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PRESENTATIONS

1 - Reconstruction of Craniomaxillofacial Bone Defects with 3D-Printed Bioceramic Implants

Maarten Verbist¹, Anne-Laure Vandeveldel¹, Geusens Joris¹, Sun Yi¹, Eman Shaheen¹, Robin Willaert¹

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Objective:

Bony defects in the craniomaxillofacial region can result in significant esthetic and functional problems. 3D-printed patient specific ceramic implants mimic human bone and have certain advantages in comparison to titanium implants. The ceramic implant has excellent osteoinductive, osteoconductive and angiogenic characteristics to achieve osteointegration. This presentation aims to highlight the potential and benefits of this new type of ceramic implants in craniomaxillofacial reconstruction surgery. In addition, the technical aspects and clinical application will be illustrated by clinical cases.

Materials and methods

The PubMed and Embase databases were searched for patients with craniomaxillofacial bone defects treated with bioceramic PSIs. Clinical outcomes such as biocompatibility, biomechanical properties, and aesthetics were evaluated and compared to those of commonly used titanium or poly-ether-ether-ketone (PEEK) implants and autologous bone grafts. Two clinical cases are presented to illustrate the surgical procedure and clinical outcomes of HA bioceramic PSIs.

Results

Literature review showed better a biocompatibility of HA PSIs than titanium and PEEK. The initial biomechanical properties were inferior to those of autologous bone grafts, PEEK, and titanium but improved when integrated. Satisfactory aesthetic results were found in our two clinical cases with good stability and absence of bone resorption or infection. Radiological signs of osteogenesis were observed in the two clinical cases six months postoperatively.

Conclusion

HA bioceramic PSIs have excellent biocompatible properties and imitate natural bone biomechanically and radiologically. They are a well-suited alternative for conventional biomaterials in the reconstruction of load-sharing bone defects in the craniomaxillofacial region.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

2 - Patients Specific Implants for Atrophic Jaw Rehabilitation a Series of 70 Printed Implants.

Yoav Leiser¹

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Customised 3D printed implants are a rapid and exciting field of medicine. The introduction of 3D printers helped push the field of customised rehabilitation a reality to both clinicians and patients alike. The presented lecture will focus on a protocol for implant restoration in all possible bone volumes upto 0.1mm of residual bone height using 3D printed implants. We will review a series of n=70 3D printed customized implants that were used in severe jaws atrophy including immediate implantation and immediate loading of total jaws, including the planning manufacturing and the use of PSI implants in various patients options.

Track

Track 2: Atrophic jaws solutions

3 - Guided Bone Regeneration by using Custom-Made Titanium Mesh vs PTFE Membrane: A Case Report and Usual Complication

Mahmut Sami Yolal¹, Aydın Özkan¹, Ömer Kara¹, Ömer Barak¹

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Aim: The aim of this case report is to compare the alveolar ridge changes and healing complications after guided bone regeneration (GBR) using a custom-made titanium mesh versus polytetrafluoroethylene(PTFE membrane) for vertical-horizontal augmentation of deficient alveolar ridges.

Materials-Methods: A 42-year-old female patient was referred to our clinic for implant treatment. The clinical-radiographic examination revealed mobility and massive bone loss in teeth 44-46-35-36. At the 3rd month follow-up after the extraction of these teeth, posterior regions of the mandible were recorded as Cawood-Howell Class VI and vertical-horizontal bone augmentation was planned. In this manner, firstly 60% autogenous (ramus)/40% xenogenous(bovine) bone graft was applied to the left mandibular region with a custom-made titanium mesh which was obtained by using the patient's tomography data. After 3 weeks, 60% autogenous (ramus)/40% xenogenous(bovine) bone graft was applied to the right mandibular region with PTFE membrane.

Results: At the 1st week clinical follow-up, the healing on the custom-made titanium mesh was uneventful. On the other hand erythema and edema were observed in the soft tissues on the PTFE membrane and conjunctivitis was observed extraorally. At the 3rd month radiographic control, bone gain and trabeculation formation under the custom-made titanium mesh were more prominent than under the PTFE membrane. The patient is still being followed up and implant treatment will be started at the 6th month.

Conclusion: Considering the short-term follow-up, custom-made titanium mesh application may be more advantageous compared to PTFE in terms of healing and bone gain.

Keywords: Atrophic mandible, polytetrafluoroethylene, custom-made titanium mesh

Track

4 - Subperiosteal implants for jaw atrophy- what have we learned so far

Tadej Dovšak¹, David Dovšak², Aleš Vesnaver¹, Vojko Didanovič¹, Janet Zimsek Mijovski³

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Introduction:

The aim of this presentation is to share our experience with three different designs of subperiosteal implants.

Materials and Methods:

We conducted a review of all patients who presented for dental rehabilitation with severe maxillary atrophy (Cawood Howell type IV or higher) at the Department of Oral and Maxillofacial Surgery in Ljubljana from January 1, 2020, onward. These patients were rehabilitated using subperiosteal implants of three distinct designs.

Results:

From January 1, 2020, onward, 19 patients were rehabilitated with subperiosteal implants at our department. The average follow-up period was 16 months. During this time, we removed three implants: two due to intraoral exposure and one due to framework fracture. We outline our surgical and prosthetic workflow, along with practical tips and lessons learned throughout the process.

Conclusions:

In cases of extreme jaw atrophy, subperiosteal implants can sometimes be the only viable option for prosthodontic rehabilitation. This presentation highlights our experience with three different types of subperiosteal implants and addresses the challenges encountered in planning, surgery, prosthodontics, and follow-up care.

Track

Track 2: Atrophic jaws solutions

5 - PSI - Long-Term Temporary Solution for Jaw Reconstruction

Petr Pošta¹, Lukáš Hauer¹, Jiří Genčur¹, Marie Sajenko¹, Christos Micopulos¹

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Reconstructive surgery, like other areas of our specialization, is constantly undergoing the development of treatment methods. We often have to deal with patients with jaw defects of various sizes and etiologies. Currently, the gold standard is reconstruction using autologous

tissues. However, in some cases, this is not possible and the surgeon must look for an alternative solution. Thanks to the developed technology of computer-assisted surgery (CAS) and the possibility of precise 3D printing of titanium and other materials, the surgeon has a wider range of methods for reconstructing missing tissues than before. In our article, we present the development of CAS and 3D printing in our department, and in case reports, we focus on the possibilities of jaw reconstruction using only patient specific implant (PSI), discussing the limits, advantages and disadvantages of such a treatment method.

Key words: PSI, CAS, reconstruction, 3D printing, titanium

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

6 - Minimally Invasive Foreign Body Removal Using Soft Tissue-Borne Patient-Specific Guides

Amjad Shhadeh¹, Shadi Daoud¹, Adeen Zoabi¹, Samer Srouji¹, Fares Kablan¹

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Foreign body retrieval in the facial region presents unique challenges due to its intricate anatomy and the proximity of vital structures. Introducing a soft tissue-borne patient-specific guide (PSG), this study aims to improve surgical accuracy while minimizing invasive techniques during foreign body removal. Six patients underwent PSG-guided procedures, with CT and CBCT imaging utilized for detailed segmentation and comprehensive analysis of both hard and soft tissues. This technique facilitated the planning and creation of stable, customized guides, with ultrasound tracing employed for intraoperative confirmation. All procedures were completed successfully, resulting in minimal scarring, no complications, and shortened operative times. The implementation of PSGs enhanced both surgical precision and efficiency, indicating their potential utility in foreign body removal across other areas of the body and in other maxillofacial surgical contexts.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

7 - Comparative Efficacy of Patient-Specific and Stock Implants in Temporomandibular Joint Replacement: A Systematic Review and Meta-analysis

Elias-Leon Nolden¹, Alexander Schulze Wenning², László Köles², Mihály Vasziló¹

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Patient-specific implants (PSI) have not demonstrated clear benefits over stock systems in temporomandibular joint replacement (TMR) surgeries. Our objective is to provide definitive, evidence-based recommendations that can guide clinical decisions in TMR based on the hypothesis that PSI is superior to stock in the rehabilitation of temporomandibular joint. A systematic search was performed in three databases following PRISMA Guidelines. Original studies reporting the functional outcome in human patients who received either uni- or bilateral implant from a custom or stock system were included. Random-effects model meta-analyses were performed, and mean difference (MD) reported. Subgroup analysis of individual patient data was performed by age and biological sex, and publication bias assessment was also conducted. The main outcome measured was maximal mouth opening (MMO) in millimeters, with additional evaluations of postoperative pain and diet. Forty-two studies with 2,221 patients were included in our meta-analysis. PSI demonstrated superior MMO in almost all follow-up times, with MD significant for pooled two-arm studies over 12 months (MD, 5.83 mm; 95% CI, 1.40-10.25; $P=0.025$). Pain outcomes were mixed, with stock showing greater immediate postoperative pain reduction ($P=0.002$), whereas custom implants were favored at 6-12 ($P=0.048$) and 12-24 months ($P=0.022$). Stock also showed dietary improvement after 24 months ($P=0.046$). Both PSI and stock implants effectively treat TMR. PSI enhances early mouth opening and long-term MMO, with varying pain and diet outcomes over time. This suggests that PSI should be used for complex movement restrictions. Results need to be interpreted with caution due to patient diversity in studies.

Track

Track 5. PS TMJ R

8 - Implant-prosthetic Rehabilitation of Atrophic Posterior Mandible with Additively Manufactured Custom-made Subperiosteal Implants

Luigi Angelo Vaira¹, Andrea Biglio¹, Giacomo De Riu¹

¹University of Sassari

The rehabilitation of severe atrophies in the posterior mandibular region remains a significant challenge in implantology. Traditional bone regeneration techniques, while effective, require multiple surgeries and extended treatment times, leading to a high burden for patients. Recent advancements in digital technology and additive manufacturing have reintroduced the use of custom-made subperiosteal implants as a graftless alternative for mandibular rehabilitation.

This presentation will explore the clinical application of additively manufactured, patient-specific subperiosteal implants for restoring function and aesthetics in cases of severe mandibular atrophy. We will discuss digital workflow protocols, from 3D imaging and CAD/CAM design to implant fabrication and surgical execution. Key aspects of implant design, fixation principles, and surgical planning will be highlighted, with a focus on optimizing stability and minimizing complications.

We will also examine post-operative outcomes, including soft tissue integration, peri-implant health, and long-term stability. The potential advantages of this approach over traditional bone grafting techniques, as well as its limitations and future research directions, will be analyzed.

By leveraging digital technology and personalized implant solutions, subperiosteal implants may offer a viable and predictable alternative for patients with advanced posterior mandibular atrophy, expanding the possibilities of implant-prosthetic rehabilitation.

Track

Track 2: Atrophic jaws solutions

9 - Accuracy Assessment of Computer-Assisted Mandibular Reconstructions Using Free Fibula Flap: A Single-Center Experience

Shadi Daoud¹, Amjad Shhadeh¹, Adeen Zoabi¹, Samer Srouji¹

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Background:

Mandibular reconstruction with a free fibula flap remains the gold standard for restoring function and aesthetics. The integration of computer-assisted planning and personalized plate design enhances precision, reduces operative time, and improves reproducibility. This study evaluates the accuracy of computer-assisted mandibular reconstructions by comparing postoperative outcomes to preoperative virtual plans, focusing on fibular segment alignment.

Methods:

Sixteen patients (7 males, 9 females; mean age 62.4 years) underwent mandibular reconstruction using free fibula flaps following resections for squamous cell carcinoma. Postoperative CT scans were analyzed to assess linear and angular discrepancies between planned and actual outcomes. Heat maps further evaluated deviations in fibular segment positioning.

Results:

The mean linear discrepancy between fibular fragments was 1.1 ± 0.3 mm, while that between healthy mandibular segments was 0.9 ± 0.4 mm. The mean angular discrepancy was $9.5 \pm 4.2^\circ$ for fibular fragments and $7.4 \pm 5.1^\circ$ for mandibular segments. Greater discrepancies were observed in reconstructions involving more segments, with three-segment cases showing a 0.9 mm increase in deviation.

Conclusion:

CAD/CAM-assisted mandibular reconstruction demonstrated high accuracy, with minimal deviations from virtual plans. Cutting and repositioning guides improved fibular segment placement, though accuracy declined with an increasing number of segments, underscoring the need for refinement in multi-segment reconstructions.

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

10 - Complications in Subperiosteal Implant Rehabilitation: Prevention and Management Strategies

Giacomo De Riu¹, Andrea Biglio¹, Luigi Angelo Vaira¹

¹University of Sassari- AOU Sassari

Subperiosteal implants have re-emerged as a viable solution for rehabilitating severe atrophies of the maxilla and mandible, particularly in patients unsuitable for conventional bone grafting. Despite their promising clinical outcomes, specific complications can arise, impacting implant stability, soft tissue health, and long-term success.

This presentation will focus on the most common complications associated with subperiosteal implants, including peri-implant soft tissue inflammation, implant exposure, screw loosening, and potential neurological complications. We will analyze the biological and mechanical factors contributing to these issues and discuss preventive strategies in surgical planning and implant design.

Key aspects such as proper patient selection, soft tissue management, optimal implant positioning, and fixation techniques will be explored. Additionally, we will outline evidence-based protocols for early detection and management of complications, emphasizing the importance of regular follow-ups and interdisciplinary collaboration.

By understanding the risks and implementing preventive measures, clinicians can enhance the predictability and longevity of subperiosteal implant rehabilitations, ensuring better functional and aesthetic outcomes for patients with severe jaw atrophies.

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

11 - The Evolution in Correction of Posttraumatic Enophthalmos

Zoe Nicolaou¹

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Management of post traumatic enophthalmos and diplopia resulting from orbital bone loss post significant challenges in reconstructive surgery. This presentation reviews the pertinent anatomy of the orbit, diagnostic modalities, indications for surgery and surgical approaches as they relate to the treatment of posttraumatic enophthalmos. Particularly, evaluates the effectiveness of patient specific titanium implants (PSIs) for addressing these conditions. Successful repair of late posttraumatic enophthalmos is likely related to the precision with which orbital anatomy can be restored. Will be presented in details several patients who underwent late reconstruction via PSI for unilateral complex orbital bone loss. These implants were customized via 3D mirroring techniques on the basis of high-resolution 3Dimensional computed tomography, 3DCBCT scans of the patients' unaffected orbits. All patients presented with significant preoperative enophthalmos. Orbital volume notably improved post surgically. Functional improvements were evident as both enophthalmos and diplopia resolved. By ensuring anatomical accuracy, patient specific titanium implants tailored from patient specific imaging and fabricated via advanced 3D printing technology, provide a precise,

effective and reliable solution for reconstructing complex orbital defects and performing complicated revision surgeries

Track

Track 4: Orbital inlay

12 - Custom-Made Subperiosteal Implants for Primary Maxillary Reconstruction: Feasibility, Challenges, and Clinical Outcomes

Andrea Biglio¹, Luigi Angelo Vaira¹, Giacomo De Riu¹

¹University of Sassari

Maxillary reconstruction following oncologic resection presents a significant challenge in restoring function and aesthetics. While microvascular bone flaps remain the gold standard, recent advances in digital technology and additive manufacturing have introduced custom-made subperiosteal implants as a viable alternative for primary maxillary reconstruction.

This presentation will explore the feasibility and clinical outcomes of additively manufactured subperiosteal implants in primary reconstructions, highlighting their advantages and limitations. We will discuss the digital workflow for implant planning, from imaging acquisition and virtual design to fabrication and intraoperative placement. Particular attention will be given to the integration of these implants with reconstructive flaps, their role in supporting prosthetic rehabilitation, and the challenges in adapting to intraoperative variations.

Potential complications such as soft tissue dehiscence, implant exposure, peri-implant mucositis, and their management strategies will be reviewed. Furthermore, we will analyze preventive measures to optimize implant stability, ensure proper tissue integration, and minimize postoperative complications. The discussion will also address the long-term implications of radiotherapy on transmucosal abutments and strategies to mitigate related complications.

By integrating personalized implant solutions with reconstructive techniques, subperiosteal implants offer a novel approach to restoring maxillary function and aesthetics in patients undergoing primary oncologic surgery. Further studies are needed to refine surgical protocols and evaluate long-term success rates

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

13 - Retrospective Analyses of Additively Manufactured Subperiosteal Jaw Implants in the Mandible

Casper Van den Borre¹, Maurice Mommaerts²

¹ZAS, ²Face-Ahead

This multicentre retrospective study evaluates the success rate, adverse events, and patient satisfaction related to additively manufactured subperiosteal jaw implants (AMSJI®) in the mandible. The study analyses data from 40 AMSJI® implants placed between 2017 and beginning of 2024 in 19 patients with severe mandibular atrophy (Cawood-Howell classes IV-VII). The findings reveal a high level of patient satisfaction, with and a survival rate of 92.5 % after an average follow-up of 804 days (SD ± 540 days). The most common post-operative adverse events were immediate oedema and temporary infection, which were generally managed with chlorhexidine mouth rinses, antibiotics, and paracetamol. One implant showed increased mobility (movement exceeding 1 mm in any direction) at the time of evaluation. Two other implants were removed due to persistent infection and suppuration, with a third implant scheduled for removal. Patient satisfaction in general was high at the time of the interview, with an average OHIP-14 score of 6.68 (SD ± 7.99) and a NRS score of 51.26 (SD ± 7.63). Mucosal recession (both buccal and lingual) was noted around 13 implants (32.25%); however, patients did not regard this as a functional or aesthetic concern.

Within the limitations of a short-term follow-up period, AMSJI in the mandible shows promise as an effective option for rehabilitating patients with severe mandibular atrophy. Despite the positive results, longer-term follow-up is necessary to confirm the implant system's durability and performance over time.

Track

Track 2: Atrophic jaws solutions

14 - The Clinical Accuracy of In-house designed Patient Specific Implant (PSI) for Orbital Floor Fractures Reconstruction

Adeeb Zoabi^{1,2}, Amjad Shhadeh^{1,2}, Shadi Daoud^{1,2}, Samer Srouji^{1,2}

¹Galilee Medical Center, ²Bar Ilan University

Objectives: In this research we examined the clinical accuracy of In-house designed PSIs for orbital floor reconstruction, the PSIs were designed by one of the participating surgeons.

Methods: The process of VSP and PSI design was conducted In-house at the Point-Of-Care 3D printing; DICOM of the CT scan were imported to D2P software for segmentation, and a 3D model of the midface was exported to FreeForm plus for VSP and PSI design. The PSI was designed upon the reconstructed fractured floor, using the software's mirroring function, and its position was confirmed on the CT images using the D2P software. The plate was then 3D printed using titanium. The orbital floor was approached via the trans-conjunctival incision, The 3D model extraction process was repeated for the post operative CT. The pre and post operative models were aligned automatically by the software, and the alignment was confirmed. 5 different corresponding points were chosen on both the designed PSI and the postoperative PSI model, and their XYZ values were compared.

Results: Our preliminary results indicated that the use of In-house 3D printed PSIs for orbital floor reconstruction has a high accuracy of less than 1.43 mm discrepancy in all XYZ

dimensions. Reduction of both the operation and hospitalization time and improve the clinical outcome

Conclusions: The use of 3D technology for VSP of PSI for orbital floor reconstruction can obtain a satisfying clinical outcome. The establishment of a Point-Of-Care 3D printing at your department can make it feasible for almost every trauma case of the midface.

Track

Track 4: Orbital inlay

15 - Prosthodontically Guided Subperiosteal Implant Design and Rehabilitation of Atrophic Maxilla

Janet Zimsek Mijovski¹, Milan Kuhar¹, Tadej Dovsak², Vojko Didanovic³

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When the bone volume of an atrophic maxilla is insufficient for conventional implant placement, a subperiosteal implant can be a viable option. Prosthodontically guided subperiosteal implants are designed to provide support for final prostheses.

We represent a unique design and rehabilitation process for a subperiosteal implant in the atrophic maxilla, prosthodontically guided to ensure that the final prosthesis (e.g., fixed or removable) will fit and function correctly.

After evaluating the patient's oral health, bone volume, and available soft tissue, a CBCT single scan with an intraorally placed radiopaque complete denture is performed. With a CBCT scan of the patient's midface, intraoral soft tissues, and the inserted patient's complete denture we obtain a high-quality outset for computer-assisted design and manufacture of a subperiosteal implant model. The subperiosteal implant is custom-designed based on the patient's anatomical needs and the prosthodontic treatment plan considering future rehabilitation. The titanium framework is fabricated to fit the contours of the atrophic maxilla, ensuring that it provides maximum support for the restoration. After the surgical procedure, a temporary fixed prosthesis is fabricated to fit the subperiosteal implant abutments. When a healing period is completed, the definitive fixed or removable denture is made.

Especially in cases of severe jaw atrophy, only prosthodontically guided rehabilitation, which ensures function and aesthetics without interference, offers the patient comfort and satisfaction.

Track

Track 2: Atrophic jaws solutions

16 - Simultaneous Bimaxillary Subperiosteal Implants Placement Using Vertical and Horizontal Osteotomy Guides: A Case Report

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Introduction:

Simultaneous bimaxillary subperiosteal implant placement remains rare, especially using vertical osteotomy guides (VOG) and horizontal osteotomy guides (HOG) in a single subject. This case highlights the successful adaptation of subperiosteal implants (AMSJIs) with precise osteotomy guidance and an optimized flap design, facilitating optimum soft tissue closure and healing.

Case Report:

A 53-year-old edentulous female with severe jaw atrophy underwent simultaneous subperiosteal implants placement for both jaws. Two maxillary and three mandibular AMSJI implants were secured in place following bone reductions, guided by VOGs and HOGs. To ease and optimize maxillary mucosal closure, two separate mucoperiosteal flaps were designed and elevated on both sides, while preserving the midline's central pedicled mucosa. A subperiosteal tunnel was created beneath this pedicle for surpassing the guides beneath it. Once both of the maxillary AMSJIs were fixated, Bichat's fat pad was then mobilized and repositioned over the buccal aspect of the implants acting as a second layer. At the end of the operation, healing abutments were placed, which were replaced by the temporary prostheses in 3 weeks time.

Results & Conclusion:

Postoperative healing was uneventful. We believe the modified maxillary flap design and the buccal fat pad repositioning played a crucial role in achieving optimal soft tissue closure. This case demonstrates the successful use of VOG and HOG in a simultaneous bimaxillary subperiosteal implants' placement case and highlights a flap technique that may enhance clinical outcomes, preventing early wound dehiscences or mucosal recessions.

Track

Track 2: Atrophic jaws solutions

17 - Eight Years of Experience in the Use of Patient Specific Jaw Implant for the Treatment of Severe Jaws Atrophies

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The rehabilitation of edulous jaws has the conventional endosseous implants as gold standard. Unfortunately, due to the concomitant presence of severe bone atrophy, this traditional method is not possible without the use of time-consuming bone regeneration techniques with moderate to high risks of complications and failure. Alternatives to bone grafting procedures are represented by short implants, narrow implants and tilted implants, but in the presence of severe atrophy even these techniques are sometimes not usable. An alternative technique is the subperiosteal implant: the development of new technologies has made it possible to manufacture customized implants (Patient Specific Jaw Implant P.S.J.I.); these P.S.J.I. are designed for the patient's specific anatomy and enable the selection of the most suitable anchorage areas also in presence of severely atrophic jaws. Experience in the use of digital subperiosteal implants for the treatment of severe jaws atrophies over the last 8 years is described

Track

Track 2: Atrophic jaws solutions

18 - Patient-Specific Implants Improve Accuracy in Splintless Orthognathic Surgery: A Systematic Review and Meta-Analysis

Darius Sandu^{1,2}, Alexander Schulze Wenning², Mojtaba Dahmardeh², Bence Szabo², Péter Hegyi^{2,3}, Gábor Varga^{2,4}, Gábor Gerber^{2,5}, Victor-Vlad Costan^{1,6}

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Objectives: Transferring the virtual plan into the operating room during Orthognathic Surgery (OS) is paramount. Splintless OS is rapidly evolving, and Patient-Specific Implants (PSI) are setting new standards. Thus, this systematic review and meta-analysis aimed to investigate the effectiveness of splintless OS using Patient-Specific Implants (PSI) and custom surgical guides over virtually planned splints.

Methods: This study included randomized and non-randomized controlled clinical trials comparing the accuracy of PSI and virtually planned splints for maxilla repositioning in OS. A systematic search was conducted on November 15, 2024, in PubMed, Embase, and Cochrane. The primary outcome was the accuracy of the surgery, which was assessed by mean linear and angular deviation from the planned position in the three axes of space.

Results: Of the 8563 identified studies, 16 met the inclusion criteria, and eight were further pooled for meta-analysis. Accuracy is significantly increased using PSI in OS. The results were statistically significant for the PSI in terms of linear deviation along the y-axis (MD= -0.47, 95% CI [-0.84, -0.10]), the x-axis (MD= -0.43, 95% CI [-0.82, -0.05]), and z-axis (MD= -0.37, 95% CI [-0.59, -0.14]). Concerning the angular deviation, PSI shows statistically significant results with

lower discrepancies in rotational movements around the y-axis (MD= -0.54, 95% CI [-1.03, -0.04]).

Conclusion: PSI consistently demonstrated significantly lower mean discrepancies, outperforming virtually planned splints. These findings suggest that PSI provides superior surgical accuracy and outcomes compared to virtually planned splints.

Keywords: Patient-Specific Implants, Splints, Orthognathic Surgery, Accuracy.

Track

Track 6: Orthognathic plates

19 - The Impact of 3D-printed PEEK Implant Manufacture and Post-Processing on Implant Durability

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Although most PEEK implants today are milled, 3D printing as a manufacturing method is slowly becoming more applicable. While it enables implant manufacture to be more precise to the desired design with less loss in material, it comes at a cost of reduced physical properties due to the underlying method. Three-dimensional printed implants often come with some shape irregularities that have not been intended in the design and a rugged surface which leads to a need to post-process the part to obtain the true desired shape.

For this study, three design samples were created and mechanically tested: a full infill sample, a full infill sample with a designated fixation hole, and a sample with a fixation hole that was post-processed mechanically by polishing the external surface and adapting the fixation hole size for the intended screw diameter. All designs had two samples printed and underwent a three-point bend test. Each sample was subject to a micro-computer tomography scan before and after testing.

The results showed that all samples had similar stress-strain behavior, meaning that mechanical post-processing did not significantly impact the physical properties of the samples. Interestingly, the fracture patterns of the samples showed that the fracture is not retained within a single layer and did not always propagate towards the fixation hole, implying that the infill pattern may play a role in determining fracture pattern behavior.

Mechanical post-processing of 3D-printed PEEK implants can improve aesthetic and medical outcomes without a reduction in their mechanical properties in non-load bearing applications.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

20 - Design and Manufacture of a Hydroxyapatite Patient-Specific Facial Implant

Matīss Kristiāns Dambergs¹, Oskars Radziņš^{1,2}, Mārtiņš Lauskis¹, Kristaps Stāmers^{1,2}, Klāvs Karlsons^{1,2}, Jānis Ločs^{2,3}

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Hydroxyapatite has long been used as a material for implants. With the help of computer assisted design and 3D printing it is possible to create patient-specific implants with complex geometries.

Several implant designs for a case were done based on the gyroid structure with a pore diameter of 80 μm and 60 μm as well as other designs with randomized and mesh-like structure with similar pore sizes. The designs were further edited to remove the need of a support structure during the printing process. Multiple printing positions were tested. All printed designs were subjected to a debinding and sintering process and scanned in a micro-computer tomography machine to access internal structure. Two design samples underwent sterilization by autoclaving and using ethanol to access the sterilization impacts via electron microscopy.

The gyroid structure design oriented in the printing direction led to the best quality results after the debinding and sintering steps, as the other designs had unwanted closure of some pores. The designs with pore size below 80 μm led to internal fractures after micro-computer tomography investigation. The electron microscopy images showed that autoclaving the printed samples caused slight deterioration of the hydroxyapatite crystals in certain orientation on the implant surface, while no such effect was found using ethanol sterilization.

Hydroxyapatite patient-specific implants encompass a design with a gyroid structure and 80 μm pores can be manufactured by 3D printing and is physically intact internally after heat treatment. In addition, steam sterilization of such implants induces change in the outer surface.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

21 - Enhancing Patient-Specific Mandibular Implants

Brecht Lenaerts^{1,2,3}, Arnout Dejana^{1,2}, Thibault Mertens^{1,2}, Yi Sun^{1,4}, G. Harry van Lenthe³, Brecht Van Hooreweder^{1,2}, Jos Vander Sloten^{1,3}

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Additive manufacturing (AM) has revolutionised mandibular reconstruction by enabling the creation of patient-specific implants (PSIs) that precisely match anatomical structures. These advancements have significantly improved the restoration of function and aesthetics for patients with severe mandibular defects. However, challenges remain, particularly in ensuring

the reliability and robustness of PSI designs, as evidenced by instances of in vivo fatigue failure.

To address these challenges, an innovative in-process remelting strategy is introduced. This technique significantly enhances the fatigue strength of implants by decreasing surface roughness and effectively ruling out sub-surface porosity, aiming to eliminate the need for hot isostatic pressing (HIP). The remelting process has demonstrated superior fatigue strength results compared to traditional methods such as polishing or sandblasting, providing a more reliable and durable solution for implant manufacturing.

In addition to remelting, a comprehensive virtual bench test has been developed to evaluate PSI reliability. This test integrates advanced finite element analysis (FEA) to simulate stress distribution within the implant and fatigue testing to estimate fatigue strength. The virtual bench test framework allows for the assessment of new remelting techniques and in-process additively manufactured locking screw systems, offering critical insights for both design and regulatory purposes.

The combination of in situ remelting and the virtual bench test aims to improve clinical outcomes, particularly in complex cases. By enhancing the reliability and durability of PSIs, this approach not only seeks to improve patient outcomes and quality of life but also aims to increase cost-efficiency by reducing the need for expensive post-processing steps.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

22 - Enhanced Jawline Contouring in Orthognathic Surgery: Integrating Patient-Specific Implants and Soft Tissue Refinement

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The global demand for jawline augmentation and mandibular contouring has significantly increased in recent years. However, achieving optimal mandibular angle definition in orthognathic surgery remains challenging due to the inherent limitations of conventional mandibular osteotomies. Traditional techniques primarily allow sagittal mandibular movements, without significantly modifying ramus height or contour.

The advent of computer-assisted surgical planning (CASP) and computer-aided design/computer-aided manufacturing (CAD/CAM) has introduced new strategies for jawline enhancement, including patient-specific implants (PSI) that can refine mandibular contouring beyond skeletal repositioning alone. Additionally, injectable products such as hyaluronic acid offer minimally invasive solutions to correct residual aesthetic imperfections and improve soft tissue symmetry postoperatively.

In this presentation, we aim to explore various methods for optimizing jawline definition during and after orthognathic surgery. Since jawline shape and mandibular contouring represent key aesthetic refinements, they must be assessed with both skeletal and soft tissue

considerations. We specifically focused on jawline enhancement by analyzing pre- and post-treatment 3D facial photographs of our patients, obtained using the VECTRA H2 Imaging System. Each jaw parameter was compared to ideal male and female mandibular angles, as defined by Professor Mommaerts.

In modern orthognathic planning, jawline definition should no longer be an afterthought, but rather an integral part of the treatment plan, incorporating both bony and soft tissue adjustments to achieve optimal facial harmony.

Track

Track 6: Orthognathic plates

23 - Use of Bone Resection Guides for AMSJI

Marco Rinaldo¹

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The AMSJI is a patient-specific implant, but in many cases the bone anatomy has a morphology that is not suitable for a subperiosteal implant. In fact, residual knife-edge bone ridges and an irregular bone morphology directly influence the design of the AMSJI that must rest on the bone surface. In addition, a secondary osseointegration has been demonstrated in the AMSJI, which occurs between the internal surface of the implant and the bone surface.

To optimize the bone morphology for the design of the AMSJI, we used bone reduction guides in both the vertical plane (VOG) and the horizontal plane (HOG). When planning osteotomies, we considered maintaining at least 3 mm of bone height below the floor of the maxillary sinuses and nose for safety. The HOG and VOG guides are made of titanium and fixed with osteosynthesis screws to the maxillary bone and guide osteotomies that can be performed using piezosurgery, and, or surgical saws and drills. The cutting guides can be used in a first preparatory intervention or simultaneously with the placement of the AMSJI.

After the first cases treated, we believe that the use of the horizontal guide should be increased to round the bone surface as much as possible.

It should also be emphasized that osteotomies allow a significant gain of gingival tissue and that gingival tissue augmentation techniques can also be considered at this stage.

Track

Track 2: Atrophic jaws solutions

24 - Extended Total Temporomandibular Joint Replacement: Feasibility, Outcomes, and Complications

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Prostheses for extended total temporomandibular joint replacement (eTJR) incorporate modifications to traditional alloplastic fossa-condyle joints to address adjacent bone defects. This study evaluates the feasibility, postoperative complications, and functional and aesthetic outcomes of eTJR. Patients aged 18 and older who underwent eTJR between 2014 and 2024 are included. Data collected include age, sex, comorbidities, surgical indications, prosthesis type, concomitant procedures, postoperative complications, maximum inter-incisal opening (MIO), pain levels, quality of life (QoL), and aesthetic outcomes. Twelve patients received 12 joint prostheses at Città della Salute e della Scienza Hospital, University of Torino, Italy. Over a median follow-up of 42 months, patients with restricted mouth opening at baseline experienced significant improvement in MIO, pain reduction, and enhanced QoL. In 86% of cases, both patients and surgeons reported facial appearance as either improved or unchanged. These findings suggest that eTJR is a safe and effective treatment for temporomandibular joint disease extending to adjacent structures, offering satisfactory functional and aesthetic outcomes.

Track

Track 5. PS TMJ R

25 - TMJ Ankylosis. Solution with Total Joint Replacement

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¹Charles University and Faculty Hospital Prague

TMJ ankylosis requires surgical intervention, with treatment involving the resection of the pathological connection between the mandible and the skull base. The current approach favors immediate joint reconstruction using a total joint prosthesis. This report presents the author's experience in managing TMJ ankylosis in a cohort of 48 patients who underwent surgery and simultaneous total joint replacement (TMJR) between 2006 and 2023. The study evaluates postoperative improvements in jaw mobility, complications related to surgery and joint reconstruction, and, in the long term, the risk of ankylosis recurrence.

Track

Track 5. PS TMJ R

26 - Patient-Specific Temporomandibular Condyle and Fossa Replacement: Outcomes from a large Multi-Centered Study (1-year + follow-up)

Maxim Valgaeren¹, Maurice Mommaerts^{1,2}

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The replacement of the temporomandibular joint, containing hemi- and total mandibular resections was already described in 19th century. The last decades, patient personalised prostheses took place next to stock prostheses for TMJ replacement. Nowadays,

patient-specific implants are more frequently chosen for cases with more significant joint degeneration. Although previous literature have shown no difference in pain and patient satisfaction after surgery, custom-made prostheses already showed an significant improvement of maximum interincisal opening (MIO) and fewer complications compared with stock prostheses. Nowadays, patient-specific implants are more frequently chosen for cases with more significant joint degeneration. The aim of this prospective, multicentred study is to further determine the functional and aesthetic outcomes in patients who received total alloplastic temporomandibular joint replacement. The cooperation between the university hospitals of Brussels, Turin and Prague led to compare outcomes of approximately one hundred cases in factors such as sex, age, total follow-up, unilateral or bilateral prosthesis and number of previous surgeries. The preliminary results show an improved quality of life with a reduced pain and diet score. This research proves the legitimate use of alloplastic TMJ replacement.

Track

Track 5. PS TMJ R

27 - Alloplastic TMJ Replacement in Childhood: Indications, Challenges, and Outcomes

Bert De Graeve¹, Maurice Mommaerts¹

¹European Face Centre, Universitair Ziekenhuis Brussel

Temporomandibular joint (TMJ) pathology in children presents unique challenges due to ongoing skeletal growth, functional demands, and long-term implant integration. While autogenous reconstruction remains the golden standard in growing patients, alloplastic TMJ replacement (ATJR) is a promising alternative. This presentation explores the indications, surgical considerations, and clinical outcomes of ATJR in pediatric patients. We will review cases involving congenital deformities and post-traumatic ankylosis. Special attention is given to implant longevity, growth-related concerns, and functional rehabilitation. Early results suggest that while ATJR in children remains controversial, it can provide significant improvements in jaw function, occlusal stability and mandibular growth.

Track

Track 5. PS TMJ R

28 - Patient-Specific Implants in Complex Craniofacial Reconstructions: Challenges and Solutions

Alireza Parhiz^{1, 2}

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Patient-specific implants (PSIs) play a crucial role in complex craniofacial reconstructions, particularly in cases involving extensive bone defects, intricate anatomical variations, and the

need for precise implant adaptation. Advances in medical imaging, digital design, and additive manufacturing have enabled the production of implants with high accuracy, optimal biocompatibility, and improved mechanical performance. This presentation will explore the key challenges in the design, manufacturing, and surgical application of patient-specific implants, including: • Material selection and biomechanical optimization • Managing anatomical complexities and customized surgical requirements • Enhancing osseointegration and minimizing soft tissue reactions • The role of digital tools in reducing design errors and facilitating surgery. Additionally, practical solutions to overcome these challenges and improve clinical outcomes for patients with severe craniofacial defects will be discussed. This talk is particularly relevant for maxillofacial surgeons, biomechanical specialists, PSI designers, and biomedical researchers seeking to advance the performance and effectiveness of craniofacial implants.

Track

Track 1: Advanced Techniques for Creating Patient Specific Implants

29 - Advanced AMSJI Scanning Protocols for Optimal Prosthetic Rehabilitation

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The development of patient-specific implant-supported prosthetics has significantly advanced with the introduction of AMSJI (Additively Manufactured Subperiosteal Jaw Implants) technology. Accurate digital planning and scanning protocols are fundamental to achieving predictable functional and aesthetic outcomes in maxillofacial rehabilitation. This presentation will outline the **dual-scan** methodology, including **intraoral and extraoral scanning techniques**, the integration of **CBCT imaging**, and the role of **mock-up prostheses** in treatment planning.

The selection between **fixed hybrid prostheses (Misch FP3)** and **removable overdentures (Misch RP4)** will be explored, emphasizing the importance of **prosthetic emergence profiles, occlusal considerations, and bone reduction requirements**. The protocol ensures precision in **vertical dimension assessment, midline alignment, occlusion evaluation, and perioral tissue support**. Best practices for **radiographic marker placement, metal artifact reduction strategies**, and **scan-prosthesis optimization** will be discussed to enhance treatment predictability.

By refining scanning techniques and aligning them with **CAD/CAM digital workflows**, clinicians can enhance patient outcomes, streamline the surgical-prosthetic workflow, and minimize complications. This multidisciplinary approach aligns with contemporary standards in implant dentistry, ensuring optimal functional, aesthetic, and long-term stability for complex maxillofacial cases.

Track

Track 8: other (Other like GBR, PSI supported facial prosthetics, standards for image capture,...)

30 - Comparative Clinical Outcomes of Two-Plate vs Four-Plate Patient-Specific Osteosynthesis in Le Fort I Osteotomies

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Patient-specific osteosynthesis (PSO) combined with virtual surgical planning (VSP) has advanced orthognathic surgery by enhancing surgical accuracy. In this retrospective study, we compared the clinical outcomes of two-plate versus four-plate fixation methods for Le Fort I osteotomies in bimaxillary procedures. A total of 23 patients operated on in 2024 were included, with eight receiving a two-plate PSO and 13 a four-plate PSO.

Postoperative cone-beam computed tomography (CBCT) at a week post-op was used to assess maxillary positioning by quantifying translational and rotational deviations. Our analysis revealed no statistically significant differences between the two fixation methods across all movement dimensions, indicating that the two-plate PSO approach achieves accuracy comparable to that of the four-plate PSO system.

Notably, the two-plate method may offer practical advantages such as reduced material costs and smaller surgical incisions without compromising outcomes. These findings are in line with previous reports demonstrating accurate outcomes with two-plate PSO fixation in Le Fort I osteotomies [1,2]. Although limited by a small sample size and the exclusion of segmental osteotomies, our study suggests that two-plate PSO fixation is a viable and less invasive alternative to conventional four-plate fixation. Further research with larger cohorts and extended follow-up is warranted to confirm long-term stability and broaden its applicability in more complex cases.

Track

Track 6: Orthognathic plates

31 - Assessment of Intra-operative and Post-operative Complications Associated with Custom Subperiosteal Jaw Implant (AMSJI) Applications in the Severely Atrophic Jaws

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Introduction:

AMSJIs offer a reliable solution for total/partial edentulism with significant bone loss. Despite their advantages, complications may arise during both the surgical procedure and/or the post-operative period. This study aims to evaluate the complications encountered following fourteen subperiosteal implants (AMSJIs) placed in seven subjects and their managements.

Materials and Methods:

Seven subjects (aged 50 to 68 years) were treated with fourteen subperiosteal implants (9 maxillary and 5 mandibular). The AMSJIs were placed following a standardized surgical protocol, and intra-operative and post-operative complications were monitored.

Results:

Intra-operatively, one drill was broken and stuck in the mandibular AMSJI. Besides that, there were no implant failures, fractures, non-fitting of the implants, infections, mobility, or screw loosening observed. Temporary pain, swelling and lip paresthesia was observed in all subjects. Minimal buccal gingival recessions around the posts or the body of the implants were observed in four subjects. In one case, there was also a significant palatal gingival recession.

Conclusion:

Overall, all subjects tolerated the procedures well. Gingival recessions were likely associated with a thin gingival phenotype and/or the pressure exerted by the immediately loaded prostheses. However, this did not affect the functionality of the implants nor it caused additional pain or other symptoms. Buccal fat pad repositioning improved maxillary mucosal coverage and supported soft tissue healing. As such, subperiosteal implants remain a reliable therapeutic option for patients with severe alveolar ridge atrophy. Further studies with extended follow-ups are needed to assess the long-term outcomes and potential delayed complications of this approach.

Track

Track 2: Atrophic jaws solutions

32 - Experience with Patient-Specific Osteosynthesis in Orthognathic Surgery

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Recent advancements in three-dimensional virtual surgical planning and patient-specific osteosynthesis (PSO) have improved the accuracy of orthognathic surgery. A growing body of literature—including randomized controlled trials and systematic reviews—demonstrates that PSO offers enhanced surgical accuracy over conventional methods employing CAD/CAM

splints and manually contoured plates . Despite these promising developments, debate persists regarding the optimal sequencing of bimaxillary procedures: whether a maxilla-first approach utilizing PSO fixation provides superior outcomes compared to a mandible-first strategy with an intermediate splint.

This review integrates current evidence and clinical experience to provide a broader perspective on sequencing strategies in orthognathic surgery. Literature suggests that the maxilla-first PSO approach may reduce deviations in translational and rotational parameters, thereby lessening the need for intraoperative adjustments and improving conformity to the preoperative 3D plan. Conversely, the traditional mandible-first approach, while familiar to many practitioners, can be more vulnerable to errors related to intraoperative condylar seating and manual plate bending.

By examining technical considerations and clinical outcomes, this review underscores the potential advantages of the maxilla-first PSO method while highlighting areas where further research is needed to refine accuracy in modern orthognathic surgery.

Track

Track 6: Orthognathic plates

33 - Application of Custom Implants in Pediatric Craniofacial Surgery

Krzysztof Dowgierd¹

¹Center for Craniofacial Anomalies and Maxillofacial Surgery for Children and Adolescents - Regional Specialist Children's Hospital in Olsztyn, Poland

Patient-specific implants (PSIs) have revolutionized craniofacial surgery, enabling precise, personalized anatomical reconstructions. Advanced CT imaging, 3D modeling, and 3D printing technologies allow for the creation of implants perfectly tailored to individual patients.

Biocompatible materials such as titanium, PEEK enhance integration and reduce surgical time.

In **pediatric craniofacial surgery**, PSIs are used to treat congenital deformities, trauma, and defects following oncological resections. Customized solutions ensure effective treatment while considering **bone growth dynamics** in young patients.

Clinical studies highlight **reduced operative time, lower complication rates, and improved functional and aesthetic outcomes**. Challenges such as cost and accessibility remain, but ongoing research and technological advancements continue to expand PSI applications in pediatric craniofacial surgery.

This presentation will explore **modern PSI design and manufacturing techniques**, their role in pediatric surgery, and emerging trends, shaping the future of craniofacial reconstruction

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

34 - Welcoming speech

Haye Glas¹

¹3DVSP BV

Haye Glas welcomes you, representing the fields of industry and engineering sciences. Haye Glas is a Technical Physician and 3D expert specializing in OMFS applications. He is the Director of 3D VSP B.V., a company focused on 3D virtual surgical planning for patient-specific medical devices. Holding a PhD in Medicine, his research encompasses areas such as augmented reality in surgery, 3D modeling, and virtual surgical planning.

Track

Welcoming speeches

35 - Invitation to EACMFS Athens

Nicholas Kalavrezos¹

¹President European Association for Cranio-Maxillo-Facial Surgery

I am pleased to invite you to the 28th EACMFS Congress, scheduled from 15th to 18th September 2026 in Athens, Greece.

As a Head and Neck Reconstructive OMF Surgeon and Lead Clinician at University College London Hospital, I am honored to lead this prestigious event. The congress will feature advancements in cranio-maxillo-facial surgery, offering a platform for knowledge exchange and professional development.

We encourage you to mark your calendars and register for this significant gathering in the historic city of Athens.

Track

Welcoming speeches

36 - TMJ replacement. From CT scan to implant

Julia Materialise¹

¹Materialise

Not yet submitted

Track

Track 5. PS TMJ R

37 - Correlation Between Design, Biotype, and Gingival Recession in AMSJI

Maurice Mommaerts¹

¹Face Ahead Private Clinic Antwerp

Not yet submitted

Track

Track 2: Atrophic jaws solutions

38 - TMJ Total Arthroplasty - From CT-Scan to Personalized Implant: Enhancing Patient Outcomes through Personalization and Virtual Surgical 3D Planning

Guillaume Dubois^{1, 2}

¹Global Market Manager CMF - Materialise, ²Associate Professor - Arts et Métiers ParisTech (ENSAM)

Temporomandibular joint (TMJ) disorders severely impact quality of life, causing chronic pain and impaired jaw function. TMJ total arthroplasty offers a viable solution for severe cases, but success depends on precise implant design and surgical execution.

This keynote will explore the **TMJ Total Arthroplasty System** by Materialise, which leverages advanced digital tools and personalized implants to enhance clinical outcomes. The process begins with a patient-specific CT scan, creating virtual 3D models for tailored surgical planning. From scan to surgery, interactive virtual planning, real-time design approval, and personalized implants ensure accuracy and alignment with each patient's unique anatomy. Key components include temporal and mandibular implants and Standard+ Solutions osteosynthesis screws for secure fixation.

This approach leads to significant pain relief, improved jaw function, and better post-surgical quality of life. With a 100% success rate after one year post-implantation, the system offers unmatched predictability and reliability.

The keynote will conclude with insights into the future of TMJ arthroplasty, highlighting advancements in digital technologies and their integration into clinical practice to further optimize patient care.

Track

Track 5. PS TMJ R

39 - Evaluating the Role of Custom-Made Subperiosteal Implants in Midface Reconstruction: Towards More Patient-Centered Solution

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Reconstructive strategies for midfacial defects, whether caused by oncological resection, trauma, or osteonecrosis, remain a complex and evolving field. Current approaches span a wide spectrum, from relatively simple closure using local soft tissue flaps combined with an obturator, to extensive autologous reconstructions such as fibula free flaps with enossal implants. Each of these methods carries specific advantages and limitations in terms of function, aesthetics, surgical burden, and patient-reported outcomes.

In recent years, custom-made, 3D-printed subperiosteal implants (PSIs) have emerged as a promising addition to the reconstructive armamentarium. By offering a patient-specific fit and eliminating the need for a donor site, PSIs may represent a middle ground between minimal and highly invasive techniques—potentially combining surgical efficiency with functional rehabilitation through fixed or removable prostheses.

This presentation provides an overview of current treatment options for midfacial defects, categorized by defect type and clinical context. It further explores the emerging role of PSIs, critically assessing their potential benefits, limitations, and indications based on available clinical experience. Rather than presenting final outcomes, the aim is to share insights from an ongoing research trajectory and stimulate discussion on where and how these implants might find their place in routine clinical practice.

Track

Track 3: Reconstructive PSI in case of maxillectomy/mandibulectomy

40 - Welcoming speech

Maurice Mommaerts¹

¹Organizing Committee Chairman

Prof. Maurice Mommaerts will welcome the delegates in place of Prof. Kalavresos, who is unable to attend on Friday.

Track

Track 8: other (Other like GBR, PSI supported facial prosthetics, standards for image capture,...)

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