



SCIENTIFIC **HIGHLIGHTS**

Short overviews on recently
published scientific evidence.

Issue **1/2024**

Edited by Dr. Marcin Maj

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EDITOR'S CHOICE

Small-diameter titanium grade IV and titanium-zirconium implants in edentulous mandibles: Ten-year results from a double-blind, randomised controlled split-mouth core-trial

(Frauke Müller et al. 2023)

and

Assessing the osseointegration potential of a strontium releasing nanostructured titanium oxide surface: A biomechanical study in the rabbit tibia plateau model.

(Sıla Çağrı İster et al., 2023)

Is transmucosal healing of an implant as effective as submerged healing when simultaneous guided bone regeneration is performed? A preclinical study

(Jin-Young Park et al., 2023)

EDITOR'S CHOICE

Clin Oral Implants Res. 2023 Nov 9

Small-diameter titanium grade IV and titanium-zirconium implants in edentulous mandibles: Ten-year results from a double-blind, randomised controlled split-mouth core-trial

Frauke Müller, Bilal Al-Nawas, Stefano Storelli, Marc Quirynen, Stefan Hicklin, Jose Castro-Laza, Mario Bassetti, Murali Srinivasan, Roxolid Study Group

STUDY OBJECTIVES

The purpose of this study was to compare the 10-year outcome of 3.3 mm diameter titanium-zirconium (TiZr) or grade IV titanium (Ti) implants in mandibular implant-overdentures. Patients with edentulous mandibles had received two implants in the interforaminal region (bone-level, diameter 3.3 mm, microrough surface), one of TiZr (test) and one of Ti (control). Implant survival and success, plaque and sulcus bleeding indices, probing pocket depth, gingival margin, clinical attachment level and radiographic crestal bone levels were evaluated.

RESULTS

- Fifty of 91 patients with implants were available for the 10-year examination and 36 patients were valid for the intent-to-treat (ITT) analysis.
- The implant success rate was calculated as 94.6% and 91.9% for the TiZr implants and the Ti implants respectively.
- Four implants were lost (TiZr = 1; Ti = 3) in the entire study period. Kaplan-Meier survival analyses estimated 10-year implant survival rate for TiZr to 98.9% and Ti 95.8%.
- The mean of total and functional crestal bone loss was 1.49 mm (± 1.37 mm) and 0.82 mm (± 1.09 mm) in the TiZr group and 1.56 mm (± 1.34 mm) and 0.85 mm (± 1.16 mm) in the Ti group.

CONCLUSIONS

This split-mouth design RCT on mandibular implant-overdentures evidenced, bearing in mind its follow-up time-related reduced cohort size, high 10-year implant success- and survival rates. These results confirm TiZr as well-suited implant material for realising small-diameter implants.

Adapted from F. Müller et al., Clin Oral Implants Res. 2023 Nov 9, for more info about this publication click [HERE](#)

Clin Exp Dent Res. 2023 Dec 3

Assessing the osseointegration potential of a strontium releasing nanostructured titanium oxide surface: A biomechanical study in the rabbit tibia plateau model

Sila Cagri Isler, Benjamin Bello, Morten Fos, Benjamin Pippenger, Andreas Stavropoulos 1 6 7, Ole Zoffmann Andersen

STUDY OBJECTIVES AND METHODS

The purpose of this study was investigate the impact of a Ti-Sr-O technology, applied to either a turned surface or an SLA surface, on the mechanical robustness of osseointegration, benchmarked against the SLActive surface. Ti discs (6.25-mm-diameter and 2-mm-thick) with three different surfaces were inserted on the proximal-anterior part of the tibial plateau of adult Swedish loop rabbits: (I) turned surface modified with Ti-Sr-O (turned + Ti-Sr-O), (II) SLA surface modified with Ti-Sr-O (SLA + Ti-Sr-O), and (III) SLActive surface (SLActive). Following a healing period of 2 weeks and 4 weeks, the pull-out (PO) force needed to detach the discs from the bone was assessed, as a surrogate of osseointegration.

RESULTS

- The SLActive surface exhibited statistically significant higher median PO forces, compared with the SLA + Ti-Sr-O surfaces at both 2- and 4 weeks post-op ($p > .05$).
- In this study, no single turned + Ti-Sr-O surface disk was integrated.

CONCLUSIONS

The tested Ti-Sr-O technology failed to enhance osseointegration; however, this finding may be related to the inappropriateness of the rabbit tibia plateau model for assessing third-generation implant surface technologies, due to the limited diffusion and clearance at the disk-bone interface.

Adapted from S Cagri Isler et al., Clin Exp Dent Res. 2023 Dec 3, for more info about this publication, click [HERE](#)

J Clin Periodontol. 2023 Dec 12.

Is transmucosal healing of an implant as effective as submerged healing when simultaneous guided bone regeneration is performed? A preclinical study

Jin-Young Park, Yoon-Hee Kwon, Young Woo Song, Jae-Kook Cha, Ui-Won Jung, Daniel Thoma, Ronald Jung

STUDY OBJECTIVES AND METHODS

The purpose of this study was to investigate whether transmucosal healing is as effective as submerged healing in terms of buccal bone regeneration when guided bone regeneration (GBR) is performed simultaneously with implant placement. In six dogs, buccal dehiscence defects were created in the edentulous mandibular ridge, sized 5 × 5 × 3 mm (length × height × depth). In each defect, a bone-level implant was placed, and four experimental groups were randomly assigned as follows: (i) transmucosal healing with GBR (T-GBR), (ii) transmucosal healing without GBR (T-control), (iii) submerged healing with GBR (S-GBR) and (iv) submerged healing without GBR (S-control). Data analyses were based on histological slides 5 months after implant placement.

RESULTS

- The T-GBR group showed significant differences compared to the control groups regarding defect height resolution, buccal bone thickness and mineralized tissue area ($p < .05$), but showed no significant differences when compared with the S-GBR group ($p > .05$).

CONCLUSIONS

The mode of healing (transmucosal vs. submerged) does not influence bone regeneration at implant sites. The clinician may therefore choose the approach based on further clinical and patient-specific parameters.

Adapted from JY. Park et al., J Clin Periodontol. 2023 Dec 12., for more info about this publication click [HERE](#)

Clin Oral Investig. 2023 Dec 23;28(1):15

Clinical outcomes of zirconia implants: a systematic review and meta-analysis

Parvin Mohseni, Ahmad Soufi, Bruno Ramos Chrcanovic



STUDY OBJECTIVES AND METHODS

The purpose of this study was to assess the clinical outcomes of zirconia dental implants based on an updated systematic literature review. An electronic search was performed in three databases, last updated in June 2023, supplemented by hand searching. The eligibility criteria were clinical studies reporting patients rehabilitated with zirconia implants. The cumulative survival rate (CSR) of implants was calculated. A meta-analysis for marginal bone loss (MBL) under different follow-up times and a meta-regression assessing the relationship between mean MBL and follow-up were done.

RESULTS

- Twenty-five studies were included (4017 implants, 2083 patients).
- Seven studies had follow-up longer than 60 months.
- 172 implants failed, after a mean of 12.0 ± 16.1 months (min-max 0.3-86.0), of which 47 early failures, and 26 due to implant fracture, the majority in narrow-diameter implants.
- The 10-year CSR was 95.1%. Implants with coronal part prepared by drills presented statistically significant lower survival than non-prepared implants ($p < 0.001$).
- Two-piece implants presented lower survival than one-piece implants ($p = 0.017$).
- Implants discontinued from the market presented lower survival than the commercially available ones ($p < 0.001$). The difference in survival was not significant between implants in maxilla and mandible ($p = 0.637$).
- The mean MBL fluctuated between 0.632 and 2.060 mm over long periods of observation (up until 132 months). There was an estimated MBL increase of 0.005 mm per additional month of follow-up.

CONCLUSIONS

Zirconia implants present high 10-year CSR and short-term low MBL.

Adapted from P. Mohseni et al., Clin Oral Investig. 2023 Dec 23;28(1):15, for more info about this publication click [HERE](#)

Clin Oral Implants Res. 2023 Nov 23

Computer-assisted and robotic implant surgery: Assessing the outcome measures of accuracy and educational implications

Atiphan Pimkhaokham, James Chow, Alessandro Pozzi, Sirida Arunjaroenusuk, Keskanya Subbalehka, Nikos Mattheos

STUDY OBJECTIVES AND METHODS

This scoping review aimed to (1) critically evaluate the outcomes measures used to assess the accuracy of implant placement with Computer Assisted Implant Surgery (CAIS) and (2) review the evidence supporting the efficient implementation of CAIS in training and education of clinicians. A scoping literature review was conducted aiming to identify (a) clinical trials assessing accuracy of implant placement with CAIS, and (b) clinical trials or simulation/cadaver studies where CAIS was utilised and assessed for the training/education of clinicians. Studies since 1995 were assessed for suitability and data related to the outcomes measures of accuracy and educational efficacy were extracted and synthesised.

RESULTS

- Accuracy of CAIS has been mainly assessed through surrogate measures. Individual clinical trials have not shown any difference between static and dynamic CAIS, but recent meta-analyses suggest an advantage of dynamic CAIS in reducing angular deviation.
- The combination of static and dynamic CAIS might offer higher accuracy than each of the two used alone.
- Dynamic CAIS is suitable for novice surgeons and might even have added value as an education tool for implant surgery, although mastering the technique requires longer training than static.

CONCLUSIONS

Meta-analyses of large samples, new and diverse outcomes measures, as well as benchmarking of levels of accuracy with specific clinical outcomes will help to better understand the potential and limitations of CAIS. Dynamic CAIS is suitable for novice operators, but educational interventions distributed over longer periods of time will be required for mastery of the process.

Adapted from A. Pimkhaokham et al., *Clin Oral Implants Res.* 2023 Nov 23, for more info about this publication, click [HERE](#)

Int Dent J. 2023 Dec 7

Oral Fluid Biomarkers for Peri-Implantitis: A Scoping Review

Supanat Lumbikananda, Supreda Suphanantachat Srithanyarat, Nikos Mattheos, Thanaphum Osathanon



STUDY OBJECTIVES AND METHODS

This scoping review aims to explore current studies in the literature on salivary and PISF biomarkers for peri-implantitis. A systematic search was conducted on 2 databases (PubMed and Scopus) to identify relevant studies published up to January 2023.

RESULTS

- Several biomarkers have been investigated in salivary and PISF samples for association with peri-implantitis. Investigations included a wide range of biomarkers, including inflammatory markers, matrix metalloproteinases and bone loss markers.
- The findings suggested that certain salivary and PISF biomarkers demonstrated potential in distinguishing healthy peri-implant conditions from peri-implantitis.
- Elevated levels of proinflammatory cytokines, such as interleukin-1 β (IL-1 β) and interleukin-6 (IL-6), tumour necrosis factor-alpha (TNF- α), and matrix metalloproteinases, have been consistently associated with peri-implantitis.
- Additionally, alterations in bone loss markers have shown potential as indicators of disease progression and treatment response. In conclusion, this scoping review provides an overview of current knowledge on salivary and PISF biomarkers for peri-implantitis.

CONCLUSIONS

The identified biomarkers are promising as noninvasive diagnostic tools for early detection, monitoring, and personalised management of peri-implantitis. Future studies should focus on establishing standardised protocols and conducting well-designed clinical trials to validate the diagnostic accuracy and clinical relevance of these biomarkers.

Adapted from S. Lumbikananda et al., Int Dent J. 2023 Dec 7, for more info about this publication, click [HERE](#)

Int Orthod. 2023 Jun;21(2):100748

Wear and fatigue resistance: An in-vitro comparison of three polyethylene terephthalate glycol and thermoplastic polyurethane materials for vacuum-formed retainers

Thorsten Grünheid, Timothy F Bitner



STUDY OBJECTIVES AND METHODS

The purpose of this study was to test the wear and fatigue resistance of three materials (Essix ACE[®], Taglus[®], and Zendura A[®]) for the fabrication of vacuum-formed retainers in an artificial oral environment. Wear resistance was tested by subjecting 21 retainers of each Essix ACE[®], Taglus[®], and Zendura A[®] to 12,000 wear cycles at 75 N to simulate one year of retainer wear with moderate nighttime bruxing. Post-wear retainer thickness was compared to baseline measurements to calculate wear depth. Fatigue resistance was tested by flexing 15 retainers of each material at an angle of 25 degrees for 1,825 cycles to simulate one year of removing and reinserting a retainer five times per day. Retainers were visually inspected for fractures.

RESULTS

- The mean wear depths were 0.155 ± 0.021 mm, 0.168 ± 0.031 mm, and 0.096 ± 0.033 mm for Essix ACE[®], Taglus[®], and Zendura A[®], respectively.
- The wear depth of Zendura A[®] was significantly lower than that of both Essix ACE[®] ($P < 0.001$) and Taglus[®] ($P < 0.001$).
- There was no significant difference in wear depth between Essix ACE[®] and Taglus[®] ($P = 0.312$).
- Under the parameters set for the fatigue resistance test, fractures did not occur on any of the tested materials.

CONCLUSIONS

Under the assumption of moderate nighttime bruxing for one year, Zendura A[®] is the most wear-resistant among the materials tested. With the assumption of retainer removal and reinsertion five times per day for one year, all three materials tested have the same ability to resist fatigue.

Adapted from T. Grünheid et al., Int Orthod. 2023 Jun;21(2):100748, for more info about this publication, click [HERE](#)

REFERENCES

F. Müller et al., Clin Oral Implants Res. 2023 Nov | S Cagri Isler et al., Clin Exp Dent Res. 2023 Dec 3 | JY. Park et al., J Clin Periodontol. 2023 Dec 12 | P. Mohseni et al., Clin Oral Investig. 2023 Dec 23;28(1):15 | A. Pimkhaokham et al., Clin Oral Implants Res. 2023 Nov 23 | S. Lumbikananda et al., Int Dent J. 2023 Dec 7 | T. Grünheid et al., Int Orthod. 2023 Jun;21(2):100748 | source: www.pubmed.gov | Dr. Marcin Maj holds the position of Head of Global Scientific Affairs at Institute Straumann in Basel, Switzerland