



# Scientific Highlights

SHORT OVERVIEWS ON RECENTLY PUBLISHED SCIENTIFIC EVIDENCE.

May – June 2019

*Edited by Dr Marcin Maj*

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<b>IN THIS ISSUE</b>	<b>3</b>
<b>EDITOR'S CHOICE</b>	<b>4</b>
1. Esthetic, clinical, and radiographic outcomes of two surgical approaches for single implant in the esthetic area: 1-year results of a randomized controlled trial with parallel design.	4
<b>HIGHLIGHTS</b>	<b>5</b>
2. Biological factors involved in alveolar bone regeneration: Consensus report of Working Group 1 of the 15th European Workshop on Periodontology on Bone Regeneration.	5
3. Influence of the fixed implant-supported provisional phase on the esthetic final outcome of implant-supported crowns: 3-year results of a randomized controlled clinical trial.	6
4. Management of the extraction socket and timing of implant placement: Consensus report and clinical recommendations of group 3 of the XV European Workshop in Periodontology.	7
5. Morphology and severity of peri-implantitis bone defects.	8
6. Alveolar ridge preservation in the posterior maxilla reduces vertical dimensional change: A randomized controlled clinical trial.	9
7. Efficacy of lateral bone augmentation prior to implant placement: A systematic review and meta-analysis.	10
8. Efficacy of lateral bone augmentation performed simultaneously with dental implant placement: A systematic review and meta-analysis.	11
9. Self-regenerative capacity of intra-oral bone defects.	12
10. The Effects of Systemic Diseases and Medications on Implant Osseointegration: A Systematic Review.	13
11. Augmented and virtual reality in dental medicine: A systematic review.	14
<b>REFERENCES</b>	<b>14</b>

## in this issue



Immediate and early implant placement comparable from both clinical and patient perspective.

*(Huynh-Ba. et al. 2019).*

Intra-oral bone defects possess a high self-regenerative capacity.

*(Sculean A. et al. 2019)*

AR/VR-technology to deliver predictable and safe therapy outcomes in implant dentistry.

*(Joda T. et al 2019).*

## Editor's choice

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Clin Oral Implants Res. 2019 May 17

### Esthetic, clinical, and radiographic outcomes of two surgical approaches for single implant in the esthetic area: 1-year results of a randomized controlled trial with parallel design.

Huynh-Ba G, Hoders AB, Meister DJ, Prihoda TJ, Mills MP, Mealey BL, Cochran DL

#### Study objectives

The aim of this study was to compare (a) esthetic, (b) clinical, (c) radiographic, and (d) patient-centered outcomes following immediate (Type 1) and early implant placement (Type 2). Forty-six subjects needing a single extraction (premolar to premolar) were randomly allocated to Type 1 or Type 2 implant placement.

#### Results

- Thirty-five patients completed the one-year examination (Type 1, n = 20; Type 2, n = 15).
- Type 1 implants lost  $1.03 \pm 0.24$  mm (mean  $\pm$  SE) of mid-facial soft tissue height while Type 2 implants lost  $1.37 \pm 0.28$  mm ( $p = 0.17$ ).
- The papillae height on the mesial and distal was reduced about 1 mm following both procedures.
- Frequency of clinical acceptability as defined by PES  $\geq 6$  (Type 1: 55% vs. Type 2 40%), WES  $\geq 6$  (Type 1: 45% vs. Type 2 27%) was not significantly different between groups ( $p > 0.05$ ).
- Clinical and radiographic were indicative of peri-implant health.
- Patient-centered outcomes failed to demonstrate significant differences between the two cohorts.

#### Conclusions

- One year after final restoration, there were no significant differences in esthetic, clinical, radiographic, and patient-centered outcomes following Type 1 and Type 2 implant placement.
- At one year, patient satisfaction may be achieved irrespective of the two placement protocols

Adapted from Huynh-Ba et al., Clin Oral Implants Res. 2019 May 17., for more info about this publication click [HERE](#)

J Clin Periodontol. 2019 Jun;46 Suppl 21:6-11

## Biological factors involved in alveolar bone regeneration: Consensus report of Working Group 1 of the 15th European Workshop on Periodontology on Bone Regeneration.

Giannobile WV, Berglundh T, Al-Nawas B, Araujo M, Bartold PM, Bouchard P, Chapple I, Gruber R, Lundberg P, Sculean A, Lang NP, Lyngstadaas P, Kebschull M, Galindo-Moreno P, Schwartz Z, Shapira L, Stavropoulos A, Reseland J

### Study objectives

The aim of this study was to describe the biology of alveolar bone regeneration. Four comprehensive reviews were performed on (a) mesenchymal cells and differentiation factors leading to bone formation; (b) the critical interplay between bone resorbing and formative cells; (c) the role of osteoimmunology in the formation and maintenance of alveolar bone; and (d) the self-regenerative capacity following bone injury or tooth extraction were prepared prior to the workshop.

### Results

- This summary information adds to the fuller understanding of the alveolar bone regenerative response with implications to reconstructive procedures for patient oral rehabilitation.
- The group collectively formulated and addressed critical questions based on each of the reviews in this consensus report to advance the field.

### Conclusions

- The report concludes with identified areas of future research

Adapted from Giannobile WV et al., J Clin Periodontol. 2019 Jun;46 Suppl 21:6-11., for more info about this publication click [HERE](#)

Clin Implant Dent Relat Res. 2019 Jun 7

## Influence of the fixed implant-supported provisional phase on the esthetic final outcome of implant-supported crowns: 3-year results of a randomized controlled clinical trial.

Furze D, Byrne A, Alam S, Brägger U, Wismeijer D, Wittneben JG

### Study objectives

The aim of this study was to evaluate whether the use of a provisional implant-supported crown improves the final esthetic outcome of implant crowns that are placed within esthetic sites. Twenty endosseous implants were inserted in sites 13 to 23 (FDI) in 20 patients. Following the reopening procedure, a randomization process assigned them to either cohort group 1: a provisional phase with soft tissue conditioning using the "dynamic compression technique" or cohort group 2: without a provisional phase.

### Results

- After 3 years, all implants survived; one implant-supported crown was excluded from the study due to adjacent tooth failure replaced with a further implant supported crown.
- Modified pink esthetic score (ModPES) scores were significantly different between groups 1 and 2 ( $P = .018$ ); white esthetic scores (WES) were not statistically different between both groups ( $P = .194$ ).
- Mean values of combined modPES and WES were 15.6 for group 1, with a SD of 3.20. Group 2 had a mean combined modPES and WES of 12.2, with a SD of 3.86.
- Mean bone loss after 3 year was -0.05 and -0.04 mm for groups 1 and 2 respectively, without being statistically significant.

### Conclusions

- Fixed implant-supported provisionals improve the final esthetic outcome of the peri-implant mucosa

Adapted from Furze D et al., *Clin Implant Dent Relat Res.* 2019 Jun 7, for more info about this publication click [HERE](#)

J Clin Periodontol. 2019 Jun;46 Suppl 21:183-194

## Management of the extraction socket and timing of implant placement: Consensus report and clinical recommendations of group 3 of the XV European Workshop in Periodontology.

Tonetti MS, Jung RE, Avila-Ortiz G, Blanco J, Cosyn J, Fickl S, Figuero E, Goldstein M, Graziani F, Madianos P, Molina A, Nart J, Salvi GE, Sanz-Martin I, Thoma D, Van Assche N, Vignoletti F

### Study objectives

This workshop focused on the formulation of evidence-based consensus statements and clinical recommendations. Four systematic reviews covering the areas of alveolar ridge preservation/bone grafting, immediate early and delayed implant placement and alveolar bone augmentation at the time of implant placement in a healed ridge formed the basis of the deliberations. The level of evidence supporting each consensus statement and its strength was described using a modification of the GRADE tool.

### Results

- The evidence base for each of the relevant topics was assessed and summarized in 23 consensus statements and 12 specific clinical recommendations.
- The group emphasized that the evidence base mostly relates to single tooth extraction/replacement; hence, external validity/applicability to multiple extractions requires careful consideration.
- The group identified six considerations that should assist clinicians in clinical decision-making: presence of infection, inability to achieve primary stability in the restoratively driven position, presence of a damaged alveolus, periodontal phenotype, aesthetic demands and systemic conditions.

### Conclusions

- A substantial and expanding evidence base is available to assist clinicians with clinical decision-making related to the transition from a tooth requiring extraction to its replacement with a dental implant.
- More high-quality research is needed for the development of evidence-based clinical guidelines.

Adapted from Tonetti MS et al., J Clin Periodontol. 2019 Jun;46 Suppl 21:183-194, for more info about this publication click [HERE](#)

Clin Implant Dent Relat Res. 2019 May 14

## Morphology and severity of peri-implantitis bone defects.

Monje A, Pons R, Insua A, Nart J, Wang HL, Schwarz F

### Study objectives

The aim of this study was to assess the morphology and severity of peri-implantitis bone defects and to insight on the patient-, implant- and site-related variables associated to these. A cone-beam computed tomography study was carried out to classify peri-implantitis defects according to the type of defect, number of remaining bony walls and severity according to the extension of vertical bone loss. Three major defect categories were proposed: class I-infraosseous; class II-horizontal; class III-combined of class I and II. These were then subclassified into: (a) dehiscence; (b) 2/3-wall; and (c) circumferential-type defect. According to the severity the defects were further subclassified into: A: advanced; M: moderate; and S: slight. In addition, 20 site-, implant-, and patient-related variables were analyzed by generalized estimating equations (GEEs) of multilevel logistic regression models.

### Results

- Based on an a priori power calculation, 332 implants were screened in 47 peri-implantitis patients. Of these, 158 peri-implantitis implants were eligible.
- The most prevalent defect morphology type was class Ib (55%) followed by class Ia (16.5%), and class IIIb (13.9%).
- On the contrary, the less frequent defect was class II (1.9%).
- The most frequent degree of severity was M (50.6%) with S (10.1%) being the least prevalent.
- Buccal bone loss was significantly greater compared to the other bony walls in class I and class III defects.
- Age was associated with the type of defect. Age and smoking habit were associated with the morphology of the defects, while smoking habit, type of prosthesis and distance to adjacent implant were associated with the severity of the defects (vertical bone loss).

### Conclusions

- Peri-implantitis defects frequently course with an infraosseous component and often with buccal bone loss.
- Certain patient-, implant-, and site-specific variables are related with defect morphology and severity. However, morphological patterns for peri-implantitis bone defects could not be proven

Adapted from Monje A *et al.*, Clin Implant Dent Relat Res. 2019 May 14, for more info about this publication click [HERE](#)

Clin Oral Implants Res. 2019 Jun;30(6):515-523

## Alveolar ridge preservation in the posterior maxilla reduces vertical dimensional change: A randomized controlled clinical trial.

Cha JK, Song YW, Park SH, Jung RE, Jung UW, Thoma DS

### Study objectives

The aim of this study was to test whether or not alveolar ridge preservation reduces vertical changes in the posterior maxilla compared to spontaneous healing following tooth extraction. Forty subjects requiring extraction of maxillary posterior teeth with root apices protruding into the maxillary sinus floor were consecutively enrolled. Patients were randomly assigned to either one of two surgical interventions: an alveolar ridge preservation procedure using collagenated bovine bone mineral and a resorbable collagen membrane (test) or no grafting (control). Cone-beam computed tomographies were taken immediately and at 6 months after surgery, prior to dental implant placement.

### Results

- Based on radiographic data, the level of the sinus floor remained stable over time (baseline to 6 months) in the test group (-0.14 mm [-0.31, -0.02]).
- In the control group, the sinus floor level shifted more coronally (-1.16 mm [-1.73, -0.61]) than the test group ( $p < 0.05$ ).
- The test group demonstrated a significantly larger residual bone height than the control group at 6 months (7.30 mm [6.36, 8.20] vs. 4.83 mm [3.94, 5.76], respectively,  $p < 0.05$ ).
- Implant placement without any additional sinus augmentation procedure was performed in 42.9% of test group cases, whereas in all of the subjects in the control group an additional augmentation procedure was needed (100% of the cases).

### Conclusions

- Alveolar ridge preservation in the posterior maxilla maintained the vertical bone height more efficiently and resulted in less need for sinus augmentation procedures at 6 months compared to spontaneous healing.

Adapted from Cha JK *et al.*, Clin Oral Implants Res. 2019 Jun;30(6):515-523, for more info about this publication click [HERE](#)

J Clin Periodontol. 2019 Jun;46 Suppl 21:287-306

## Efficacy of lateral bone augmentation prior to implant placement: A systematic review and meta-analysis.

Naenni N, Lim H, Papageorgiou SN, Hämmerle CHF

### Study objectives

The aim of this study was to critically appraise evidence from randomized and prospective non-randomized comparative clinical trials about the efficacy of lateral bone augmentation prior to implant placement and their outcome regarding bone width gain.

### Results

- Overall, 25 trials (16 randomized/9 non-randomized) were identified, which included a total of 553 patients (42.2% male; mean age of 43.9 years). In these included studies and populations, various modalities for primary lateral bone augmentation rendered implant placement feasible. Small discrepancies were found between overall clinical and radiographic gain (pooled gains of  $3.45 \pm 1.18$  mm versus  $2.90 \pm 0.83$  mm, respectively), but were not statistically significant.
- Bone width gain was significantly inversely associated with baseline bone width (pooled effect:  $-0.35$  mm/mm; 95% CI:  $-0.63$  to  $-0.07$  mm;  $p = 0.01$ ). Additionally, % graft resorption was associated with patient age (36%/year, 95% CI:  $-0.62$  to  $-0.11$  mm;  $p = 0.01$ ).
- The presence of xenograft added to autologous graft led to less resorption compared to autologous graft alone (MD: 1.06 mm; 95% CI: 0.21 to 1.92 mm;  $p = 0.01$ ).
- Barrier membrane did not yield significant difference in terms of bone width gain (MD:  $-0.33$  mm; 95% CI:  $-2.24$  to 1.58 mm;  $p > 0.05$ ) and graft resorption (MD: 0.84 mm; 95% CI:  $-1.42$  to 3.09 mm;  $p > 0.05$ ). However, the quality of evidence ranged from very low to moderate due to bias and imprecision.

### Conclusions

- Initially smaller bone dimensions are associated with favours larger bone width gain, which indicates that a severe lateral bone deficiency can be effectively augmented applying primary lateral bone augmentation.
- Both Patients' age and recipient site (maxilla or mandible) seem to influence graft resorption. The addition of a xenograft can be helpful in reducing graft resorption.
- Existing evidence from randomized and prospective non-randomized trials on humans indicates that lateral bone augmentation prior to implant placement can successfully increase bone width.
- There are some indications that patient-related, site-related, and technique-related characteristics might influence the amount of gained bone width, but the quality of evidence is for the most part hampered by the small number of existing studies and methodological limitations that might lead to bias.

Adapted from Naenni N et al., J Clin Periodontol. 2019 Jun;46 Suppl 21:287-306, for more info about this publication click [HERE](#)

J Clin Periodontol. 2019 Jun;46 Suppl 21:257-276

## Efficacy of lateral bone augmentation performed simultaneously with dental implant placement: A systematic review and meta-analysis.

Thoma DS, Bienz SP, Figuero E, Jung RE, Sanz-Martín I

### Study objectives

The aim of this study was to analyse the evidence regarding the efficacy of lateral bone augmentation procedures in terms of defect resolution in cases of horizontal ridge deficiencies after implant placement. Included studies met the following inclusion criteria: randomized controlled trials (RCTs) or controlled clinical trials (CCTs), re-entry procedure to assess defect resolution, minimum of 10 patients (5 per group).

### Results

- Twenty-eight publications were included. The most often used type of intervention was a xenogeneic particulated grafting material (XE) and a resorbable collagen membrane (CM).
- The mean defect height at baseline amounted to 5.1 mm (range 2.4-7.8) and decreased to a mean of 0.9 mm (range 0.2-2.2) at re-entry, and the mean defect resolution was 81.3% (range 56.4%-97.1%).
- Defect height reduction was not significantly different using CM+XE as control treatment compared to the combined data of the respective test groups [ $n = 11$ ; weighted mean difference (WMD) = -0.006 mm; 95% CI, -0.61, 0.60;  $p = 0.985$ ].
- The absence of any lateral bone augmentation was less favourable than the conjunction of a membrane and a bone grafting material ( $n = 1$ ; MD = -1.96 mm; 95% CI, -3.48, -0.44;  $p = 0.011$ ).
- The lack of a grafting material was less favourable than the conjunction of grafting material and membrane ( $n = 1$ ; MD = -2.44 mm; 95% CI, -4.53, -0.35;  $p = 0.022$ ), and the addition of a membrane compared to a grafting material alone was more favourable ( $n = 3$ ; WMD = 0.97 mm; 95% CI, 0.31, 1.64;  $p = 0.004$ ).

### Conclusions

- Lateral bone augmentation is a successful treatment modality.
- For optimal defect height reduction, a barrier membrane and a grafting material should be combined

Adapted from Thoma DS et al., J Clin Periodontol. 2019 Jun;46 Suppl 21:257-276, for more info about this publication click [HERE](#)

J Clin Periodontol. 2019 Jun;46 Suppl 21:70-81

## Self-regenerative capacity of intra-oral bone defects.

Sculean A, Stavropoulos A, Bosshardt DD

### Study objectives

The aim of this study was to provide an overview on the self-regenerative capacity of various types of intra-oral bone defects. This paper has narratively reviewed the most important aspects of bone biology and the healing outcomes related to the self-regenerative capacity (i.e. without the placement of any biomaterial) of bone defects that occur following tooth extraction, autogenous graft harvesting, periapical lesions, cystic lesions of the jaws, third molar extraction and experimentally created ridge defects.

### Results

- In animals (i.e. dogs and monkeys), the greatest changes in horizontal and vertical dimension occur during the first 6 months following tooth extraction.
- In humans, bone remodelling may take from several months to years and exhibits marked inter-individual variability. Following tooth extraction at compromised sites (e.g. presence of severe bone loss at the time-point of extraction), the healing may occur slower and a substantial volume reduction can be expected than following tooth extraction at non-compromised sites.
- In the mandibular symphysis and ramus, the bone defects resulting following bone block harvesting are gradually healing to a large extent, but complete healing appears not to occur due to poorer space provision and wound stability capacities.
- Defects after peri-apical surgery display a substantial self-regenerative capacity and heal at a great extent without the use of any adjunct measures.
- The vast majority of jawbone defects after cystectomy heal at a great extent and without apparent influence in the shape of the jaw, without the need of adjunct measures.
- After surgical removal of mandibular third molars, bone fill can be observed over a period of at least 12 months, with the most substantial change (e.g. the greatest bone fill) occurring during the first 3 months after surgery. However, complete fill of these residual bone defects does not always occur.

### Conclusions

- Intra-oral bone defects possess a high self-regenerative capacity.
- Factors such as extent of bone loss, presence of bony walls, closed healing environment, space provision and mechanical wound stability substantially influence healing/regeneration.

Adapted from Sculean A et al., J Clin Periodontol. 2019 Jun;46 Suppl 21:70-81, for more info about this publication click [HERE](#)

Int J Oral Maxillofac Implants. 2019 Suppl;34:s35-s49

## The Effects of Systemic Diseases and Medications on Implant Osseointegration: A Systematic Review.

Aghaloo T, Pi-Anfruns J, Moshaverinia A, Sim D, Grogan T, Hadaya D

### Study objectives

The aim of this study was to evaluate the effect of systemic disorders including diabetes and osteoporosis on implant osseointegration. The aim was also to evaluate the effect of other diseases, such as neurocognitive diseases, cardiovascular disease, human immunodeficiency virus (HIV), hypothyroidism, rheumatoid arthritis, and medications, such as selective serotonin reuptake inhibitors (SSRIs), proton pump inhibitors (PPIs), and antihypertensives.

### Results

- Although the literature does not demonstrate that diabetes negatively affects implant osseointegration, most studies focus on well-controlled diabetics and the use of prophylactic antibiotics. In addition, studies have shown increased long-term bone and soft tissue complications.
- For osteoporosis, recent studies and reviews also fail to demonstrate a lower osseointegration rate. However, caution must be exercised in these patients due to the risk for osteonecrosis of the jaws (ONJ), especially in patients with bone malignancies.
- There is also no direct evidence that patients with HIV, cardiovascular disease, neurologic disorders, hypothyroidism, or rheumatoid arthritis have a decreased rate of implant osseointegration. However, some preliminary evidence suggests that medications such as SSRIs or PPIs may have a negative effect on implant osseointegration. These studies are fairly recent and must be validated with continuous research.

### Conclusions

- Disease control, concomitant medications, and other comorbidities complicate implant osseointegration and must guide our treatment approaches and clinical guidelines.

Adapted from Aghaloo T et al., *Int J Oral Maxillofac Implants*. 2019 Suppl;34:s35-s49, for more info about this publication click [HERE](#)

Comput Biol Med. 2019 May;108:93-100

## Augmented and virtual reality in dental medicine: A systematic review.

Joda T, Gallucci GO, Wismeijer D, Zitzmann NU

### Study objectives

The aim of this study was to provide an update on the contemporary knowledge and scientific development of augmented reality (AR) and virtual reality (VR) in dental medicine, and to identify future research needs to accomplish its clinical translation.

### Results

- The systematic search identified 315 titles, whereas 87 abstracts and successively 32 full-texts were selected for review, resulting in 16 studies for final inclusion.
- AR/VR-technologies were predominantly used for educational motor skill training (n = 9 studies), clinical testing of maxillofacial surgical protocols (n = 5), investigation of human anatomy (n = 1), and the treatment of patients with dental phobia (n = 1). Due to the heterogeneity of the included studies, meta-analyses could not be performed.

### Conclusions

- The overall number of includable studies was low; and scientifically proven recommendations for clinical protocols could not be given at this time.
- However, AR/VR-applications are of increasing interest and importance in dental under- and postgraduate education offering interactive learning concepts with 24/7-access and objective evaluation.
- In maxillofacial surgery, AR/VR-technology is a promising tool for complex procedures and can help to deliver predictable and safe therapy outcomes.
- Future research should focus on establishing technological standards with high data quality and developing approved applications for dental AR/VR-devices for clinical routine.

Adapted from Joda T et al., *Comput Biol Med.* 2019 May;108:93-100., for more info about this publication click [HERE](#)

## References

Huynh-Ba et al., *Clin Oral Implants Res.* 2019 May 17 | Giannobile WV et al., *J Clin Periodontol.* 2019 Jun;46 Suppl 21:6-11 | Furze D et al., *Clin Implant Dent Relat Res.* 2019 Jun 7 | Tonetti MS et al., *J Clin Periodontol.* 2019 Jun;46 Suppl 21:183-194 | Monje A et al., *Clin Implant Dent Relat Res.* 2019 May 14 | Cha JK et al., *Clin Oral Implants Res.* 2019 Jun;30(6):515-523 | Naenni N et al., *J Clin Periodontol.* 2019 Jun;46 Suppl 21:287-306 | Thoma DS et al., *J Clin Periodontol.* 2019 Jun;46 Suppl 21:257-276 | Sculean A et al., *J Clin Periodontol.* 2019 Jun;46 Suppl 21:70-81 | Aghaloo T et al., *Int J Oral Maxillofac Implants.* 2019 Suppl;34:s35-s49 | Joda T et al., *Comput Biol Med.* 2019 May;108:93-100 | source: [www.pubmed.com](http://www.pubmed.com) | Dr Maj holds a position of Senior Global Medical Marketing Manager at Institute Straumann in Basel, Switzerland