

## MAGNETIC MALLET AND LASERS FOR A MINIMALLY INVASIVE IMPLANTOLOGY: A FULL ARCH CASE REPORT

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**Aim:** the use of Magnetic Mallet and the laser allows the same interventions to be performed in less time, in a minimally invasive way and with a reduction of postoperative complications. It is possible to exploit the photoablative potential of the Erbium Laser on the bone tissue to create the invitation to the inserts of the Magnetic Mallet with which to practice the expansion of a residual bone crest lacking in thickness and/or the preparation of the implant sites, as well as the properties decontaminants and photo-bio-modulators of photodynamic therapy without dye.

**Methods:** case report in an 81-year-old patient, fragile subject (ASA-3), with mobility of the upper elements remaining to support a removable prosthesis. The patient requests to rehabilitate the upper arch with a fixed prosthesis. The extraction of the remaining dental elements, root residues and implants, is proposed in the same intervention, with the Magnetic Mallet, after antibiotic prophylaxis; Oxygen High Level Laser Therapy (OHLTL) protocol is performed on post-extraction sites; er-

bium laser is used to increase the regenerative capacity of the site and to create an access where to house the ostotomy inserts of the magnetic mallet; the inserts of the Magnetic mallet are used to compact the bone (increasing its density) and create new implant sites where eight implants are inserted. 4-0 silk sutures, after placing centrifuged PRF to protect the flaps and extraction sites. ATP38 session is performed for 12 minutes within the next two days, the implants will be loaded with a temporary total prosthesis with immediate load screwed to them of the Toronto Bridge type.

**Results:** the patient had no pain or other complications during the surgery. In the following days, patient declares the absence of edema or post-operative pain. She did not need to take pain relieving or anti-inflammatory drugs. No evidence of infectious complication.

**Conclusions:** the combined use of the laser and the Magnetic Mallet has made it possible to perform complex therapy even in fragile patient.

## CORRELATION BETWEEN ACCURACY IN COMPUTER-GUIDED IMPLANTOLOGY AND PERI-IMPLANT HEALTH

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**Aim:** the Present Pilot study evaluated the correlation between accuracy, intended as the deviation between the preoperative digital planning and the actual implant position, and peri-implant health.

**Methods:** five patients underwent computer-guided implant surgery and full-arch immediate loading. Accuracy was calculated on 34 implants overlapping pre and postoperative CT scans. After 1 and 5 years of follow-up, peri-implant health was assessed clinically and radiographically measuring marginal bone loss (MBL), peri-implant probing depth (PPD), bleeding on probing (BOP), width of the peri-implant keratinized mucosa (KM), peri-implant mucosal recession (REC), and plaque accumulation. Statistical analyses were performed using generalized linear models with a level of significance  $\alpha = 0.05$ .

**Results:** mean linear deviation was  $0.57 \pm 0.23$  mm at implant head and  $0.69 \pm 0.26$  mm at implant apex, while mean angular deviation of the long axis was  $2.88^\circ \pm 1.22^\circ$ . A mean MBL of  $1.16 \pm 0.94$  mm and  $2.01 \pm 1.76$  mm was observed after 1 and 5 years of follow-up, respectively. At 5 years, mean PD was  $4.09 \pm 1.44$  mm, 66.6% of the evaluated implants showed BOP, KM was  $< 2$  mm in 48.4% of cases, REC  $\geq 1$  mm was assessed in 45.4% of the included implants, plaque accumulation occurred in 66.6% of cases. A negative correlation was observed between bucco-palatal/lingual linear inaccuracy and MBL, PD, BOP and KM.

**Conclusions:** a tendency toward increased MBL, PD, BOP and KM was observed when implants were placed more buccally compared to the preoperative planning. Thus, inaccuracy may compromise peri-implant health.

## NEW FLAT DESIGN OF ZYGOMATIC IMPLANTS IN A PARTIAL REHABILITATION

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**Aim:** description of partial rehabilitation with the use of zygomatic implants with new flat design and a traditional fixture in premolar area.

**Methods:** in this clinical case was used a traditional implant in position 1.4 (Fixo 10 x 3.5 head 0°, Oxy implant, Colico, Italy) that was inserted with the Sincrest method (Meta Technologies, Reggio Emilia, Italy). In position 1.7 was inserted a new type of zygomatic implant with flat morphology and 52.5° pre-angled head, with a length of 42.5 mm and a diameter of 4 mm (Oxy implant, Colico, Italy). A temporary prosthesis was screwed a few hours apart for immediate loading which is particularly indicated in zygomatic implantology.

**Results:** this new model combines a series of innovations already introduced on other fixtures and introduces a particular design characterized by a flat surface at the vestibular level on the body of the fixture to favor a better expression of the soft tissues and contains the risk of decubitus and plaque buildup.

**Conclusions:** zygomatic implantology has proven to be reliable over time and represents a valid alternative to bone reconstructions in cases of severe atrophy, reducing rehabilitation time and both biological and economic costs, as well as offering the possibility of performing the surgery chairside in conscious sedation especially for partial rehabilitations.

## FULL ARCH REHABILITATION WITH NEW FLAT DESIGN ZYGOMATIC IMPLANTS

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**Aim:** description of a full arch rehabilitation with the use of zygomatic implants with new flat design and three traditional fixtures in premaxilla.

**Methods:** in this clinical case three one-piece Fixo fixtures with a length of 10 mm and a diameter of 3.5 mm were inserted (Oxy implant, Colico, Italy) already equipped with integrated abutments with 0° angulation in sites 1.2, 2.1 and 2.3. It was also inserted a new type of zygomatic implant with flat morphology, 52.5° pre-angled head, length of 37.5 mm and a diameter of 4 mm, one on each side. A temporary prosthesis was screwed a few hours apart for immediate loading which is particularly indicated in zygomatic implantology.

**Results:** this new model combines a series of innovations already introduced on other fixtures and introduces a particular design characterized by a flat surface at the vestibular level on the body of the fixture to favor a better expression of the soft tissues and contains the risk of decubitus and plaque buildup.

**Conclusions:** zygomatic implantology has proven to be reliable over time and represents a valid alternative to bone reconstructions in cases of severe atrophy, reducing rehabilitation time and both biological and economic costs, as well as offering the possibility of performing the surgery chairside in conscious sedation especially for partial rehabilitations.

## THE CURVED PRE-SPLITTING TECHNIQUE IN AN EDENTULOUS ATROPHIC MANDIBLE: A CASE REPORT

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**Aim:** to describe a surgical case of curved two-staged pre-splitting technique as a suitable alternative to the bone augmentation procedures in a fully edentulous horizontally atrophic mandible.

**Methods:** a 58-years-old systemically healthy patient was referred for an implant-supported rehabilitation of edentulous inferior jaw. The mean available bone detected on Cone Beam Computerized Tomography (CBCT) scans was enough to perform a two-step split-crest technique and it was about 3 mm in width of which 1 mm of cancellous bone. At first, four linear corticotomies were performed using a piezoelectric device in antibiotic prophylaxis regimen. After 4 weeks, the bone expansion was performed and four implants were placed in the interforaminal area.

**Results:** postoperative CBCT images showed a mean bone width gain of about 3.7 mm.

Six months after the second stage surgery, implants were uncovered and a vestibuloplasty involving an autologous epithelial connective tissue graft was performed.

One month later a provisional fixed screw-retained prosthesis was delivered.

**Conclusions:** this approach could be used as a reconstructive technique avoiding grafts, reducing times, possible complications, post-surgical morbidity and costs, exploiting as much as possible patient's native bone.

Aware of the limitations of a case report, Randomized Controlled clinical Trials are needed to confirm the authors' results and validate this technique.

## SINGLE IMPLANT-SUPPORTED TWO-UNIT IN THE POSTERIOR AREA: CASE REPORT AND LITERATURE REVIEW

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**Aim:** this study describes a clinical case with a digital workflow for the rehabilitation of two missing teeth in the posterior maxilla with a single implant retained fixed cantilevered zirconia prosthesis and review the current literature regarding the outcome of a single implant supporting fixed dental prostheses made of two crowns designed to replace posterior missing adjacent teeth.

**Methods:** a systematic electronic search in the Medline and PubMed medical databases was performed for articles published in the English language until February 2022. Only articles that considered single-implant supporting two fixed units in the posterior area with a mean follow-up of at least 3 years were selected. The outcome variables were the survival of implants, the presence of peri-implantitis, and mechanical and technical prosthetic complications. The review was performed according to the PRISMA statements.

**Results:** a total of four papers were selected, which reported high survival rates of the rehabilitations.

The estimated survival rates for 3–9 years were calculated to be 96.78% for the implants and 100% for the fixed partial dentures.

Mechanical, technical and biological complications were reported with a complication rate of 5.37% and 15.05% for the implants and for the prosthesis, respectively.

**Conclusions:** although the evidence is encouraging regarding the survival rates, the insertion of a single implant supporting two adjacent posterior units needs to be carefully assessed in daily practice while considering the high rates of prosthetic complications.

Antirrotational implant connections and monolithic restorative materials could be an advantage for this type of rehabilitation.

## EVALUATION OF ZIRCONIA IMPLANTS IN AESTHETIC AREA: A CLINICAL CASE WITH 16 YEARS FOLLOW UP

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**Aim:** the aim of this report was to evaluate surgical and clinical management of zirconia one piece implants in aesthetic area of the upper jaw.

**Methods:** a female patient came in our department in 2006 for an implant-prosthetic rehabilitation in the aesthetic area. Orthopantomography was used for pre-surgical evaluation. The clinical-surgical decision was to place two one-piece implants in 1.1 and 2.1 position to rehabilitate the area. A surgical guide was performed to correctly guide the preparation of the implant site.

Two ceramic implants were placed (*WhiteSky, Bredent medical GmbH & Co.KG, Senden, Germania*). Provisional prosthesis was placed immediately after surgery.

The definitive prosthesis was placed after 6 months. Follow-ups were scheduled to evaluate both post operative and long term healing every 6 months for the first five years and then annually up to now, 16 years after.

**Results:** the zirconia implants allow to overcome the limits of titanium, in terms of restoration, as in the case of rehabilitations in the anterior area in patients with thin gingival biotype. All follow-ups show excellent healing results, in particular the follow-up 16 years after the surgery, shows a satisfactory clinical and radiographic result.

**Conclusions:** the zirconia implants seem to give excellent results even in the long term both from the point of view of stability and peri-implant tissues, especially in the aesthetic area.

## CLINICAL EVALUATION OF A NEW ALVEO LINE ZIRCONIA IMPLANT DESIGN

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**Aim:** the aim of this report is to evaluate surgical and clinical management of a new one piece design, alveo line zirconia implant.

**Methods:** a female patient asked for an implant-prosthetic rehabilitation in an edentulous area of the second quadrant. Bone crest was well preserved. An orthopantomography was done before the surgery. We decided to place two alveo line zirconia implants. A surgical guide based on the future prosthetic rehabilitation was prepared to correctly insert the fixtures. Surgery started with a crest incision from canines to the median margin of the first molar and a subsequent creation of a full-thickness trapezoidal flap. Drills were used to prepare the implant sites. Two ceramic alveo line implants (*Bredent, WHI-*

*TE SKY alveo line*) were placed. A new orthopantomography was done after surgery. The definitive prosthesis was placed after 6 months.

**Results:** the new alveo line implant design has two main characteristics: the ability to fill the cavity and to customize the implant, which is a new step compared to the tissue line implant that didn't allow any customization of the implant body. After 6 months from the surgery the tissues are healed and reconditioned in an excellent way.

**Conclusions:** new implant design gives very good results and seems to be an excellent solution especially in specific situation as post extraction rehabilitation or if it's necessary an improvement of emergence profile.

## REHABILITATION OF ATROPHIC MAXILLA WITH ZYGOMATIC IMPLANTS: CASE REPORT

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**Aim:** conventional implants treatment cannot be performed in the edentulous maxilla in some patients because of advanced bone resorption and/or the presence of extensive maxillary sinuses. There are many rehabilitative techniques that can be used in the case of patients with atrophic jaws, one of these is zygomatic implantology. The aim of the article is to present a case with severe atrophy of the jaw-bones and previous failed treatments that required an approach with zygomatic surgery.

**Methods:** the patient is 65 years old, clinical and radiological examination showed severe atrophy in the premaxilla and also posteriorly. He was wearing an unstable removable maxillary prosthesis and he had already been previously treated with standard implants and sinus lift both of which failed. Due to the

previous failed treatments it was decided to intervene with the placement of four zygomatic implants. The type of approach depends by the different bone availability, with both anterior and posterior atrophy, as in the case presented, the right solution is use of four implants.

**Results:** due to the primary stability assessed after surgery and thanks to an excellent seal of the mucous tissues around the MUA, immediate loading was performed.

**Conclusions:** zygomatic implants remains a surgery to be used as a last resort, in case of : significant atrophy that does not allow rehabilitation with standard implants, patients with previous unsuccessful surgeries or still in patients with previous maxillectomies.

## ACCURACY OF IMPLANT PLACEMENT WITH COMPUTER-GUIDED SURGERY IN PARTIAL EDENTULISM

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**Aim:** the purpose of the present study is to evaluate the accuracy of guided implant surgery in a single partial edentulism case.

**Methods:** a CBCT and a digital intraoral scan were required for case planning and a virtual diagnostic wax-up was produced by the data acquired. These data were converted into a printed surgical dime. The surgery involves micro flaps setup to preserve keratinized tissue, the preparation of the implant site through calibrated drills with depth stop, and implant insertion in 14 and 16 sites. The post-operative intraoral scan is taken ten weeks after surgery with PEEK scan bodies. The metal-ceramic final restoration was cemented with water-soluble cement. Finally, the crestal and apical point deviation, depth deviation and angular deviation was calculated.

**Results:** data analysis showed the following outcomes (mm): a lateral apical point deviation of 1,87 (14) and 0,51 (16), a depth apical deviation of 0,10 (14) and 0,43 (16), a lateral coronal deviation of 0,81 (14) and 0,27 (16), a coronal depth deviation of 0,07 (14) and 0,44 (16), an angular deviation of 5,29° (14) and 1,20° (16).

**Conclusions:** this case report confirms the predictability of guided surgery: the correspondence between project and realization respects the security standard set by literature at 2,00mm. It allows a precise implant placement, a correct prosthetic therapy and the preservation of the noble anatomical structures, however, deviation between virtual planning and realization may occur because of the errors accumulated throughout the steps of the digital workflow.

## MULTIDISCIPLINARY CASE OF AGENETIC LATERAL INCISOR IN PATIENT WITH CLEFT LIP AND PALATE

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**Aim:** the aim of this treatment is to solve an agenesis within an area of high aesthetic value.

**Methods:** A.R. (22 y.o.), surgically treated for cleft lip and palate comes to attention of the orthodontic department due to an agenesis of 2.2. The ortho treatment aims to distalize the element 2.3 to create the space for the implant-prosthetic rehabilitation of 2.2. The ortho treatment was carried out using aligners. For the case study, alginate impressions were taken from which plaster models were obtained. The dental technician carried out an immediate aesthetic temporary rehabilitation. The implant insertion surgery was planned. A crestal incision was made from element 2.1 to element 2.3 with a mucoperiosteal flap. The implant site was prepared using a sequence of dedicated drills of the Nobel Biocare N1tm system. The

first drill supported the engagement in the bone; the second taper of the drill body allowed the correction of the pilot osteotomy direction. The drill created a specific osteotomy for the N1 implant. A temporary abutment was screwed at 15 Ncm. The Maryland was adapted on the abutment. The provisional was finished and relieved of the occlusion. The flap has been repositioned.

**Results:** the case was solved with the insertion of an implant with a non-functionalized load to meet the aesthetic needs of the patient.

**Conclusions:** the multidisciplinary treatment allowed the resolution of the case respecting the biological times of healing. The immediate provisional allows the correct conditioning of the tissues, responding to the high aesthetic demands of the patient.

## COMPUTER GUIDED IMPLANTOLOGY IN EDENTULOUS PATIENT: CASE REPORT

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**Aim:** computer guided surgery is a surgical technique that through the use of 3D radiographic investigations and specific programming software allows a very precise planning of surgery, and the realization of it through surgical guides. A CT scan of the patient wearing radiological templates is performed and it is match with a file (STL or DICOM) that reproduces the anatomy of the patient's oral cavity. The purpose of this poster is to show a clinical case of a completely edentulous patient rehabilitated with guided implants through a new data acquisition protocol named "Dual Scan Plus".

**Methods:** the completely edentulous 69-year-old patient was rehabilitated with 4 implants for the upper arch and 4 for the lower arch, then two all-on-four for a total of 10 teeth. The acqui-

sition data were obtained with a CT scan of the patient who was wearing the radiological templates matched with the STL obtained by scanning the templates with a laboratory scanner according to Dual Scan Plus protocol.

**Results:** in the upper arch the surgery was performed flapless, a small flap was made in the lower arch to preserve the adherent gingiva, in both cases the implants had good primary stability so immediate loading was performed.

**Conclusions:** in conclusion in cases of total edentulism with severe bone resorption like this one, guided implantology is extremely advantageous because it reduces the risk of damaging important anatomical structures and increases the chances of performing an immediate load. So in this case the Dual Scan Plus protocol was proved to be valid.

## SOCKET SHIELD TECHNIQUE AND IMMEDIATE GUIDED IMPLANT PLACEMENT: A CASE REPORT

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**Aim:** the present study aims to show the digital workflow in the socket shield technique for single tooth replacement in the aesthetic area.

**Methods:** the patient is a male, 58 years old, ASA I, with a central incisor (1.1) decay on the palatal aspect. The tooth was stable with the absence of periodontal disease and periapical lesions. CBCT showed a thin buccal cortical plate with most residual alveolar bone on the palatal side. An intraoral scan was performed for digital implant planning. Socket Shield Technique was used to prevent the resorption of the vestibular alveolar bone and implant placed with a surgical template. A straight abutment with a milled resin crown was the solution

for the immediate provisional phase.

**Results:** the follow-up at three months highlight good soft and hard tissues healing, with no marginal changes.

**Conclusions:** the success of this result was due to the minimally invasive surgical protocol, the use of the “one abutment one time” concept and digital planning of the prosthesis. The socket shield technique is very promising for preserving hard and soft tissues in aesthetic areas, such as anterior maxillary teeth, in cases of post-extraction immediate implant placement. The definitive abutment, placed at the time of surgery, guides soft tissue healing and improves the final aesthetic results.

## POST-EXTRACTIVE CONDITIONING OF PERIMPLANT TISSUES WITH CUSTOMIZED HEALING ABUTMENT: CASE REPORT

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**Aim:** the purpose of this case report is to present post-extraction surgical implant techniques that reduce the invasiveness of the intervention and facilitate the consequent prosthetic rehabilitation.

**Methods:** following the extraction of element 1.5, a titanium implant of 4 mm of diameter is placed. The coronal mesio-distal space of the alveolus is 5mm and the buccal-palatal surface is 7 mm. The healing abutment is made of acetal resin, having a diameter of 7 mm with the characteristic of being customizable according to clinical needs, since it is equipped with a through screw.

**Results:** the healing took place without complications and after 4 months the healing abutment was removed to perform the prosthetic rehabilitation. The great advantage is the ideal conformation assumed by peri-implant soft tissues, which do not require further adaptive conditioning to the prosthetic element.

**Conclusions:** with implant customized healing abutment the socket is preserved in its shape; soft tissue conditioning takes place during extraction/implant positioning and it is conservative.

## THE FULL-DIGITAL FLOW IN POST-EXTRACTIVE IMPLANT REHABILITATION, FROM THE SURGICAL PHASE TO THE PROSTHETIC FINALIZATION: A CASE REPORT

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**Aim:** the purpose of this work is to present a case of post-extraction implant rehabilitation managed prosthetically in full-digital mode, from the provisional phase to the prosthetic finalization.

**Methods:** following a fracture of element 1.4, a pre-operative scan with a digital intraoral scanner of the element is performed to prepare the pre-shaping provisional of the element. On the day of surgery, extraction of 1.4 is performed with immediate placement of a 4mm diameter titanium implant. The provisional is locked to a temporary titanium abutment using self-curing resin and transformed into a screw-retained crown by means of a hole created on the occlusal surface. After 4 months, the provisional is removed and the final metal-free screw-retained crown is created by digital scanning.

**Results:** the healing took place without complications and after 4 months the provisional was removed to perform the definitive prosthetic rehabilitation. The great advantage of this technique is the ideal conformation assumed by the peri-implant soft tissues through the immediate provisional and the reduced invasivity of the digital technique which allows to temporarily and definitively rehabilitate the implant without using impression materials.

**Conclusions:** the full-digital flow in both temporary and definitive implant prosthetic rehabilitation allows to preserve the architecture of the peri-implant tissues and reduce invasivity towards the patient, avoiding the use of any impression material, thus improving the ergonomics of the rehabilitation therapy.

## 10-YEARS EVALUATION OF THE FIRST ROOT ANALOGUE IMPLANT ON HUMANS MADE USING DMLS

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**Aim:** in dental field, implant rehabilitation is increasingly in demand. The purpose of this work is to take a first step to validate the new custom made RAI technique made with the DLMS technique and the realization of the models using the CAD-CAM method. To do this, we performed a long 10-year follow-up on the first ROOT ANALOGUE IMPLANT (RAI) in Ti-6Al-4v made by us and inserted in a 50-year-old female patient in good health.

**Methods:** during the checks the patient was subjected to an anamnestic examination, looking for possible presence of pathological symptoms. Meticulous examinations were carried out by observation, palpation, percussion and probing, collecting periodontal / peri-implant health index data. Intraoral radiographs were performed with parallel x-rays technique supported by customized resin checks.

**Results:** no pathological symptoms were reported, over the years the peri-implant tissues have adapted perfectly and remain healthy. PPD was within the normal values (2,5mm), BOP wasn't present, there wasn't sign of gingival recession, no in-

creased mobility and dimensional stability was highlighted. No sign of bone resorption (0mm) was evident, considering the distance between the bone crest and the implant shoulder as a reference.

**Conclusions:** the result obtained is very satisfactory as the crestal bone has not altered its size over time and no complications have been highlighted. Obviously, to support the thesis it is necessary that further studies and statistical analyzes will have to confirm what is highlighted in this work on a single case, which is meant to be a first step. This method therefore seems to give predictable results over time although at the present stage the limits seem to be of an organizational nature as designing and producing individualized products with this technique requires several design phases. In recent years the various 3D printing methods are spreading and some of these are so common that there are machines produced for hobby use; it is not unthinkable that the DLMS production technique could be made more available in the future.



## ALVEOLINE: A NEW ZIRCONIA IMPLANT DESIGN FOR IMMEDIATE PROSTHETIC-IMPLANTS REHABILITATION

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**Aim:** the aim of this report is to describe the surgical management of an immediate implant-prosthetic rehabilitation using ceramic implants by computer-guided surgery.

**Methods:** a 64 years-old female patient needed to rehabilitate the lower jaw, in which there were root residues of the elements 3.5, 3.6 and 3.7.

A pre-operative orthopantomography and a digitally planned CBCT were performed by matching the CBCT with the patient's intraoral scan which allowed to analyze the future position of the implants. A surgical template was realized for the placement of the implants.

For the surgical protocol, after extraction of the root residues, two monolithic ceramic implants (White Sky AL, Bredent medi-

cal GmbH & Co.KG, Senden, Germania) were placed into pre-molar and molar socket using the surgical template. Immediate loading was performed by fixing provisional crowns on the two zirconia abutments.

**Results:** the design of this zirconia implants and the guided surgical protocol guarantee high primary stability with all types of bone density and thus create the ideal prerequisite for immediate load rehabilitation.

**Conclusions:** zirconia implants are made of zirconium oxide with a tetragonal structure, which offers the best mechanical properties for oral implantology. Thanks to their elasticity, the bone tissue is protected from overloads during the osseointegration phase.

## VERTICAL GUIDED BONE REGENERATION IN THE ESTHETIC ZONE: CASE PRESENTATION

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**Aim:** a literature review was conducted to evaluate the state of art on horizontal and vertical GBR to examine the various surgical techniques, graft materials and membranes. Complications related to the various methods were also carefully evaluated in order to select the best surgical approach. A case report is reported to describe a modification of the surgical technique in order to reducing postoperative complications. A paracrestal method is described to evaluate an alternative treatment option in comparison to the incision in the center of the bone crest, especially in the case of thin and aesthetic biotypes.

**Methods:** the patient presents a combined horizontal and vertical bone defect in the esthetic zone.

Vertical guided bone regeneration was performed and, after preparing the implant site by drilling, two conical implants were inserted.

**Results:** no complications occurred and the clinical and radiographic outcome is reported after 9 months of healing.

**Conclusions:** there are no differences between the paracrestal approach compared to the classic GBR approach in terms of postoperative complications.

## REHABILITATION OF THE FIRST LOWER MOLAR USING A NEW GENERATION OF HEALING ABUTMENT

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**Aim:** this case report aims to evaluate the efficacy of implant-prosthetic rehabilitation in the non-aesthetic area by using a new type of healing abutment (Iphysio) and Connective Tissue Graft (CTG).

**Methods:** a 30-year-old woman, ASA I and negative medical history need the implant-prosthetic rehabilitation of the first lower molar. After the failure of the endodontic treatment, the tooth needed to be extracted. Following the preparation of a full-thickness envelope flap, a Naturactis implant was placed, and after, the Iphysio healing abutment was screwed to the implant with a CTG sutured internally to the flap. After two months, a digital impression was taken using the Iphysio healing abutment as a scan body. The implant was rehabilitated with a definitive prosthetic crown in monolithic zirconia cemented to a T-base.

**Results:** at the end of the treatment, there was a good integration of the soft and hard peri-implant tissues with a good emergence profile in a non-aesthetic area.

**Conclusions:** the management of the surgical and prosthetic phases was effortless thanks to the characteristics of the scan body/healing abutment.

Without the provisional crown, it was possible to reduce the length of the treatment. Healing abutment works as a profile designer until the end of treatment, when it was also used as a scan body and unscrewed to place the final restoration. The CTG helps get the best results regarding the quality and quantity of the soft tissues.

The reduction in the number of connection reconnection of screwed components preserves the stability of the peri-implant tissues.

## CASE REPORT: IMMEDIATE LOADING OF TWO ONE-PIECE ZIRCONIUM OXIDE IMPLANTS BY GUIDED SURGERY

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**Aim:** this case describes the placement of two (4x10mm) one-piece WhiteSKY implants (Bredent srl, Bolzano, Italy) via guided surgery with immediate loading.

**Methods:** on oral examination of the patient, root remnants at sites 3.5, 3.6 and 3.7 are revealed. A preliminary intraoral scan and CBCT is performed to make an implant-prosthetic evaluation. The DICOM file and the STL file are matched within the Real Guide system (3DIEMME srl, Cantù, Italy), implant-prosthetic processing software for the design of the template for guided surgery. The procedure is performed under local anesthesia (articaine 1:100000) in buccal and lingual site. Once the avulsions of the roots have been performed, the surgical tem-

plate is positioned and the implant placement is carried out. The whiteSKY prosthetic copings are then fitted over the implant abutment without the need for retention screws or cement, but only with mechanical retention. On the copings will then be passivated, through resin, the temporary, which after polishing and finishing is ready for delivery.

**Results:** the ability to use a screwless and cementless immediate load provisional leads to a reduction in forces that are not congruent with implant osseointegration.

**Conclusions:** guided surgery for the placement of zirconia implants leads to an increase in esthetic yield and facilitates the operator to perform complex cases.

## IMPLANT-SUPPORTED REHABILITATION USING GBR ON RECONSTRUCTED MAXILLA WITH FIBULA FREE FLAP

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**Aim:** the aim of this study is to present a clinical case of fibrous dysplasia treated with association of GBR on a maxillary reconstructed area with Free Fibula Flap (FFF). This case was documented in 2019: no previous evidence existed in literature.

**Methods:** a 27-year-old female's medical history was positive for Fibrous Dysplasia of the maxillofacial bones. Due to an increasing facial swelling, the patient underwent right-sided maxillomalar reconstruction with FFF. The FFF was remodeled and 4 dental implants were placed. 12 years later, the onset of peri-implantitis had caused the loss of 1 of the 4 dental implants and bone resorption with consequent thinning of the fibula flap. It was decided to use GBR technique to avoid the risk of fracture and restore the bone volumes. GBR was performed

by using heterologous biomaterials in combination with a non-reabsorbable titanium-reinforced membrane and 4 fastening screws to pin the membrane.

**Results:** 6 months after GBR, TC showed a good bone regeneration. After removal of the membrane, two implants were placed. Then a fixed implant-supported prosthesis with a custom-milled titanium bar screwed to the implants was made. The prosthesis satisfied the patient both esthetically and functionally with significant improvements in oral function and psychosocial activities.

**Conclusions:** this case has demonstrated that good bone regeneration can be obtained with GBR technique even on reconstructed maxilla with Free Flaps by following carefully the operative protocol and respecting its principles.

## SURGICAL TREATMENT OF PERI-IMPLANTITIS. A SYSTEMATIC REVIEW

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**Aim:** alongside with a wide diffusion of dental implant rehabilitation, the occurrence of peri-implant complications requiring treatment become more frequent. There is no consensus on the choice of materials, instruments or procedures for surgical treatment of peri-implantitis. The aim of present study is to systematically review the available literature in order to evaluate the effectiveness of surgical treatments of peri-implantitis and summarize the results.

**Methods:** electronic databases PubMed, Scopus and Web of Science were explored in order to identify clinical trials comparing different surgical treatments of peri-implantitis. Studies with minimum 10 participants per group and a follow-up of minimum 6 months were included. Primary outcomes consisted of implant survival. Secondary outcomes included: Probing

depth (PD) reduction, Bleeding on Probing (BoP) reduction and Marginal bone level (MBL) gain.

**Results:** a total of 21 articles, with examination of 1090 implants were included. Success rate of the treatment was reported only by 10 studies and ranged between 70 and 100%. Regenerative procedures were performed in 14 studies, reporting a mean PD reduction of 2,63 mm and a mean MBL gain of 1,67 mm with use of bone substitutes. In groups where only Open Flap Debridement was performed, PD reduction was of 1,94 mm and bone gain of 0,44 mm in average. Furthermore, a mean reduction of 41,78% in BoP was observed in the studies.

**Conclusions:** the use of regenerative materials seems to improve clinical and radiologic results of surgical treatment of peri-implantitis.

## BONE DENSITY AND IMPLANT STABILITY IN KIDNEY-TRANSPLANTED PATIENTS: A PROSPECTIVE STUDY

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**Aim:** this study evaluated bone density and clinical outcomes (implant stability and survival) in kidney-transplanted patients.

**Methods:** patients with mono- or partial edentulism, who underwent kidney transplant for congenital or acquired pathologies, and presenting satisfactory systemic compensation and local bony and periodontal pre-requisites for implant placement, were included in this study. Following informed consent, patients underwent placement of implants with platform-switched conical connection; during implant site preparation, a bone biopsy was collected with a trephine bur for histomorphometric evaluation. RFA (Osstell, Göteborg, Sweden) was measured at implant placement and four months after prosthetic loading.

**Results:** a total of 12 patients were included in the study, receiving a total of 19 implants. Seventeen bone biopsies were performed (15 mandibular and 2 maxillary), showing a mean trabecular space area of  $41.6 \pm 14.4\%$  and  $58.3 \pm 14.5\%$  of lamellar bone. No implants were lost before prosthesis delivery, and one failure occurred during the first year of loading. Mean ISQ were  $71.7 \pm 10.5$  and  $73.0 \pm 9.3$  at implant placement and at 4-month follow-up, respectively.

**Conclusions:** bone density and clinical outcomes recorded in kidney-transplanted patients seem to be comparable to normal population. Accurate patient selection and a correct surgical protocol are crucial pre-requisites for successful implant therapy. Further studies are necessary to evaluate the success of implant therapy on larger samples and long-term follow-up.

## A NEW HORIZONTAL GBR TECHNIQUE: “THE SLING TECHNIQUE”

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**Aim:** the aim of this study was to introduce a new technique for massive horizontal alveolar ridge augmentation through an innovative use of expanded-polytetrafluoroethylene (e-PTFE) membrane, to reduce the risk of biological complication related to membrane exposure.

**Methods:** eligible patients for implant rehabilitation with horizontal bone defect were enrolled in our study. All patients were treated with our new GBR approach called “Sling Technique” (ST) which consisted on covering the vestibular side of the bone defect with a stretched e-PTFE membrane. This technique allowed the amplification of the membrane surface, as long as the compression and the immobilization of the underlying graft material (50% autologous bone and 50% bovine xenograft). The membrane was placed far from the surgical in-

cision of the mucosa, to avoid infective complications. Pre and post regenerative surgery CBCT scans were used to assess the tissue gain amount after GBR.

**Results:** 10 patients (4 females, 6 males; age range: 45-60 years old) were enrolled in our study and 33 implants were placed in regenerated bone. An average of 4mm bone gain was achieved using the ST. No membrane exposure or biological complications were registered during the postoperative healing period. After a 24-month follow-up a 100% implant survival rate was observed, without hard or soft tissue dehiscence.

**Conclusions:** the e-PTFE membrane positioned with the “Sling Technique” gave satisfactory results in horizontal bone augmentation. Considering the small sample, further confirmations with larger studies are certainly needed.

## EVALUATION OF SOFT TISSUE STABILITY IN POST-EXTRACTION IMPLANT: A 3D SUPERIMPOSED STUDY

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**Aim:** the volume stability of soft tissue plays a key role to achieve an aesthetic result, especially in cases of post-extractive implants in aesthetic areas. Several authors have pointed out that hard and soft tissue changes occur after tooth extraction. The aim of this pilot study is to analyze the volumetric changes of soft tissue in post-extraction implants with and without the placement of an immediate temporary by means of 3D overlay analysis.

**Methods:** a total of 6 teeth that could no longer be restored (1 upper central incisor, 2 upper lateral incisors, 3 upper premolars) were extracted and replaced with 6 post-extraction implants. Slow-resorbing material (DBBA) was placed in all sites to fill the jumping-gap and immediate temporary loading was performed randomly on 3 implants. A digital impression was

taken 4 months after surgery. The .stl files were analyzed using software (3D slicer, Brigham and Women's Hospital, Harvard University, NIH) to assess volumetric changes in the sites.

**Results:** a total of 5 patients were enrolled in this preliminary study ( $59 \pm 4.18$  age). In the group with immediate provisional a volumetric contraction of less than 1 mm in the V/P direction was found ( $0.52 \pm 0.48$  mm), while in the group without immediate provisional a linear contraction of 2 mm was measured ( $2.12 \pm 0.98$ )

**Conclusions:** the use of an immediate temporary in the case of post-extraction implants would appear to decrease the volumetric contraction of the soft tissues, improving the aesthetic result. More randomized clinical trials are needed to confirm these results.

## DYNAMIC GUIDED SURGERY: ACCURACY OF PTERYGOID IMPLANT PLACEMENT

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**Aim:** the purpose of this study is to demonstrate accuracy and reduction in operative time comparing dynamic surgery with freehand surgery. The results of this work, allow us to evaluate the differences between these two kinds of procedures.

**Methods:** the sample of this study is composed of 39 patients and a total of 63 implants placed, 31 by dynamic navigation and 32 by freehand surgery. The patients included are partially edentulous and need rehabilitation with at least one pterygoid implant. Implant placement is performed freehand or using dynamic navigation surgery. This surgery type is randomized on the same day. A sample of 24 patients treated with bilateral pterygoid implants and 15 with unilateral pterygoid implants.

**Results:** the results show a greater precision of dynamic surgery compared to freehand surgery.

This is emphasised by the two most important variables: the average depth 0.67 mm in dynamic surgery compared to 1.17 mm in freehand surgery; and the angular discrepancy:  $2.64^\circ$  in dynamic surgery compared to  $12.49^\circ$  in freehand.

Important evidence to consider is the distance between the implant and the greater palatine hole, which is smaller in dynamic navigation surgery; at the same time dynamic navigation was 9 minutes compared with 22 minutes in freehand surgery.

**Conclusions:** this peculiar surgery allows us to obtain greater precision in the implant's insertion, reduction of operative time and, less invasiveness of the special procedure.

Thus, dynamic navigation implant surgery was found to be a predictable successful technique.

## ACCURACY OF STATIC COMPUTER-AIDED IMPLANT SURGERY WITH TOOTH-SUPPORTED SURGICAL GUIDES

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**Aim:** the aim of this study was to assess the accuracy of virtual planning of computer-aided surgery based on the actual outcomes of clinical dental implant placement using tooth-supported surgical guides.

**Methods:** the inclusion criteria were as follows: 1) no mouth opening limitation; 2) sufficient bone volume based on preoperative CBCT images. The exclusion criteria were as follows: 1) uncontrolled systemic disease; 2) smokers (> 5 cigarettes per day); 3) radiotherapy of cervical-facial district; 4) pregnant or breastfeeding women. A conventional gypsum material dental cast made from polyvinyl siloxane impression was scanned into STL file. To establish implant placement plan and create digital tooth-supported implant guides, DICOM data and STL data were matched. Implants were placed with fully guided surgery and flapped approach.

To compare the position of the preoperative planned implant with the actual position of the implant after the surgery, implants impression were taken after osseointegration. Then 4 parameters were evaluated as follows: Coronal Vertical Deviation (CVD), Coronal Global Deviation (CGD), Apical Global Deviation (AGD) and Angular Deviation (AD).

**Results:** a total of 9 implants were placed in 5 patients (3 males and 2 females, age between 40 and 60). The average of the results was: CVD 0,60 ( $\sigma$  0,59; SE 0,26); CGD 0,82 ( $\sigma$  0,43; SE 0,15); AGD 1,07 ( $\sigma$  0,40; SE 0,13); AD 1,84 ( $\sigma$  1,31; SE 0,44).

**Conclusions:** fully guided implant surgery with tooth-supported surgical guides shows high accuracy in implant placement. More cases to improve statistic value of the study are needed.

## A NOVEL MINI-INVASIVE APPROACH TO RIDGE AUGMENTATION IN THE ESTHETIC ZONE WITH TI-FOIL

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**Aim:** the aim of this case series is to propose a simplified approach for ridge augmentation in the esthetic zone obtained through the use of Ti-foil. The Ti-barrier was positioned on the defect by opening an envelope flap, without fixing screws and left exposed intentionally without releasing incisions.

**Methods:** five patients with horizontal bone defect in the esthetic zone were enrolled in this study. A single incision was performed in the middle of the ridge and extended marginally on the adjacent teeth. Autologous bone was harvested from the zone of the defect, mixed with a 1:1 rate with demineralized freeze-dried bone allograft, placed into the defect and covered with the Ti-barrier. The flap was sutured leaving a portion of the foil exposed.

**Results:** the exposure of the foil increased overtime, without compromising the new bone regeneration. Under the titanium

barrier a healthy soft tissue was found covering the new bone. Hard tissue histological examination confirmed new bone formation, while soft tissue examination revealed keratinized epithelial tissue.

**Conclusions:** this technique ensured good isolation of the regenerative space, optimal clot stability and excellent bone formation.

Simplified soft tissue management, without the need to mobilize the flap, is an important feature. Furthermore, the intentional exposure of the barrier has shown that the foils are difficult to colonize by bacteria. Of great interest was the finding of keratinized epithelial tissue below the membrane. This healthy tissue may have provided the isolation of regenerative space from bacterial invasion.

## PERI-IMPLANT CONDITION AND PROSTHETIC RESIDUAL CEMENT: AN ENDOSCOPICAL EVALUATION

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**Aim:** the main objective of this study is to evaluate under endoscopic vision the eventual presence of submucosal residual prosthetic cement (CE) in peri-implant disease cases. The correlation between the pathological condition and the apical position of CE has been also investigated.

**Methods:** forty-six patients with clinical and/or radiographic signs of peri-implant disease (mucositis or peri-implantitis) were included. All patients had a definitive cemented prosthesis loaded for at least 3 months. Patients with mucositis were treated with gentle debridement and re-evaluated at one month; if mucositis was resolved the patient was not included in the study. All enrolled patients underwent to endoscopic analysis (DV2 Perio-

scope) at the implant site, to identify eventual submucosal CE. The proximity of CE to implant platform was measured by means of a periodontal probe (PCP UNC-15) under endoscopic vision.

**Results:** CE was detected in 37 out of 46 implants (80.4%) and were mainly located at vestibular and lingual or palatal areas. The most apical portion of the CE was located at 1.80 mm from the edge of the implant platform. This distance was lower for implants with a diagnosis of peri-implantitis (1.11 mm) than in sites with mucositis (2.21mm) ( $p = 0.001$ ).

**Conclusions:** the presence of CE was strongly associated with peri-implant disease. The proximity of CE to implant platform was correlated to the severity of peri-implant disease.

## ONE-STAGE VS TWO-STAGE TECHNIQUE USING EXTRASHORT IMPLANTS IN PARTIALLY EDENTULOUS REHABILITATIONS

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**Aim:** evaluation of the differences between peri-implant tissue behavior using extrashort implants with one-stage or two-stage technique.

**Methods:** 12 subjects, mean age 60,8, who needed to receive two adjacent extra-short implants have been enrolled. Patients were all partially edentulous with high level of bone resorption. Two adjacent distal implants (extrashort BTI 5,5 or 6,5 length) were inserted during the same surgery. One was submerged (2-stage technique) and one was immediately connected by the multim abutment (1-stage technique). The second stage surgery was performed after 3 months. The two implants were then loaded with screw-retained splinted rehabilitation. ISQ value (Osstell) was performed to analyze the implant stability. Peri-implant bone levels were evaluated on intraoral paralleling

radiographs. Peri-implant probing depth, plaque index, BOP, mobility and pain were also evaluated. Follow-up and measurements were made at T0, T3, T6, T12. A statistical analyze was then elaborated.

**Results:** at T12 the linear mixed model of the ISQ results shows a non-significant difference between one-stage group and two-stage group. The MB mesial for one-stage was mean of 1,15 (SD: 0,55), while for two-stage was mean of 1,2 (SD: 0,62). ( $p = 0,522$ ). The MB distal was for one-stage mean of 1,22 (SD: 0,61) while for second stage was mean of 1,21 (SD: 0,56). ( $p = 0,601$ ). No statistically differences were found in any of the peri-implant parameters evaluated.

**Conclusions:** according to 12 months results, no statistically differences resulted between the two techniques.

## EFFECTIVENESS OF AN ANTIBACTERIAL COATING OF IMPLANT CHAMBER WITH REAL-TIME VOCs ASSESSMENT

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**Aim:** the implant-abutment junction represents a peri-implant tissues loss causal factors, as a bacterial reservoir that results in halitosis due to the release of Volatile Organic Compounds (VOCs) produced by bacterial metabolism. This study aims to assess the efficacy of an antibacterial coating (PiXiT) in reducing bacterial proliferation by using real-time VOCs analysis.

**Methods:** for the present study, they were recruited 20 patients (9M-11F) with a mean age  $41 \pm 6.3$  years affected by partial or total edentulism. A total of 40 implants were positioned, 20 fixtures with PiXiT within chlorhexidine gluconate 1% and an alcoholic solution (T) and 20 implants with no internal coating (C). The VOCs evaluations were performed on the internal chamber of the implant after removing the healing screw.

**Results:** the VOCs max peak amplitude was assessed for Test and Control Group at the baseline (T0), after 7 (T1) and 14 (T2) days. At T0, Test and Control group showed a VOCs max peak mean respectively of  $2.15 \pm 0.71$  and  $2.21 \pm 0.69$  with no significant differences ( $p > 0.05$ ). A significant difference ( $p < 0.01$ ) at T1 between groups was detected ( $2.26 \pm 0.76$  Test- $3.15 \pm 0.85$  Control). At T2 the Test showed a mean of  $2.29 \pm 0.73$ , the Control a mean of  $3.65 \pm 0.91$  with a significant difference ( $p < 0.01$ ). A significant increase of Control T1 and T2 VOCs max peak was reported ( $p < 0.05$ ).

**Conclusions:** the antibacterial internal coating (PiXiT) demonstrated the capacity to decrease the microbial VOCs activity and resists the bacterial penetration. The present device represented an effective tool for peri-implant tissues health.

## HORIZONTAL GBR USING SAUSAGE TECHNIQUE: A COHORT STUDY

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**Aim:** to evaluate if GBR using “sausage technique” is effective for horizontal bone augmentation in the maxilla.

**Methods:** 5 patients with class IV and V maxillary defects requiring implant treatment were enrolled for a total of 10 implants placed. All the sites evaluated were healed post extraction ( $> 4$  months). A CBCT was executed at T0 (prior to surgery). GBR with sausage technique was performed using a resorbable double layered collagene membrane and a mixture of 50% autologous bone and 50% ABBM by the same operator in every case. 8 months after GBR procedure, implants were placed in a prosthetically driven position and a new CBCT (T1) was taken. In a CBCT software a plane parallel to the implant long axis was created and this was crossed with perpendicular planes every 1.5 mm. CBCT sections at T0 and T1 were then superimposed, and

205 Measurements were obtained. The measurements at T0 and T1 were then compared. Thickness variation was the main outcome evaluated. A statistical analysis was carried out using SPSS Statistics with an interval of confidence of 95%.

**Results:** the average thickness gain was  $2,82 \pm 1,79$  mm. The maximum gains were obtained at 4.5mm from the most coronal crest line ( $3.8 \pm 1,51$  mm). Maximum thickness obtained was  $8,92 \pm 1,54$  mm (T0:  $6,58 \pm 2,64$  mm)

**Conclusions:** GBR sausage technique was effective and shows low percentage of post-operative complications. The biggest gains were obtained at the intermediate vertical point of the membrane. Within the limits of this study we conclude that sausage technique is effective for horizontal GBR in the maxilla.



## THE ACCURACY OF DYNAMIC NAVIGATION IN PLACING TILTED AND STRAIGHT IMPLANTS: A COHORT STUDY

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**Aim:** comparing the accuracy of dynamic navigation in placing tilted and straight implants.

**Methods:** 15 implants were placed (7 axially and 8 tilted) on 7 patients needing implant-prosthetic rehabilitation of a posterior maxillary atrophic area, using a dynamic navigation system with a flapless approach. Each patient received at least one straight and one tilted implant.

Postoperative cone beam was superimposed to the preoperative ones and the placed implants positions were compared to the planned ones.

The implant placement's accuracy was assessed measuring the vertical deviations and linear deviations at the entry and apical points.

**Results:** the median of implant length was 10 mm for implants axially placed and 12.25 mm for tilted ones. The mean horizontal deviations measured at the implant entry point were  $0.81 \pm 0.40$  mm for straight and  $1.01 \pm 0.53$  mm for the tilted implants. The mean horizontal deviations measured at the implant apical point were  $0.91 \pm 0.53$  mm for the straight and  $0.85 \pm 0.51$  mm for tilted group. The mean vertical deviations were respectively  $0.72 \pm 0.56$  mm and  $0.49 \pm 0.66$  mm.

**Conclusions:** similar accuracy for implants placed axially or tilted were found. According to this study, dynamic navigation can be considered as an accurate and reliable technique for implant placement; further data are needed before making more reliable clinical recommendations.

## COMPUTER-AIDED REHABILITATION SUPPORTED BY ZYGOMATIC IMPLANTS: A COHORT STUDY

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**Aim:** to evaluate the survival and clinical success rate, complications, and patients' quality of life after computer-aided rehabilitation supported by zygomatic implants in cases of severe maxillary atrophy (10 patients) and in bone defects in oncologic patients (10 patients).

**Methods:** all patients underwent computer-aided planning and surgery. Seventy-three zygomatic implants were placed. The mean follow-up period was 39.9 months. Implant survival and clinical success rate, the effectiveness of planning the implant length, biological and prosthetic complications, and the quality of life were evaluated.

**Results:** the five-year implant survival rate for patients with maxillary atrophy and oncologic patients was 97.4% and

96.7%, respectively. The prosthetic survival rate was 100%. Two implant failures occurred in the first year. One implant failure was observed in each group. Minor biological and prosthetic complications occurred in both groups without significant differences. All complications were managed without affecting the treatment. The quality of life increased by 71.3% in the atrophic group and by 82.9% in the oncologic group.

**Conclusions:** zygomatic implant rehabilitation seems to be a reliable technique for patients with maxillary atrophy and for oncologic patients. The three-dimensional computer-aided approach allows the surgeon to plan the surgery and increase its predictability. Early prosthetic loading certainly allows for better functional outcomes.

## EVALUATION OF INNOVATIVE TITANIUM SURFACE ESTHETIC PROPERTIES: AN *IN VITRO* STUDY

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**Aim:** the purpose of the study was to evaluate the physical and esthetic improvements of the dental implant colored titanium Grade 5 laser treated surface.

**Methods:** five specimens of titanium Grade 5 (Ti6Al4V) were selected and for 10 min ultrasonically cleaned first in acetone, after in Millipore water and dried in a thermostatic oven. A specific ytterbium laser nano-second pulses sequences were used to ablate the specimens using. Physical and topographic properties were evaluated by stereo, light and electron microscopy and profilometric analyses. L\*a\*b\* colorimetric coordinates were measured by spectrometry, and the superficial chemical characteristics were evaluated by energy dispersive X-ray analysis.

**Results:** pink Type 1 (P1), Pink Type 2 (P2), Incarnadine (I) and white (W) colors were selected for the study. The topography, texture, hues, saturation, roughness, and porosity of the samples were compared with machined (M) and sand-blasted and etched (SBAE) control surfaces. P1, P2 and I, similar in hue and roughness ( $R_a \cong 0.5 \mu\text{m}$ ), had a microgroove spacing of  $56 \mu\text{m}$  and a decreasing porosity. The W sample with a "checkerboard" texture and a light color ( $L^* 96.31$ ) was similar to the M samples ( $R_a = 0.32 \mu\text{m}$ ), but different from SBAE ( $R_a = 1.41 \mu\text{m}$ ,  $L^* 65.47$ ).

**Conclusions:** these preliminary results showed in innovative physical titanium improvements due to laser treatment and represent interesting perspectives in order to obtain esthetic in dental implants innovation and more predictable esthetic use.

## USE OF RADIOMIC FEATURES TO DEFINE A PREDICTIVE MODEL OF MBL AROUND IMPLANTS

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**Aim:** the aims of the present study were: i) to extract radiomic features from 2D intraoral images, ii) to search for a correlation between radiomic features and early MBL of dental implants, iii) To develop an artificial intelligence –based prediction model for early MBL after osseointegration.

**Methods:** 2D intraoral images of 44 patients were used. Each patient underwent 3 periapical intraoral radiographs: T0 (baseline), T1 (after 3 months), T2 (after 5 months). T0 images were analyzed using LifeX software which is able to extract radiomic features from mesial and distal regions of interest. A predictive model of MBL, based on the extracted features, was calculated using machine learning techniques. Finally the real MBL between T1 and T0 was measured.

**Results:** the mean MBL in the studied cohort was  $0.48 \pm 0.49$  mm. Based on such results two categories of MBL were obtained by categorizing for the median value. Radiomics analysis revealed features correlates with high/low MBL at logistic regression analysis. Such features were put together in a machine learning prediction model in order to predict the occurrence of MBL in the studied cohort. The best performing model was based on an ANN architecture who yielded a performance of 0.706 in area under the curve (AUC) with a sensitivity of 81.4% and specificity of 51.1%.

**Conclusions:** based on the obtained findings, coupling Radiomics with machine learning seems to be a very promising approach for the prediction of early MBL after dental implant insertion.

## OSTEOBLAST LIKE CELLS PROLIFERATION AND BONE DEPOSITION ONTO 3 DENTAL IMPLANTS SURFACES

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**Aim:** *in vitro* evaluation of osteoblast-like cells behavior during proliferation and growth onto 3 different titanium surfaces.

**Methods:** after differentiation, osteoblast-like cells (hOcs) from human primary sub-cutaneous adipose stem cells, were cultured onto 3 different nano and micro-roughness titanium surfaces: 2 innovative laser-treated (L1; L2) and one sandblasted and acid-etched (SBAE). After 60 days, Cell Proliferation Viability Test (MTT), Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray (EDAX), and Matrix Phosphoglycoprotein (MEPE), Alkaline Phosphatase (ALP) and Osteocalcin (OCN) RT-PCR and WB analysis of hOcs behavior was evaluated.

**Results:** profilometric and SEM analysis showed crucial differences all samples analyzed. After 20 days of cell culture, SEM evaluation showed a small number of hOcs onto SBAE specimens. While, onto L1 surface a monolayer of osteoblasts with

initial bone deposition were detected. In L2 specimens, a thickness network of flattened stellate cells interconnected in multi-layer adherent to titanium surface and several crystalline bone structures were observed. At same time, EDAX analysis showed absence of impurities and confirmed bone matrix deposition in L2 samples compared to L1 and SBAE. All biological osteogenic markers evaluation have shown higher level in L2 samples compared to L1 and SBAE.

**Conclusions:** further *in vivo* studies will be need to confirm the interesting results of the present study. However, titanium laser treatment confirmed the high biocompatibility level compared to SBAE surface used as a control. Furthermore, after hOcs proliferation and differentiation, L2 samples have showed higher cell adhesion, growth, and osteogenic markers levels compared to L1 and SBAE.

## ALVEOLAR SOCKET PRESERVATION WITH TOOTH DERIVED BIOMATERIALS AND DENTAL IMPLANT EVALUATION

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**Aim:** evaluation of dental implants 1 year after loading, placed in human maxillary sites after alveolar socket preservation (ASP) procedures through an innovative autologous tooth derived graft material.

**Methods:** 504 patients (average age 54 years) were recruited and 483 dental implants were placed after tooth extraction. The extracted teeth, after water irrigation cleaned procedures, were cut in small pieces (10x10 mm) and inserted in the Tooth Transformer<sup>®</sup>. Tooth demineralized autologous graft were obtained and placed in the alveolar post-extractive socket sites and covered by a resorbable collagen membrane. After 4 months healing period, 100 bone biopsies were performed for histological and histomorphometric evaluation. After a year,

periapical X-rays were performed to evaluate the bone and dental implants osseointegration behavior.

**Results:** biopsies histomorphometric analysis showed 43,58% ( $\pm$  12.09) average value of BV (Bone Volume), 10.47% ( $\pm$  10.68%) of the RG (Residual Graft) and 32.38 ( $\pm$  17.15) of the NB (New Bone). One year after loading the implant failure rate was 1,7% and the implant survival rate was 98,2%.

**Conclusions:** further studies will be necessary, with a larger number of implants and a longer follow up to confirm this promising results. Therefore, the high BV and NB level in the biopsies and the high dental implant success rate confirmed the promising role of the demineralized tooth graft materials in dental implant rehabilitations.

## MACHINED VS LASER-TEXTURED IMPLANTS COMPARED IN IL-6 AND IL-1B SULCUS FLUID CONCENTRATIONS

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**Aim:** to Microbiologically evaluate and compare gingival tissue healing in surgically manipulated periodontal tissues (T+), non-surgically manipulated periodontal tissues (T-) and soft tissue healing in sites that have received implants with surfaces machined (MS) vs Laser-microtextured (LMS) surfaces with one-stage surgical protocol.

**Methods:** twenty-four non-smoking patients were recruited for this clinical evaluation. They received two implants in a split-mouth design study on the same jaw: one implant with a MS collar and ones with a LMS collar. At weeks 1,2,3,4,6,8 and 12 soft tissues healing of T(+) and T(-) sites, MS and LMS implant sites were compared by evaluating clinical and biochemical parameters: sulcus fluid volume (SF), IL-6 and IL-1 $\beta$ . Two paper strips were used for these data collection. Periotron

8000 was used for volume quantification of SF. For the biochemical analysis, the paper strips were placed in a single Eppendorf vial containing 100  $\mu$ l phosphate-buffered saline and stored at  $-80^{\circ}\text{C}$ .

**Results:** throughout the study period, LMS and T(+) showed no statistically significant differences for the analyzed parameters ( $p > 0.05$ ), while higher mean values were noted in MS implant sites with statistical significance ( $p < 0.05$ ).

**Conclusions:** peri-implant gingival healing differs from periodontal healing and show a higher pro-inflammatory state. LMS characteristics and their distinct relationships with surrounding tissues and marginal implant-gingivae interface may create environmental changes that could modify the cytokines production during the post-surgical healing phase.

## HOW LASER MICROGROOVED OR MACHINED HEALING ABUTMENT REPLACEMENT INFLUENCED SOFT TISSUES

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**Aim:** the present study aims to evaluate the clinical and biochemical effect on peri-implant tissues of repeated disconnection/reconnection of both laser microgrooved (LMS group) and machined healing abutments (MS group).

**Methods:** twenty-four patients received 2 implants with one-stage protocol in a split-mouth design study on the same jaw. In each patient, one implant received a LMS healing and prosthetic abutment, while the other received MS ones. After four months from implant placement (T0), to carry out the prosthetic procedures, the healing abutments were removed three times. Four weeks later (T1), definitive prosthetic abutments were applied with screw-retained crowns. Modified plaque index (mPI), modified gingival index (mGI), bleeding on probing (BoP), probing depth (PD) were assessed at T0 and T1. There-

fore, peri-implant crevicular fluid (PICF) was collected with standardized paper strips to quantify interleukin-1beta (IL-1 $\beta$ ), interleukin-6 (IL-6), and tumor necrosis factor (TNF)- $\alpha$  levels, using the ELISA kit.

**Results:** the two groups (LMS and MS) showed no significant difference in mPI and mGI, at T0 and T1, while higher PD and BoP values were noted for the MS group. The mean PICF volume and levels of proinflammatory cytokines in the LMS group were less than those in the MS group. Moreover, amongst mean concentrations of interleukins at T0 and T1 in the MS group, a significant increase was found, differently from the LMS group.

**Conclusions:** multiple disconnections/reconnections of LMS healing abutments resulted in less inflammation compared to conventional ones.

## ACCURACY IN POSITIONING OF BONE BASES RESPECT TO IMPLANT NEEDS IN THE SOFTWARE-ASSISTED IMPLANT PROJECT

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**Aim:** an implant project must be absolutely precise and accurate to allow the surgeon maximum reliability and predictability. The software normally reposition the images of the bone bases with automatism linked to their algorithms but often the measurements we take are not accurate precisely because of this automatism. It therefore becomes important to reposition the bone bases with respect to the axis of the implant which must be inserted in prosthetically guided mode and not skeletally guided.

**Methods:** 25 CTCBs were planned for the replacement of a single missing tooth by prosthetically guided implant surgery with and without correct alignment. Measurements were made from the crest to the anatomical limit to be reached. The Bland-Altman plot was used to assess the agreement between the

two measurements. The level of agreement was also assessed through Lin's concordance correlation coefficient of absolute agreement and the intraclass correlation coefficient.

**Results:** a good level of agreement between the two measurements was observed from the Bland-Altman plot with a mean difference of 0.76 (95% CI: 0.48; 1.03), although this mean difference showed a statistically significant difference from the line of equality. This was also confirmed by the Lin Agreement correlation coefficient of Absolute Agreement of 0.9452 and ICC 0.9718 (95% CI: 0.9412 to 0.9865).

**Conclusions:** a statistically significant difference between the two average measurements indicates that maximum attention is required in the correct verification of the position of the bone bases to give correct information to the surgeon

## MARGINAL BONE LOSS IN RELATION TO SUBCRESTAL IMPLANT PLACEMENT, FOLLOW UP FROM 3 TO 10 YEARS

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**Aim:** determine radiographically the long-term "stability" of marginal bone in sub-crestally placed implants, with a follow-up of 3 to 10 years, and identify the main risk factors for the marginal bone resorption.

**Methods:** 93 patients treated with an implant-prosthetic rehabilitation between 2010 and 2016 were considered, with a Follow-up from 3 to 10. 410 plants have been examined, equipped with internal conical connection and platform-switching positioned sub-crestally, were radiographically examined and the marginal bone level was evaluated. Immediate loading cases were excluded, cases in which uses had required tissue regeneration and those in which a periapical radiograph had not been performed at the time of prosthetic loading. The marginal bone resorption that occurred between the time of prosthetic loading (t0) and the time of the follow-up visit (t1) was calculated. A multiple regression model was performed to identify the most relevant risk factors for marginal bone resorption.

**Results:** in the following study, 410 implants were examined from 93 different patients. The mean follow-up of the study was 3.58 years. The mean value of the marginal bone level observed was  $-1.09 \pm 0.65$  mm at the time of delivery of the prosthesis (t0) and  $-1.00 \pm 0.37$  mm at the follow-up visit (t1). The combination of the presence of type 2 diabetes in patient and the vertical position of the implant, resulted in the increased predictability of changes related to marginal bone level.

**Conclusions:** despite the limitations of the following study, implants equipped with a tapered internal connection and platform-switching, inserted at a subcrestal level of about mm1, showed a stable marginal bone level and a low rate of peri-implantitis or peri-implant mucositis after medium and long-term follow up. Type 2 diabetes, vertical implant position, and follow-up time had the greatest influence on marginal bone resorption. However, further studies are needed to verify the long-term clinical validity of subcrestal implant placement.

## A RETROSPECTIVE STUDY OF MARGINAL BONE LOSS AROUND 110 IMPLANTS WITH A SUBCRESTAL PLACEMENT

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**Aim:** the aim of this study is to evaluate the Marginal Bone Loss (MBL) around implants with a peculiar macrogeometry combined with a subcrestal positioning technique.

**Methods:** a population of 25 patients was selected for progressive radiographic evaluation on orthopantomograms and/or intraoral radiographs. The implant sample included 110 fixtures, of variable length and diameter, but all with the same characteristic crestal module, defined “without neck” (EVEN, Mech & Human, Grisignano, Italy), and placed subcrestally ( $\geq 0.5$  mm). Using an image processing software (ImageJ), two operators measured the distance between the implant shoulder and the crestal bone level both on the mesial and the distal aspect of each fixture, from the first surgical time to the latest available control radiograph. The

data obtained were analyzed separately by a statistician and compared with the results from similar clinical studies found in the literature.

**Results:** after a mean follow-up of 8 years (range 10-161 months), the overall MBL was 0.98 mm (SD  $\pm$  0.89 mm). There were no statistically significant differences among different functional loading times or number of surgical phases (1 or 2). The clinical behavior observed was better than what we expected basing on the review of available literature.

**Conclusions:** despite the limited sample size and the retrospective nature of the work, the MBL values recorded for EVEN “without neck” implants seem promising, and tend to suggest a subcrestal positioning technique whenever possible, at least with this peculiar fixture morphology.

## MONOLITHIC ZIRCONIA CROWNS FOR SINGLE IMPLANTS IN POSTERIOR REGIONS: A RETROSPECTIVE STUDY

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**Aim:** a retrospective study was made to evaluate the survival rate at short and medium-term for monolithic zirconia crowns used in posterior regions as single implants.

**Methods:** inclusion criteria for each clinical case are single implants supported crowns and the absence of periapical lesions and periodontal problems in adjacent teeth. US Public Health Service criteria have been used to evaluate the results in the short and medium-term. Possible adverse events have been grouped in a table to evaluate their occurrence.

**Results:** the study was made on 41 clinical cases with a follow-up ranging from 8 months up to 78 months (with an average duration of 37.8 months). The results were classi-

fied as excellent in 30 cases (73%); Success was reached in 11 samples (27%) these have been defined as acceptable cases since they had a partial impairment of a single evaluation parameter: in all 11 cases, it was the color factor. In only one case there was an adverse event, represented by the fracture of the connecting screw between the abutment and the crown.

**Conclusions:** the study showed a high level of trust for monolithic zirconia crown used in posterior regions as a single implant, based on the survival rate at both short and medium-term. Monolithic zirconia crowns on implants look like a valid option for clinical usage.

## EFFICACY OF AIR-POLISHING DEVICES WITHOUT REMOVAL OF IMPLANT-SUPPORTED FULL-ARCH PROSTHESES

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**Aim:** long-term success of titanium dental implants is influenced by various factors, including the maintenance of good oral hygiene. The present study aimed to evaluate cleaning effectiveness and patient satisfaction with glycine powder air-polishing and traditional professional oral hygiene treatments when applied to implant-supported full-arch restorations without removal of the fixed prostheses.

**Methods:** 85 patients (357 implants) supporting full-arch fixed restorations were included. After removal of the prostheses (T0), Plaque Index, peri-implant spontaneous bleeding, probing depth, bleeding on probing were recorded. After prostheses reinsertion, the patients were divided into three groups, each receiving two hygiene therapies randomly administered in each hemiarch.

The possible treatments were: glycine powder air-polishing and use of sponge floss vs sponge floss only in group 1; glycine air-polishing vs use of an ultrasonic device with a polyethe-

retherketone fibre tip coating in group 2; glycine air-polishing vs use of carbon fibre curettes and sponge floss in group 3. After instrumentation, the prostheses were removed to assess the Plaque Index and peri-implant spontaneous bleeding. Questionnaires were used to record patients' levels of comfort and satisfaction.

**Results:** glycine air-polishing reduced significantly better plaque around implants compared to control treatments ( $P = 0.020$ ). Glycine powder air-polishing followed by application of sponge floss provided the greatest reduction of plaque deposits on the prosthetic surfaces. About 80% of patients rated glycine air-polishing highest with regard to satisfaction.

**Conclusions:** glycine air-polishing is a highly effective and comfortable treatment to maintain good oral hygiene in clinical practice, and could be used as an alternative to manual and mechanical instrumentation when dealing with implant-supported restorations.

## THE EFFICACY OF OSSEODENSIFICATION BURS: A COMPARATIVE STUDY *IN VITRO*

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**Aim:** a proper bone density of the implant site can ensure optimal primary stability to achieve a successful osseointegration. Among the different techniques used to increase bone density in the implant site, the use of osseodensification burs shows promising results. A comparative in-vitro study is carried out in order to define the greater efficacy of osseodensification burs compared to osteosubtractive burs.

**Methods:** an osseodensification burs kit is used to realize 48 osteotomies on a rigid polyurethane foam test ground. Burs are used on a TMM2 implant motor for a greater entirety of collected data. The osteotomies are divided into 2 study groups (A and C) in which the sites, extended respectively 12 and 14 mm deep, are prepared by the cutters in a compaction rotation; the two control groups B and D represent osteotomies for which the cutters are used in a cutting direction. In each site has been inserted a conical implant 3.8x12. For each implant were collected data about peak torque (cp), average tor-

que (cm), integral depth-curve (I.). The implants are subjected to the resonance frequency analysis RFA to evaluate the implant stability quotient ISQ.

**Results:** a correlation analysis was performed between (I), Cm, Cp and ISQ. One-way variance analysis (ANOVA) was used to identify statistically significant differences between averages of the considered values in the groups. C group, representative to osteotomies prepared to 14 mm with osseodensification burs, always showed a significantly higher value in each parameter.

**Conclusions:** implants in sites obtained with osteocondensation cutters and prepared to a length to accommodate the autologous particulate graft produced by the drilling, show a significant increase of each parameter. The use of osseodensification burs may improve primary stability in the clinical scenario on tapered implants. Further randomized controlled trial studies *in vivo* are necessary to validate this.

## PARTIAL VS FULL THICKNESS FLAP: PRELIMINARY RESULTS OF A RCT

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**Aim:** the primary purpose of this prospective multicenter study is to evaluate whether the partial thickness detachment of a flap results in a maintenance of the stability of the hard and soft peri-implant tissues, following the respective peri-implant indices for a follow-up of three years.

**Methods:** patients with partial edentulism of at least 1 element received an implant 0.5 mm below the bone crest positioned with partial thickness flap detachment mode or with full thickness flap detachment mode. MBL was measured at Baseline, 1 year (T1) and 2 years (T2) of follow up.

**Results:** only patients with a minimum follow-up period of 2 years were considered in the present analysis. All patients received their implant treatment between October 2018 and Fe-

bruary 2022. Due to the pandemic condition one patient dropped out of the study after 1 year. A total of 18 implants has been applied to 5 patients and analyzed in the present study. No one implant or patient was diagnosed with peri-implantitis or showed major or minor prosthetic complications. The statistical analysis showed no significant differences between groups in terms of marginal bone level changes ( $p = 0.67$ ).

**Conclusions:** within the limitations of the present study, no difference could be found at 2-year follow-up between the two different flap approach for the surgical phase of implant insertion. However, improvements in sample size and follow-up are needed to better elucidate marginal bone level changes in the next future

## NARROW IMPLANTS VERSUS HORIZONTAL BONE AUGMENTATION: 1-YEAR RCT RESULTS

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**Aim:** to evaluate a year post-loading the effectiveness of immediately loaded 3 mm-diameter implants as an alternative to horizontal bone augmentation for placing 4 mm-diameter implants.

**Methods:** partially edentulous patients with between 4 and 5 mm of bone width were randomized to receive one to three 3.0 mm-diameter implants (23 patients) to be loaded immediately if the insertion torque was  $\geq 35$  Ncm, or after 4 months, or horizontal crest augmentation for placing one to three 4 mm-diameter implants (22 patients). Four mm-diameter implants were loaded after 4 months using provisional screw prostheses, replaced after 4 months by definitive ones.

**Results:** in the augmentation group two patients dropped out and two implants failed ( $P = 0.2333$ ). Five patients with narrow-

diameter implants were affected by six complications versus 11 augmented patients with 12 complications, the difference being statistically significant ( $P = 0.0477$ ). One year after loading, patients with 3 mm-diameter implants lost on average 0.14 mm of peri-implant bone, while augmentation patients lost 0.52 mm. The difference in bone loss between the two groups was statistically significant ( $P = 0.0112$ ). Six 3-mm group patients versus four augmentation group patients were partially satisfied with function ( $P = 0.4205$ ) and aesthetics ( $P = 0.5900$ ).

**Conclusions:** one year after loading, 3 mm-diameter implants group exhibited better results, so it might be the preferable choice to horizontal bone augmentation. However, longer follow up data will be necessary.



## FREE-HAND VS COMPUTER GUIDED IMPLANT SURGERY: PRELIMINARY RESULTS OF A RCT ON MBL

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**Aim:** a 3-years prospective study was conducted to evaluate which type of surgical protocol was the best between the insertion of the implant fixture free-hand in opposition to guided implant surgery with templates based on technology of CBCT. Strengths and weaknesses were evaluated, with an accurate description of predictability and precision of surgical protocols.

**Methods:** for each selected patient, the same number of implants for site were placed, without the need of bone regeneration techniques. After preparation of the site in accordance with the two techniques indicated, conical implants (Megagen Anyridge, Seoul, South Korea®) were inserted 0,5 mm under bone crest, with variable dimensions depending on the available bone and adjacent dental elements. The following parameters were considered: Marginal Bone Level (MBL) measured with standardized x-rays at Baseline, 1 year (T1) and 2 years

(T2) of follow up; prosthetic and implant complications in the follow-up period.

**Results:** only patients with a minimum follow-up period of 2 years were considered in the present analysis. All patients receive their implant treatment between October 2018 and February 2020. Due to the pandemic condition one patient dropped out after 1 year. Hence a total of 18 implants belonging to 5 patients were analyzed. No implant or patient was diagnosed with peri-implantitis or showed minor or major prosthetic complication. The statistical analysis showed no significant differences between groups (study and control) in terms of MBL change ( $p = 0.67$ ).

**Conclusions:** within the limitations of this study, no difference could be found at 2-year follow-up. Improvements in sample size and follow-up are needed in order to better elucidated MBL change in the next future.

## DRILLS VERSUS PIEZOELECTRIC SURGERY FOR ZYGOMATIC IMPLANT PLACEMENT: 3-YEAR RCT

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**Aim:** 3-year results of a within-person randomized controlled trial to compare the outcome of site preparation for two zygomatic oncology implants per zygoma using conventional preparation with rotary drills or piezoelectric surgery with dedicated inserts.

**Methods:** twenty edentulous patients with severely atrophic maxillae had their hemi-maxillae randomized according to a within-patient study design into implant site preparation with either conventional drills or piezoelectric surgery. Two zygomatic oncology implants were placed in each hemi-maxilla.

**Results:** six patients experienced at least one complication at drilled sites and five at piezoelectric surgery sites ( $P = 1.0$ ). Implant placement with drills took on average  $14.35 \pm 1.76$  minutes

vs.  $23.50 \pm 2.26$  minutes with piezoelectric surgery, the implant placement time being significantly shorter with conventional drilling (difference =  $9.15 \pm 1.69$  minutes;  $P = 0.000$ ). Post-operative haematomas were larger at drilled sites in 11 patients and similar at both sides in nine patients ( $P = 0.0001$ ), and 16 patients found both techniques equally acceptable while four preferred piezoelectric surgery ( $P < 0.0001$ ).

**Conclusions:** although these results may be system-dependent, and therefore cannot be generalized to other zygomatic systems with confidence, both drilling techniques achieved similar clinical outcomes. However, conventional drilling required 9 minutes less and could be used in all instances, though it was more aggressive.

## ZYGOMATIC VS CONVENTIONAL DENTAL IMPLANTS IN AUGMENTED ATROPHIC MAXILLA: 3-YEAR RCT

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**Aim:** to compare 3 years post-loading the clinical outcomes of immediately loaded cross-arch maxillary prostheses supported by zygomatic implants versus conventional implants placed in augmented bone.

**Methods:** seventy-one edentulous patients with severely atrophic maxillae were randomized according to a parallel-group design to receive either zygomatic implants (35 patients) to be loaded immediately or xenograft followed, after 6 months of graft consolidation, by placement of six to eight conventional dental implants submerged for 4 months (36 patients).

**Results:** eight prostheses could not be fitted or failed in the augmentation group versus two prostheses in the zygomatic group ( $P = 0.082$ ). Nine patients in the augmentation group lost

42 implants versus three patients who lost six zygomatic implants, the difference being not statistically significant ( $P = 0.052$ ). 16 augmented patients were affected by complications versus 29 zygomatic patients, the difference being statistically significant ( $P = 0.007$ ). The mean number of days to functional prosthesis fitting were  $444.32 \pm 207.86$  in augmentation patients and  $1.34 \pm 2.27$  in zygomatic patients ( $P < 0.001$ ), the difference being statistically significant.

**Conclusions:** immediately loaded zygomatic implants are associated with fewer prosthesis failures, implant failures and less time needed for functional loading as compared to augmentation procedures and conventionally loaded dental implants. More complications were reported for zygomatic implants.

## INTERNAL VS EXTERNAL CONNECTIONS IN IMMEDIATELY LOADED FULL-ARCH REHABILITATIONS: SPLIT-MOUTH STUDY

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**Aim:** the aim of the study was to evaluate the difference between peri-implant tissue behavior using internal and external connections in immediately loaded-full-arch implant rehabilitations after 48 months follow-up.

**Methods:** 10 subjects aged 46-77 years have been enrolled, all partially edentulous with high level of bone resorption. After extraction of the remaining teeth, patients were rehabilitated with four post extractive implants according to the All on 4 Protocol<sup>®</sup>, using two implants with external connection in one semi-jaw and two with internal connection in the other one. Full-arch resin prosthesis supported with metal framework, according to Columbus Bridge Protocol<sup>®</sup>, were screwed following immediate loading protocol (24 to 48 h after the surgery). In each patient, the following parameters were evaluated:

peri-implant bone loss, implant survival rate, peri-implant probing depth, plaque index, bleeding on probing, mobility and pain.

**Results:** implant success rate was 97% at 48 months. Bone resorption at 48 months was  $1,75 \pm 0,62$  mm for the external connection and  $1,69 \pm 0,52$  mm for the internal connection (p-value 0.386).

**Conclusions:** in 48 months there was a moderate not statistically significant greater bone resorption with the use of the external connection. Regarding peri-implant probing, no differences emerged between the two types of connections. The implant survival at 48 months was found to be comparable. Further studies are needed in order to define whether one type of connection is more suitable than the other.

## MANAGEMENT OF MAXILLOFACIAL BALLISTIC TRAUMA

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**Aim:** this study aims to define the best management of maxillofacial ballistic trauma and to describe a standardized, surgical and prosthetic, rehabilitation protocol from the first emergency stage up until the complete aesthetic and functional rehabilitation.

**Methods:** we undertook a retrospective review of all patients prosthetically rehabilitated for maxillofacial ballistic trauma. We evaluated the mechanism of injury, the anatomic sites involved, the surgical and reconstructive procedure performed, the following prosthetic choice and the complications.

**Results:** in low-velocity ballistic injuries (bullet speed < 600 m/s), the wound is usually less severe and non-fatal, and the management should be based on early and definitive surgery with reconstruction, followed by oral rehabilitation. High-velocity

ballistic injuries (bullet speed > 600 m/s) are associated with extensive hard and soft tissue disruption and the management should be based on a 3-stage reconstructive algorithm: debridement and fixation, reconstruction, and final revision.

**Conclusions:** the management of these patients requires a multi-step and multi-disciplinary treatment plan. The prosthetic rehabilitation has the greatest impact on the patient's quality of life: an implant-supported prosthesis allows the restoration of aesthetic, functional and psychological outcomes. In our opinion, the fixed hybrid prosthesis guarantees the best follow-up because the metal structure ensures a better distribution of forces while the space under the prosthesis flanges facilitates the maintenance of hygiene by preventing the accumulation of food and plaque.

## EFFECTS OF PROSTHETIC EMERGENCE ANGLES ON MARGINAL BONE LEVEL: A RETROSPECTIVE STUDY

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**Aim:** the aim of the present retrospective study was to evaluate marginal bone level changes in patients restored with implant fixed rehabilitation with different prosthetic emergence angles (EA).

**Methods:** seventy-four patients were included in the analysis and a total of 312 implants were examined. Patients had a mean 3-year follow-up, in which marginal bone level (MBL) was first assessed at prosthesis installation (t0) and then at 3-years follow up visit (t1). Two groups were considered: Group 1 and Group 2 included restorations with angle between implant axis and prosthetic emergence profile > 30° and ≤ 30°, respectively.

Furthermore, peri-implant soft tissue parameters, such as modified bleeding index (MBI) and plaque index (PI), were assessed.

**Results:** mean EA in Group 1 and 2 was respectively 45° ± 4° and 22° ± 7°. Mean MBL change was 0.06 ± 0.09 mm in Group 1 and 0.06 ± 0.10 mm in Group 2. Differences in MBL between the two groups were not statistically significant (p = 0.969).

**Conclusions:** MBL stability may not be affected by more than 30 degrees and less than 50 degrees emergence angles with a tight and stable implant to abutment connection and platform switching of the abutment diameter. Nevertheless, long-term data are required to confirm this trend.

## MMP-8 LEVELS IN PERI-IMPLANT MARGINAL BONE LOSS PROGRESSION: A RETROSPECTIVE STUDY

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**Aim:** the purpose of this retrospective study was to evaluate the possible correlation between peri-implant sulcular fluid levels of Metalloproteinase-8 (MMP-8) and peri-implant Marginal Bone Loss (MBL) progression.

**Methods:** two groups of patients (A and B) were selected. In group A, 39 implants with a laser-microtextured collar surface were surgically placed in 39 patients, while, in group B, 41 implants with a machined/smooth surface were inserted in 41 subjects. Periapical radiographs and a software package were used to measure MBL rates for each patient. ELISA test was performed to analyze implant fluid samples. Rates of MBL and MMP-8 were recorded in three timeframes (6 months post-surgery- restoration delivery (T0)-and 6 (T6) and 24 (T24)-months post-loading).

**Results:** elevated MBL levels at T24 were strongly related with high rates between T0 and T6. The values of MMP-8 were significantly higher around implants with MBL, comparing to implants without MBL. The MBL rates at T24 were associated with initial bone loss rates and initial levels of MMP-8.

**Conclusions:** the presence of peri-implant sulcular fluid levels of MMP-8 is statistically associated to peri-implant MBL progression. Additionally, the initial high levels of MBL and MMP-8 can be predictive of the consecutive progression of peri-implant MBL: implants with increased MBL rates and MMP-8 levels at 6 months after loading are likely to reach further marginal bone loss values.

## FOUR MM ULTRASHORT VERSUS LONGER IMPLANTS PLACED IN AUGMENTED BONE: A 5-YEAR RCT

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**Aim:** to evaluate if 4-mm ultrashort implants could be an alternative to bone augmentation in the severely atrophic posterior jaws.

**Methods:** eighty partially edentulous patients with posterior atrophic jaws were included: 40 patients in the maxilla and 40 in mandible. The patients were randomized to receive one to three ultrashort or at least 10-mm long implants in augmented bone. Results are reported 5 years after loading with the following outcome measures: implant and prosthetic failures, complications and peri-implant marginal bone level changes.

**Results:** thirty-two complications were reported for the control group in 18 patients versus 13 complications in 10 patients in the test group, the difference being not statistically signifi-

cant ( $p = 0.103$ ). In the augmented group, 12 implants failed in 6 patients versus 7 short implants in 6 cases, and 9 prostheses failed in the control group while 4 in the test one, without statistically significant differences ( $p = 1.000$  and  $0.363$ ). At 5 years after loading, short implants lost on average  $0.58 \pm 0.40$  mm of peri-implant marginal bone and long implants  $0.99 \pm 0.58$  mm, the difference was statistically significant ( $p = 0.006$ ).

**Conclusions:** ultrashort implants showed similar if not better results compared to longer implants placed in augmented jaws 5 years after loading. For this reason, their use could be in specific cases preferable to bone augmentation. However, longer follow-ups and larger trials are needed.

## THE INFLUENCE OF THE KERATINIZED TISSUE ON SHORT IMPLANTS: A RETROSPECTIVE STUDY

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**Aim:** to assess whether the presence/absence of keratinized tissue height (KTh) influence short implants health.

**Methods:** the study was designed as a parallel cohort retrospective research. Short implants with an implant length < 7 mm were considered. One cohort was composed of patients with short implants surrounded by  $\geq 2$  mm of KTh; the other one included implants with < 2 mm of KTh. Outcome measures were: marginal bone level changes (MBL), failures and complications.

**Results:** 110 patients treated with 217 short and ultrashort implants were retrospectively included. The mean follow-up was 4.1 years after prosthetic loading. The differences between groups in MBL were not statistically significant at every follow-up considered: 0.05 mm at 1 year ( $P = 0.48$ ), 0.06 mm at 3 ye-

ars ( $P = 0.34$ ), 0.04 mm at 5 years ( $P = 0.64$ ) and 0.03 at 8 years ( $P = 0.82$ ). A total of 9 complications were reported, 3 in the narrow KTh group and 6 in the wide one, the difference being not statistically significant ( $P = 0.14$ ). Five implants failed due to peri-implantitis, 2 in the narrow KTh group and 3 in the wide, without a statistically significant difference ( $P = 0.29$ ).

**Conclusions:** there are no statistically significant differences in MBL, complication and implant failure rates between short implants with adequate or inadequate KThs. However, a KT graft could be helpful in making brushing comfortable and in limiting plaque accumulation. Nevertheless, longer follow-ups, larger number of patients and RCTs are needed before making more reliable clinical recommendations.

## VOLUMETRIC STABILITY OF REGENERATED TISSUE FIVE YEARS AFTER CRESTAL SINUS FLOOR ELEVATION

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**Aim:** this study evaluated, at 5-year follow-up, the clinical outcomes of transcrestal sinus floor elevation (implant survival, regenerated tissue stability and formation of new apical cortical layer).

**Methods:** patients with residual crestal height < 5mm who underwent tSFE and implant-supported rehabilitation were included. Grafted area height was evaluated on periapical radiographs at functional loading (T0) and after 5 years of function (T1), using implant platform as landmark. Demographic data, anatomical variables and histomorphometric outcomes were correlated with implant failure rate, apical cortical layer formation and graft volumetric stability using univariate and multivariate regression logistic models.

**Results:** thirty-three patients were included. Implant failure

was recorded in 3 patients (9.1%): bucco-palatal sinus width > 16.5mm resulted to be a perfect predictor for this outcome. Mean height of grafted material at T0 and T1 was  $12.5 \pm 2.7$ mm and  $11.2 \pm 3.2$ mm, respectively. Mean graft resorption was  $1.3 \pm 1.9$ mm, showing strong inverse correlation with the percentage of newly formed bone after 6 months of healing ( $p < 0.000$ ). The formation of apical cortical layer was present in 14 out of 33 cases at T0 (42.4%) and in 21 out of 30 at T1 (70%). This outcome showed strong inverse correlation with bucco-palatal sinus width ( $p = 0.009$ ).

**Conclusions:** bucco-palatal sinus width seems to be a crucial factor influencing clinical and histological outcomes after tSFE. Careful preoperative planning and case selection is needed to optimize long-term results of this surgical technique.

## PRE-SHAPED TITANIUM MESHES AT DEHISCENCE-TYPE PERI-IMPLANT DEFECTS: A PROSPECTIVE STUDY

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**Aim:** the aim of the present prospective study was to evaluate the use of a newly preformed titanium mesh to support bone regeneration simultaneously to implant placement at dehiscence-type defects both from clinical and radiological outcomes. This device can be fixed directly to the implant with no need of extra fixation screws.

**Methods:** overall, 13 implants were placed in 8 patients. All sites were treated with preshape titanium mesh. Horizontal bone augmentation was promoted with autogenous bone and deproteinized bovine bone in a 1:1 ratio. Clinical measurements and radiographic evaluations (Cone Beam CT) were performed to assess the horizontal bone gain after 6 months from surgery.

**Results:** the healing proceeded uneventfully in the majority of patients. Late complications included loss of the cover screw in one patient and bilateral exposure of the titanium mesh at the occlusal-lingual aspect in another patient. Clinically, a mean horizontal bone gain of  $3.34 \pm 0.59$  mm, and a mean horizontal bone thickness of  $8.19 \pm 0.93$  mm were assessed. A mean horizontal bone gain of  $3.39 \pm 0.43$  mm associated with a mean horizontal thickness of  $8.50 \pm 0.50$  mm were observed radiographically. Well vascularized newly formed bone-like tissue was observed in intimate contact with the implants.

**Conclusions:** the results suggest that preformed titanium mesh may be effective in supporting simultaneous horizontal bone regeneration at dehiscence-type peri-implant defects.

## MARGINAL BONE MAINTENANCE WITH DIFFERENT PROSTHETIC EMERGENCE ANGLES

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**Aim:** many studies have shown throughout the years that over-contoured restorations tend to have an influence on gingival inflammation and plaque retention. The aim of this study is to investigate the influence on marginal bone level stability of restorations with different emergence angles (EA) of implants with internal conical connection and platform-switching.

**Methods:** the radiographic images were then analyzed with a software program (Image J, NIH, Montgomery County, Maryland, USA) to measure the peri-implant bone level (Marginal Bone Level, MBL). Measurements were made at mesial and distal aspect of each implant and were reported in millimeters. All radiographs were performed at the time of prosthetic deli-

very and at the follow-up visit through customized plastic supports. In addition, radiographs were used to measure the emergence angle (EA) between implant long axis and the line tangent to the restoration.

**Results:** results from the regression model showed that complete vs partial restoration and the time from prosthetic delivery (follow-up) are significant predictors of variation in MBL change (adjusted  $R^2 = 0.036$ ;  $F(5,306) = 2.302$ ;  $p = 0.045$ ).

**Conclusions:** within the limits of the present investigation, it could be concluded that emergence profile comprised between 30 and 50 degrees might not influence the marginal bone level stability in the short term.

## PERI-IMPLANT TISSUE HEALTH IN IMPLANT-SUPPORTED FIXED PARTIAL REHABILITATIONS

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**Aim:** to investigate peri-implant tissue health in patients with implant-supported fixed partial rehabilitations.

**Methods:** 44 patients rehabilitated with fixed partial implant-supported rehabilitations were included. The following parameters were measured: spontaneous bleeding, suppuration, bleeding on probing (BOP), probing depth (PD), plaque index (PI). Periapical radiographs were taken to measure crestal bone loss (BL). A non-parametric test (Spearman's rank coefficient) was used to identify possible correlations between the clinical parameters recorded.

**Results:** 121 implants have been analyzed. Mean PI and BOP were 1.98% and 0.80% respectively; there were no cases of suppuration (0.00), and only two implants showed spontaneous bleeding. Mean BL was 1.53 mm (SD 0.98). There was a very weak statistically significant correlation between PI and BL  $r_s = 0.26$   $p(2\text{-tailed}) = 0.65$ , and between PI and the other peri-implant parameters (BOP  $r_s = 0.13$   $p =$

0.13, PD  $r_s = 0.04$ ,  $p = 0.6$ ). A very weak correlation was also found between BL and BOP  $r_s: 0.1$   $p = 0.2$  and between BL and PD ( $r_s = 0.02$   $p = 0.7$ ). Correlation was found between BL and age ( $r_s = 0.13$ ,  $p = 0.81$ ) and between the other peri-implant parameters and age ( $\geq 65$  years) using dichotomized: (PI  $r_s: -0.14$ ,  $p = 0.11$ ; PD  $r_s: -0.21$   $p = 0.01$ ; BOP  $r_s: -0.21$   $p = 0.01$ ; SB  $r_s: 0.05$   $p = 0.53$ ). No statistically significant correlations were found between the clinical parameters evaluated and sex or the dental arch treated (maxilla vs. mandible). In contrast, the correlation between periodontal parameters and years since surgery (follow-up) was significant ( $p 0.75$ ,  $z\text{-score} = 12.9$ ).

**Conclusions:** the present research suggests that in implant-supported fixed partial rehabilitations, dental implants with greater plaque accumulation are more likely to present peri-implant health problems, although the correlation was statistically very weak.

## SHORT VERSUS LONGER IMPLANTS IN NON-ATROPHIC SITES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Aim:** the present meta-analysis aims to analyze the clinical performance of short compared to longer implants inserted in sites without the need for bone augmentation.

**Methods:** the protocol of the present PRISMA-driven meta-analysis was registered on PROSPERO (CRD42021264781). Electronic and manual searches were performed up to January 2022. All Randomized Controlled Trials (RCTs) comparing short ( $\leq 6$  mm) to longer ( $\geq 8.5$  mm) implants placed in non-atrophic and non-augmented sites were included. The quality of the included studies was assessed using the Cochrane risk of bias tool for randomized clinical trials (RoB 2) and the quality of evidence was determined with the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach. A meta-analysis was performed on implant survival rate, marginal bone level change (MBLc), technical and biologic complications at the available follow-up time points.

The power of the meta-analytic findings was determined by trial sequential analysis (TSA).

**Results:** from 1485 initial records, 13 articles were finally included. No significant difference was found in the survival rate between short and long implant at any follow-up (moderate quality of evidence). Significantly more bone loss for long implants at 1 and 5 years from implant placement and more technical complications with short implants at 10 years were found. No other significant inter-group differences in terms of MBLc, and biologic complications were detected.

**Conclusions:** a moderate evidence exists that short implants perform as well as longer ones in the rehabilitation of edentulous sites without the need for bone augmentation. Further studies, however, are still needed, to provide specific evidence-based clinical recommendations for an extended use of short implants in non-atrophic sites.

## WHAT WE KNOW ABOUT MALPRACTICE AND DENTAL IMPLANT PROSTHETIC THERAPIES: A SCOPING REVIEW

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**Aim:** the purpose of this scoping review is to search the current literature on malpractice and implant prosthesis to obtain information on the presence and incidence of malpractice in the onset of personal injury.

**Methods:** the research period considered runs from 1990 to 2022. The research was conducted on various databases using different keywords and applying suitable inclusion and exclusion criteria to obtain data relating to the lack of clinical tests and documentation, type of damage and type of proposed implant-prosthetic therapy.

Articles available in both English and Italian were included. The exclusion criteria applied exclude systematic reviews and case reports that have references other than implant-prosthetic therapies.

**Results:** of the 47 articles found, 31 were subjected to a review of the abstract. As a result, 7 fully reviewed articles were selected. 6 articles reported relevant information about the lack of clinical examinations and documentation, 4 reported information about the type of damage most frequent, while none of the reviewed articles reported information about the type of surgery implant or prosthetic implant rehabilitation involved in malpractice.

**Conclusions:** this scoping review highlighted a clear correlation between the lack of documentation necessary for the purpose of therapy and cases of malpractice, identifying the most frequent types of damage caused by therapeutic procedures. However, there is no specific indication of the most frequent types of implant prosthetic therapies involved to a greater extent in determining personal injury.

## MAINTAINABILITY OF NON-RESORBABLE MEMBRANES AFTER EXPOSURE: A SYSTEMATIC REVIEW

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**Aim:** non-resorbable membranes are nowadays used in horizontal and vertical bone regeneration and are divided into two main categories: titanium mesh and PTFE membranes.

The aim of this review is to investigate the possibility of keeping a non-resorbable membrane in place after exposure.

**Methods:** two independent reviewers electronically and manually searched the EMBASE, PubMed/MEDLINE, Scopus, and Cochrane bibliographic databases, to retrieve pertinent articles available between January 2000 and March 2021. Only human studies describing the type of treatment and the soft-tissue outcome following exposure of PTFE-ms or TMs were included.

**Results:** overall, 11 articles in the PTFE-ms group and 24 in the TMs group were included for data analysis. A statistically significant evidence of an association between the type of bar-

rier membrane and the exposure rate ( $P = .019$ ) and between the type of exposed device in terms of removal rate ( $P < .001$ ) was noted.

**Conclusions:** in conclusion, the titanium mesh can usually be left in place with no bone loss after delayed exposure, in case of early exposures bone regeneration is compromised instead. PTFE membranes are removed 2 weeks to 4 months after exposure with a regeneration rate of 90-100%, the e-PTFE must be removed in the first weeks while the d-PTFE could be left in place for a period between 2 - 4 months under plaque control. Premature removal of PTFE membranes is more common than that of titanium membranes, because the latter, especially custom-made membranes, show a lower degree of exposure and better responsiveness to treatment.



## PRE-SHAPED TITANIUM MESH FOR GBR WITH CONTESTUAL IMPLANT REHABILITATION: LITERATURE REVIEW

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**Aim:** the aim of the present review was to evaluate the use of a newly preformed titanium mesh to support bone regeneration simultaneously to implant placement at dehiscence-type defects both from clinical and radiological outcomes.

**Methods:** a search on the main databases as PubMed, Cochrane library, Medline was performed. Only human studies reporting the use of pre-shaped titanium mesh were included. The studies must indicate bone gain in percentage or in millimeters and observation time of the healing. Rehabilitation through implant must be reported.

**Results:** overall, 6 articles were included for data analysis. In 3 reports horizontal bone gain is evaluated by CBCT with a me-

an of  $3.94 \pm 0.89$  mm. Vertical bone gain is reported in 3 reports by clinical measurements or CBCT with a mean of  $4.21 \pm 1.13$  mm. Percentage bone gain varies between 80 and 93.5%. Reports have an average healing time of 5.6 months.

**Conclusions:** titanium mesh are advantageous devices applied to GBR procedures: Most literature studies, however, only report GBR procedures performed prior to implant placement. A therapeutic approach involving bone regeneration at the same time as fixture insertion would save time, reduce post-operative morbidity and number of surgeries, and reduce economic costs. As highlighted by literature, implant survival rate in regenerated bone is close to the one in native bone.

## TREATMENT OF PERIMPLANTITES: CURRENT SURGICAL AND NON-SURGICAL PROTOCOLS

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**Aim:** the purpose of this study is to systematically review the literature on the surgical regenerative treatment of the peri-implantitis.

**Methods:** four electronic databases were searched from 1990 to 2018. Research included human clinical trials of surgical treatment of peri-implantitis. Parameters evaluated: probing depth reduction, clinical attachment level gain, bleeding on probing reduction, radiographic bone fill, and mucosal recession.

**Results:** the first search obtained 883 citations, but only 21 articles were included in the review. Four groups have been identified: access flap and debridement only; resective approach; application of bone grafting material; guided bone regeneration. Non-resorbable and resorbable membranes were used. Contaminated implant surfaces were treated primarily with air abrasives, curets and implantoplasty. Chemotherapy was commonly accompanied by mechanical debridement. Implantoplasty with resective surgery was associated with a hi-

gher implant survival rate, reduced PD, and reduced bone loss compared with resective surgery alone. Care should be taken when performing implantoplasty on narrow implants as it can lead to fracture of the fixture. CO<sub>2</sub>, diode, and Er: YAG lasers have been applied in several studies, suggesting that these lasers produce results similar to hand curettes. Most surgical protocols included pre- or post-operative systemic antibiotics followed by chlorhexidine rinse.

**Conclusions:** currently available surgical approaches carry out some clinical benefits measured at surrogate endpoints in the short term. The therapeutic effect on implant survival and patient-centric outcomes is unknown. The results provided a PD reduction, among other parameters that could be used to predict treatment outcomes. Regenerative procedures using bone grafts and membranes appeared to result in a significant reduction in PD. The patient's general condition, defect characteristics and material type can affect outcomes.

## GRAPHENE-DOPED POLY (METHYL-METHACRYLATE) (PMMA) IMPLANTS OSSEOINTEGRATION

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**Aim:** graphene-based materials present high traction strength, an optimal thermal expansion coefficient, biological activity, absorption and lubrication capacity, flexibility and high resistance ratio. The aim of the present *in vivo* investigation was to assess the osseointegration of PMMA and GD-PMMA implants in rabbit knee-joints.

**Methods:** a total of eighteen (18) GD-PMMA implants and eighteen PMMA implants were positioned into the femoral knee joint of New Zealand male white rabbits and retrieved at 15, 30 and 60 days.

The biopsies were evaluated by Micro-CT and histomorphometry to evaluate the new bone formation and the osseointegration.

**Results:** the study findings reported that a successful osseointegration was achieved for 36 implants. A higher compo-

nent of cortical bone was reported in contact with the upper implant's threads, while the lower threads appeared in contact with newly formed bone and marrow spaces. No evidence of fibrous tissue interposition was reported for all implants. The osseointegration of the GP-PMMA and PMMA implants was confirmed by histomorphometry and Micro-CT. Wide parts of the implant surfaces appeared in close contact with the cortical bone, including the space in the medullary canal.

**Conclusions:** the present study findings reported that GD-PMMA improves the osseointegration in rabbit femurs. This should incentivize further research and formulations in order to obtain GD-PMMA with greater radiopacity.

Further experimental protocols involving animals *in vitro* and *in vivo* are necessary to evaluate a potential clinical use for the applications of dental implants on humans.

## MICRO-ROUGH SURFACE ENRICHED WITH CALCIUM AND PHOSPHORUS IMPROVES OSTEOBLASTS BIOACTIVITY

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**Aim:** the aim of this study was the evaluation of the response of human oral osteoblasts (hOBs) to three different titanium surfaces: Machined, double etched (Osteopore), and double etched surface enriched with Calcium and Phosphorus (CaP) (Nanopore).

**Methods:** the surface characterization was investigated by scanning electron microscopy (SEM) and by sessile drop technique. The biocompatibility and osteoinductive properties were assessed by: (i) cell proliferation at 2 and 5 days; (ii) adhesion by multiphoton microscopy at day 2; (iii) the interaction with Ti-discs by blue toluidine staining at day 5; (iv) Alkaline Phosphatase (ALP) activity at 14 days; (v) calcium deposition by Alizarin Red Staining (ARS) and Cetylpyridinium Chloride (CPC), at 14 days.

**Results:** the surface investigations confirmed that Nanopore and Osteopore were characterized by the same micro-topography and a reduced hydrophilicity, respect to Machined. Furthermore, they showed similar osteoblasts proliferation and adhesion that were increased compared to Machined. However, Nanopore attracted a higher number of osteoblasts and promoted higher osteogenic activity as observed by an increased ALP activity and calcium deposition, with respect to the other groups.

**Conclusions:** CaP enrichment of DAE surfaces seemed to stimulate oral osteoblasts response and osteogenic activity, inspiring their use for *in vivo* applications.

## CONTAMINATION OF ABUTMENTS BY ORAL BIOFILM: A MATHEMATICAL MODEL

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**Aim:** bacterial colonization of connection inner portion can be correlated with peri-implant bone loss and peri-implantitis. Many authors have suggested how decontamination can be promoted by micro-geographically smoother surfaces. Aim of this study is to build up a mathematical model capable to explain how roughness and wettability of a surface may affect bacterial contamination.

**Methods:** nine different surfaces used for abutment and implant junction manufacturing were submitted to SEM and Contact Angle Analysis. Oral biofilm taken from periodontal pocket with probing greater than 7 mm has been cultured on sterile samples. Contaminated samples were valuated with ImageJ using Cell-Count plugin. Obtained results were analyzed with MathLab software.

**Results:** surfaces roughness ranged from Sa=0,2 to Sa=21. Surfaces had wettability with maximum values of  $114 \pm 6.2$  at minimum  $48.7 \pm 2.7$ . The “Roughness–Wettability” mathematic model was thus investigated and led to the following equation: Contamination=  $a \cdot \text{wettability} + b \cdot \text{roughness} + c$  where  $a = -0.142$  (CI= 95%:  $-0.2712, -0.01475$ )  $b = 0.5273$  (CI= 95%:  $0.4001, 0.6546$ )  $c = 16.4$  (CI= 95%:  $5.461, 27.33$ )  $R^2_{\text{adjusted}} = 74.87\%$

**Conclusions:** surface roughness seems to increase the possibility of creating ecological niches conducive to bacterial colonization. Surface wettability increases the bioactivity of the surface by recalling integrins and proteins that seem to promote bacterial adhesion. Further studies will be needed to fully understand the dynamics of bacterial contamination.