abutment units presented with major morphological differences. Two million cycles of in vitro loading did not appear to affect the stability of the units despite the micromorphological changes.

For more information about this publication, please click HERE.
**A systematic review of the survival and complication rates of inlay-retained fixed dental prostheses.**

**Study objective:**
The aim of this systematic review was to investigate the survival and complication rates of inlay-retainer fixed dental prostheses (IRFDPs). A systematic search was conducted in the PubMed, EMBASE, and Cochrane Library databases in English and time filters (articles published from 1960) were used.

**Results and conclusions:**
- Compared with conventional fixed dental prostheses (FDPs) and implant-supported single crowns (ISCs), IRFDPs exhibited an acceptable 3-year survival rate but higher complication rates of debonding and veneer fracture.
- IRFDPs can be recommended as viable short- or middle-term minimally invasive alternatives to short-span conventional FDPs and ISCs, while the clinical outcome of IRFDPs as long-term definitive restorations still calls for further research.
- The indications of IRFDPs should be strictly controlled and monitored.

For more information about this publication, please click HERE

**In-vitro fatigue and fracture testing of CAD/CAM-materials in implant-supported molar crowns.**
Preis V, Hahnel S, Behr M, Bein L, Rosentritt M.

**Study objective:**
The aim of this study was to investigate the fatigue and fracture resistance of different CAD/CAM-materials as implant- or tooth-supported molar crowns with respect to the clinical procedure (screwed/bonded restoration). 168 crowns were fabricated from different CAD/CAM-materials (n=8/material): ZLS (zirconia-reinforced lithium silicate ceramic; Suprinity, Vita-Zahnfabrik), COB (composite; Brilliant Crios, Coltene), COL (composite; Lava Ultimate, 3M Espe), PMV/PPV (polyether ether ketone (PEEK)+milled composite veneer/composite paste veneer; BioHPP+HIPC veneer/Crealign veneer, Bredent), COH (composite; Block HC, Shofu), and ZIR (zirconia; IPS e.max ZirCAD, Ivoclar-Vivadent) as reference.

**Results and conclusions:**
- All crowns of group LAB-PPV showed cracks after TCML. The other groups survived fatigue testing without failures.
- Fracture forces varied between 921.3N (PPV) and 4817.8N (ZIR) [CHAIR], 978.0N (COH) and 5081.4N (ZIR) [LAB], 746.7N (PPV) and 3313.5N (ZIR) [TOOTH].
- Significantly (p<0.05) different fracture values were found between materials in all three groups. Only ZLS crowns provided no significant (p>0.05) differences between the individual groups.
- Different ceramic and resin-based materials partly performed differently in implant or tooth situations. Individual resin-based materials (PPV, COB, COH) were weakened by inserting a screw channel.
- Most CAD/CAM-materials may be clinically applied in implant-supported crowns without restrictions.

For more information about this publication, please click HERE
The Acute Inflammatory Response to Absorbed Collagen Sponge Is Not Enhanced by BMP-2.
Huang H, Wismeijer D, Hunziker EB, Wu G.

Study objective:
The aim of this study was to clarify if the pro-inflammatory activities, associated with BMP-2 added to ACS, were related to the physical state of the carrier itself, i.e., a wet or a highly dehydrated state of the ACS, to the local degree of vascularisation and/or to local biomechanical factors. ACS (0.8 cm diameter)/BMP-2 were implanted subcutaneously in the back of 12 eight-week-old Sprague Dawley rats.

Results and conclusions:
 The acute inflammatory response following implantation of ACS was dependent of neither the presence or absence of BMP-2 nor the degree of vascularization in the surrounding tissue nor the hydration state (wet versus dry) of the ACS material at the time of implantation.
 Differential micro biomechanical factors operating at the implantation site appeared to have an influence on the thickness of inflammation.
 The degree of the early inflammatory response of the ACS/BMP-2 may be associated with the physical and chemical properties of the carrier material itself.

For more information about this publication, please click HERE

Guided bone regeneration with particulate vs. block xenogenic bone substitutes: a pilot cone beam computed tomographic investigation.
Benic GI, Thoma DS, Jung RE, Sanz IM, Unger S, Cantalapiedra A, Hämmerle CH.

Study objective:
The aim of this study was to test whether an equine bone substitute block used for guided bone regeneration (GBR) of peri-implant defects differs from bovine block or particulate bone substitutes regarding the hard and soft tissue contours of the augmented ridge. Two semi-saddle bone defects were prepared in each side of the mandible of eight dogs, and one titanium implant was inserted into every defect. The defects were randomly allocated to receive one of the following treatments: bone augmentation by GBR using (1) particulate deproteinized bovine bone mineral (DBBM) + a collagen membrane (CM), (2) block DBBM + CM, (3) equine bone substitute block + CM, and (4) empty controls.

Results and conclusions:
 GBR with bone substitute blocks lead to higher ridge dimensions than empty controls.
 The equine block with CM rendered the most favorable outcomes in hard and soft tissue contours followed by DBBM block and DBBM granulate with CM.

For more information about this publication, please click HERE
Effect of a Connective Tissue Graft in Combination With a Single Flap Approach in the Regenerative Treatment of Intraosseous Defects
Trombelli L, Simonelli A, Minenna L, Rasperini G, Farina R.

Study objective:
The aim of this study was to evaluate the effect of a connective tissue graft (CTG) when combined with a buccal single flap approach (SFA) in the regenerative treatment of intraosseous defects. METHODS: Data related to 30 patients with an intraosseous defect treated with a buccal SFA with (SFA+CTG group; n = 15) or without (SFA group; n = 15) placement of a CTG and regenerative treatment were retrospectively derived at three clinical centers.

Results and conclusions:
- In addition to a significant attachment gain and probing depth reduction, adjunctive use of a CTG to a buccal SFA in the regenerative treatment of periodontal intraosseous defects associated with a buccal bone dehiscence resulted in a limited post-surgery bREC, a lower prevalence of defects with a clinically detectable apical displacement of the gingival margin, and an increase in gingival width and thickness.
- Adjunctive use of a CTG in the regenerative treatment of intraosseous defects associated with buccal bone dehiscence accessed by buccal SFA may support the stability of the gingival profile.

For more information about this publication, please click HERE

Randomized controlled clinical study comparing a volume-stable collagen matrix to autogenous connective tissue grafts for soft tissue augmentation at implant sites: linear volumetric soft tissue changes up to 3 months.
Zeltner M, Jung RE, Hämmerle CH, Hüsler J, Thoma DS.

Study objective:
The aim of this study was to test whether or not the use of a volume-stable collagen matrix (VCMX) results in soft tissue volume increase at implant sites non-inferior to an autogenous subepithelial connective tissue graft (SCTG). In 20 patients, soft tissue augmentation at implant sites was performed using VCMX or SCTG.

Results and conclusions:
- The median linear changes from BL to FU-90 in the crestal ROI amounted to 0.175 mm (0.06; 0.51) for VCMX (p = 0.002 over time) and to 0.51 mm (0.23; 0.94) for SCTG (p = 0.129). The differences between the two groups were not significant (p = 0.287).
- The respective values in the buccal ROI were 0.59 mm (0.26; 1.06) for VCMX (p = 0.002) and 0.94 mm (0.66; 1.13) for SCTG (p = 0.004). The differences between the two groups were not significant (crestal: p = 0.287; buccal: p = 0.534).
- Non-inferiority could be concluded for VCMX compared to SCTG for both ROI.
- VCMX and SCTG can be used for soft tissue augmentation at implant sites resulting in an at least short-term increase in volume.

For more information about this publication, please click HERE