



Scientific Highlights

SHORT OVERVIEWS ON RECENTLY PUBLISHED SCIENTIFIC EVIDENCE.

Issue 05/2020

Edited by Dr Pooja Nair

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in this issue



EDITOR'S CHOICE

Investigating the Response of Human Neutrophils to Hydrophilic and Hydrophobic Micro-Rough Titanium Surfaces

(El Kholy K et al. 2020)

and

Effect of enamel matrix derivative liquid combined with synthetic bone substitute on bone regeneration in a rabbit calvarial model.

(Jung J et al. 2020)

Mandibular implant-supported fixed complete dental prostheses on implants with ultrashort and standard length: A pilot treatment

(Schimmel M et al, 2020)

Regenerative surgery versus access flap for the treatment of intra-bony periodontal defects: A systematic review and meta-analysis f

(Nibali. L et al. 2020)

Editor's choice

Materials (Basel)2020 Aug 3;13(15):3421.

Investigating the Response of Human Neutrophils to Hydrophilic and Hydrophobic Micro-Rough Titanium Surfaces

El Kholy K, Buser D, Wittneben J G, Bosshardt D D, Van Dyke T E, Kowolik M J.

Study objectives and methods

The purpose of this study was to investigate the effect of titanium surface hydrophilicity on the response of human neutrophils by monitoring oxygen radical production, which was measured as chemiluminescence activity.

Neutrophils were isolated from human donors' blood buffy coats using the double sucrose gradient method. Neutrophils were exposed to both hydrophilic and hydrophobic titanium surfaces with identical topographies in the presence and absence of human serum.

This resulted in six experimental groups including two different implant surfaces, with and without exposure to human serum, and two control groups including an active control with cells alone and a passive control with no cells. Two samples from each group were fixed and analyzed by SEM. Comparisons between surface treatments for differences in chemiluminescence values were performed using analysis of variance ANOVA

Results

- In the absence of exposure to serum, there was no significant difference noted between the reaction of neutrophils to hydrophilic and hydrophobic surfaces.
- However, there was a significant reduction in the mean and active chemiluminescence activity of neutrophils to serum-coated hydrophilic titanium surfaces than to serum-coated hydrophobic titanium surfaces.

Conclusions

This suggests that surface hydrophilicity promotes enhanced adsorption of serum proteins, which leads to decreased provocation of initial immune cells and reduction of local oxygen radical production during wound healing. This can help explain the faster osseointegration demonstrated by hydrophilic titanium implants.

Adapted from El Kholy K et al., *Materials (Basel)*2020 Aug 3;13(15):3421, for more info about this publication click [HERE](#)

Clin Oral Investig. 2020 Aug 1.

Effect of enamel matrix derivative liquid combined with synthetic bone substitute on bone regeneration in a rabbit calvarial model

J Jung, J S Park, M Dard, B.Al-Nawas, Y-D Kwon

Study objectives and methods

This study aimed to verify the effectiveness of EMD-liquid in combination with a synthetic bone substitute in a rabbit calvarial model.

Four 7-mm outer diameter circular slits were created in the calvaria of 10 New Zealand white rabbits, and polycarbonate cylinders were inserted into the slits.

Two experimental groups were established:

- (1) EMD-liquid + bone substitute (Osteon III®; biphasic calcium phosphate (BCP), β -TCP/HA = 40:60) and
- (2) saline + bone substitute (Osteon III®; BCP).

The cylinders were filled with saturated graft materials and covered with polycarbonate caps. Micro-CT and histomorphometric evaluation were conducted.

Results

- In the histomorphometric analysis, new bone formation was significantly higher in the bone substitute (BS) + EMD-liquid group than in the BS only group at both 5 and 10 weeks ($p < 0.01$).
- There were statistically significant differences in the material area between the bone substitute and bone substitute + EMD-liquid groups at only 5 weeks ($p < 0.05$). The BS + EMD-liquid group demonstrated reduced material area to a greater extent.
- In micro-CT analysis, the BS + EMD-liquid group (27.04 ± 8.06 at 5 weeks, 28.49 ± 9.22 at 10 weeks) showed a significantly higher percentage of mineralized tissue volume at both 5 and 10 weeks ($p < 0.05$) than the BS only group.

Conclusions

EMD-liquid enhances new bone formation when combined with BCP bone substitute in an animal model. Moreover, the EMD-liquid + BS has significantly lesser material area than BS alone, indicating accelerated graft degradation.

Further studies on types of graft materials are required to verify the effect of EMD-liquid and to optimize its regenerative potential

Adapted from Jung J et al., Clin Oral Investig. 2020 Aug 1., for more info about this publication click [HERE](#)

J Prosthet Dent. 2020 Jul 28

Mandibular implant-supported fixed complete dental prostheses on implants with ultrashort and standard length: A pilot treatment

M Schimmel, S F M Janner, T Joda, J G Wittneben, G McKenna, U Brägger

Study objectives and methods

Edentulous patients may be restored with complete-arch implant-supported fixed complete dental prostheses (IFCDPs) on angled distal implants or on parallel implants distributed equally across the mandible to increase the area of support.

A treatment is presented to introduce the clinical concept of providing edentulous patients with an implant-supported fixed complete dental prosthesis on parallel tissue-level implants in the mandible with standard length implants interforaminally and ultrashort implants distally.

A structured prosthetic approach was used for the tooth arrangement with a modified workflow as per the Bifunctional Prosthetic System adapted for static computer-aided implant surgery (s-CAIS) and computer-aided design and computer-aided manufacturing (CAD-CAM) of the screw-retained implant-supported fixed complete dental prosthesis.

Conclusions

The concept offered advantages in challenging anatomic, surgical, and prosthetic conditions; providing distal nonangled abutments and implant platforms, which were straightforward to clean. If necessary, the prosthesis could have been easily converted into a removable overdenture using the existing digital prosthetic arrangement. Should implant removal be required, the extra short implants can be removed with minimal surgical risk or morbidity.

Adapted from Schimmel M et al., J Prosthet Dent. 2020 Jul 28, for more info about this publication click [HERE](#)

J Clin Periodontol 2020 Jul;47 Suppl 22:320-351

Regenerative surgery versus access flap for the treatment of intra-bony periodontal defects: A systematic review and meta-analysis

L Nibali, V P Koidou, M Nieri, L Barbato, U Pagliaro, F Cairo

Study objectives and methods

The aim of this systematic review was to compare clinical, radiographic and patient-reported outcomes (PROMs) in intra-bony defects treated with regenerative surgery or access flap.

A systematic review protocol was written following the PRISMA checklist. Electronic and hand searches were performed to identify randomized clinical trials (RCTs) on regenerative treatment of deep intra-bony defects (≥ 3 mm) with a follow-up of at least 12 months. Primary outcome variables were probing pocket depth (PPD) reduction, clinical attachment level (CAL) gain and tooth loss. Secondary outcome variables were Rec, radiographic bone gain, pocket "closure," PROMs and adverse events. Meta-analysis was carried out when possible. To evaluate treatment effect, odds ratios were combined for dichotomous data and mean differences for continuous data using a random-effect model.

Results

- A total of 79 RCTs (88 articles) published from 1990 to 2019 and accounting for 3,042 patients and 3,612 intra-bony defects were included in this systematic review.
- Only 10 of included studies were rated at low risk of bias. A total of 13 meta-analyses were performed.
- All regenerative procedures provided adjunctive benefit in terms of CAL gain (1.34 mm; 0.95-1.73) compared with open flap debridement alone.
- Both enamel matrix derivative (EMD) and guided tissue regeneration (GTR) were superior to OFD alone in improving CAL (1.27 mm; 0.79-1.74 mm and 1.43 mm; 0.76-2.22, respectively), although with moderate-high heterogeneity.
- Among biomaterials, the addition of deproteinized bovine bone mineral (DBBM) improved the clinical outcomes of both GTR with resorbable barriers and EMD. Papillary preservation flaps enhanced the clinical outcomes. The strength of evidence was low to moderate.

Conclusions

EMD or GTR in combination with papillary preservation flaps should be considered the treatment of choice for residual pockets with deep (≥ 3 mm) intra-bony defects.

Adapted from Nibali. L et al., J Clin Periodontol 2020 Jul;47 Suppl 22:320-351, for more info about this publication click [HERE](#)

J Periodontol. 2020 Aug 27

Decontamination of rough implant surfaces colonized by multispecies oral biofilm by application of leukocyte-platelet rich fibrin

L Schuldt, J Bi, G Owen, Y Shen, M Haapasalo, L Häkkinen, H Larjava.

Study objectives and methods

The objectives were to evaluate the bone loss (BL) around narrow diameter implants (3.3 mm) 2 years after implant loading. Decontamination of biofilm-infected rough implant surfaces is challenging. Platelet rich blood products have been shown to have anti-microbial properties against periodontal pathogens. Our aim was to investigate the effect of a potential biological implant surface disinfectant, leukocyte-platelet rich fibrin (L-PRF), on a mature oral multispecies biofilm on a rough titanium surface.

SLA titanium disks were inoculated with subgingival dental plaque and cultured anaerobically for 21 days. The L-PRF membranes were collected from 12 donors in three trials (four donors in each trial). The disks were rinsed with 0.9% NaCl and exposed to the cell-rich portion of the L-PRF membranes for 48 hours followed by scanning electron microscope (SEM) analysis immediately or after rinsing with 0.9% NaCl prior to fixation. The presence of platelet factor-4 in the rinse samples was analyzed by Western blotting. Remaining bacteria were quantified from SEM images of the implant surfaces and their numbers statistically compared.

Results

- The L-PRF-treated samples without rinsing displayed numerous cells with multiple pseudopodia in immediate contact with bacteria that appeared perforated and increased in size.
- The cells were identified as platelets based on morphological criteria and by positive reaction for platelet factor-4 by Western blotting. After post-treatment rinsing, the L-PRF-treated disks displayed a significant reduction in bacterial counts (in average 92% reduction)

Conclusion

Application of L-PRF significantly reduced bacterial counts on contaminated SLA titanium surface, most likely through anti-microbial action by platelets.

Adapted from Schuldt L et al., J Periodontol. 2020 Aug 27, for more info about this publication click [HERE](#)

J Oral Implantol 2020 Aug 31

Evaluation of resorption and osseointegration of autogenous bone ring grafting in vertical bone defect with simultaneous implant placement in dogs

K Yu, W Liu, N Su, H Chen, H Wang, Z Tan

Study objectives and methods

The aim of this research was to evaluate the resorption and osseointegration of an autogenous bone ring, which was grafted in a local vertical alveolar defect with simultaneous implant placement.

Six Beagle dogs were enrolled in the study; their four nonadjacent mandibular premolars were extracted, and the buccal plate was removed to create bone defects in two of the four sites. Three months after extraction, Straumann implants (\varnothing 3.3 mm, length of 8 mm) were placed in the bone defect sites with simultaneous autogenous bone ring grafting and in the conventional extraction sites. After a 3-month healing period and a 3-month loading period, the animals were euthanized. The harvested samples were analyzed using micro-CT scanning and histological analysis.

Results

- From the micro-CT measurements, the average vertical bone resorption of the bone ring was 0.23 ± 0.03 mm, which was not significantly different from that around the conventional implant, 0.24 ± 0.12 mm ($P > 0.05$).
- The ratio of the bone volume to the total volume of the bone ring group was 91.11 ± 0.02 , which was higher than that of the control group, 88.38 ± 2.34 ($P < 0.05$).
- From the hard tissue section, the bone rings developed fine osseointegration with the implants and the base alveolar bone.

Conclusions

The results suggest autogenous bone ring grafting with simultaneous implant placement can survive in a local vertical bone defect with little bone resorption and good osseointegration in dogs with strict management.

Adapted from Yu K et al., J Oral Implantol 2020 Aug 31, for more info about this publication click [HERE](#)

J Oral Implantol. 2020 Jul 14

The Relationship Between Serum Level of Vitamin D3 and Osseointegration Around the Dental Implant

S Pourshahidi, M Yousefian

Abstract

At present, dental implants are used more than before, and their high success rate is attributed to sufficient osseointegration, which, per se, depends on prosthetic, implant, and patient-related factors. The quality and quantity of bone and the host response are the main patient-related factors. Vitamin D3 affects the bone metabolism by stimulating both osteoclasts and osteoblasts.

This study aimed to review the human studies on the efficacy of vitamin D3 for dental implant osseointegration. Search of the literature yielded only four studies on human models; out of which, two showed the optimal efficacy of vitamin D3 for dental implant osseointegration while the remaining two did not report any positive effect. However, this finding may be related to the small sample size of vitamin D3-deficient group, which can compromise statistical analyses.

Conclusions

In conclusion, vitamin D3 seems to be effective for dental implant osseointegration, although further research is required on human models.

Adapted from Pourshahidi S et al., J Oral Implantol. 2020 Jul 14 for more info about this publication click [HERE](#)

Int J Oral Maxillofac Implants. Jul/Aug 2020;35(4):707-720

Zirconia Implants and Marginal Bone Loss: A Systematic Review and Meta-Analysis of Clinical Studies

H Borges, A Ricardo, M Correia, R M Castilho, G V O Fernandes

Study objectives and methods

The purpose of this study was to provide sufficient information on the clinical outcome of zirconia implants, mainly observing the survival rate and marginal bone loss (MBL), with a minimum follow-up of 12 months, to verify the adoption of ceramics as a rational possibility for dental implants.

A systematic electronic search through the PubMed (MEDLINE) and EMBASE databases was performed by two independent reviewers to identify clinical studies published between January 2005 and April 2019 containing a minimum of 10 patients per study and 12 months of follow-up after functional loading. References from the selected articles were manually reviewed for further studies

Results

- From the initial 1,225 articles retrieved, 19 met all the inclusion criteria. The marginal bone remodeling accounted for mean losses of 0.8 mm (95% CI: 0.60 to 1.00 mm) and 1.01 mm (95% CI: 0.72 to 1.29 mm) at 1 year and 2 years post loading, respectively.
- The failure rate of 6.8% was calculated for a mean follow-up period of 2.75 years, where the prevalence of early failure, late failure, and implant fracture was 3.4%, 1.7%, and 1.7%, respectively.
- The meta-analysis associated with the survival rate of one- and two-piece zirconia dental implants was hindered due to the lack of confidence interval or standard deviation information in most of the included articles.

Conclusions

Zirconia implants presented MBL values consistent with the standard in the global consensus, high survival rates, and considerable clinical results at short-term observation periods following prosthetic delivery.

Adapted from Borges H et al., Int J Oral Maxillofac Implants. Jul/Aug 2020;35(4):707-720, for more info about this publication click [HERE](#)

References

El Kholy K et al., Materials (Basel)2020 Aug 3;13(15):3421| Jung J et al., Clin Oral Investig. 2020 Aug 1| Schimmel M et al., J Prosthet Dent. 2020 Jul 28| Nibali. L et al., J Clin Periodontol 2020 Jul;47 Suppl 22:320-351| L Schuldt et al., J Periodontol. 2020 Aug 27| Yu K et al., J Oral Implantol 2020 Aug 31| Pourshahidi S et al., J Oral Implantol. 2020 Jul 14 | Borges H et al., Int J Oral Maxillofac Implants. Jul/Aug 2020;35(4):707-720| source: www.pubmed.gov | Dr Nair holds a position of Global Scientific Communications Manager at Institute Straumann in Basel, Switzerland.