Journal of
Clinical Medicine

MDPI

Editorial

Breakthroughs in Oral and Maxillofacial Surgery

Alessandro Antonelli *, Francesco Bennardo and Amerigo Giudice

School of Dentistry, Department of Health Sciences, Magna Graecia University of Catanzaro, 88100 Catanzaro, Italy; francesco.bennardo@unicz.it (F.B.); a.giudice@unicz.it (A.G.)
* Correspondence: alessandro.antonelli@unicz.it

1. Introduction

In the field of oral and maxillofacial surgery, continuous advances have ushered in a new era of innovation, profoundly influencing this branch of medicine. Cutting-edge technologies, techniques, and detailed analysis of the patient's local and general clinical conditions have transformed traditional surgical procedures, improving precision, efficiency, and patient outcomes [1,2].

From individual case planning using surgical simulation software to the use of 3D printing to create stereolithographic models and customized prostheses, the landscape of oral surgery has evolved significantly [3].

2. Discussion

Breakthroughs in oral and maxillofacial surgery have been driven by continuous research, innovation, and collaboration among surgeons, researchers, and engineers. The development and improvement in surgical techniques have enabled complex procedures such as orthognathic surgery, oncologic, and reconstructive surgery and the management of facial trauma to be performed with greater precision and improved outcomes [4–6]. Furthermore, the introduction of advanced imaging techniques, such as computed tomography (CT) scans and cone beam computed tomography (CBCT), has revolutionized diagnosis and treatment planning by providing detailed 3D images of the oral and facial structures [7–9].

In addition, the integration of three-dimensional imaging for the analysis of bone structures with non-invasive devices that enable the analysis of facial soft tissue has made it possible to more accurately assess the benefits that patients can derive from new surgical methods and custom-made treatment plans [10].

This background includes the latest generation of facial scanners and devices accessible to everyone, such as smartphones, that allow the capture of high-resolution 3D images of the patient's facial anatomy with remarkable precision [11]. Surgeons leverage this technology to create detailed digital models, enabling them to analyze complex craniofacial structures and plan interventions with unprecedented accuracy [12,13]. In fact, the relevance of encoded parameters becomes even more pronounced in the field of precision medicine, where tailored treatment strategies are designed based on individualized patient profiles [14].

As a result of continuous innovations in the medical and pharmacological fields, researchers have also had to find solutions to possible adverse reactions due to interactions with new drugs [15,16]. In particular, the development of new monoclonal antibodies for the management and treatment of oncological pathologies has had important repercussions on the management of pathologies associated with the action of these drugs on the maxillary bone [17].

The importance of the management of these patients, often subjected to multiple therapies, has highlighted the relevance of the management of possible odontogenic infections that can trigger adverse processes such as medication-related osteonecrosis of the

Citation: Antonelli, A.; Bennardo, F.; Giudice, A. Breakthroughs in Oral and Maxillofacial Surgery. *J. Clin. Med.* **2024**, *13*, 685. https://doi.org/10.3390/jcm13030685

Received: 7 January 2024
Accepted: 18 January 2024
Published: 24 January 2024

jaws [18]. In fact, researchers have recently demonstrated that the focus of this pathology is the inflammatory-infective state of the periodontal and alveolar bone, which is the main clue for the onset of this adverse drug reaction [18,19].

In recent years, during the COVID-19 pandemic, significant advancements and breakthroughs in oral surgery have emerged, driven by the need for enhanced safety measures and improved patient care [20]. The usefulness of telemedicine and virtual consultations has streamlined the pre-operative assessment process, reducing hospital access and minimizing potential exposure to the virus [20,21]. Furthermore, the rigorous infection control protocols implemented in oral surgery units have not only safeguarded patients and healthcare providers but have also set new standards for hygiene and safety in the field [22–24].

Another field of oral and maxillofacial surgery in which researchers have developed new procedures and analyzed biological phenomena is prosthetic implant surgery [25]. Although great emphasis has been placed on guided bone regeneration (GBR) procedures over the years, they are still often unpredictable and difficult to perform [26]. For this reason, clinicians and researchers have developed implant designs in consultation with engineers to exploit as much residual native bone as possible [27,28]. Equally, interest has been placed on new surgical methods for implant site preparation to modify the bone density at the osteotomy site walls to achieve higher and more predictable primary stability values [29–34]. In fact, it has been observed that a parameter such as primary implant stability is directly linked to the biological phenomenon of osseointegration and thus obtains a better success rate of implant prosthetic therapy in the medium to long term [35,36]. Precisely for this reason, another biological factor that is monitored over time is crestal marginal bone loss, which can occur over time and lead to possible peri-implantitis phenomena [37–39].

Taken together, the research included in this Special Issue highlights the relevance of new discoveries and breakthroughs in oral and maxillofacial surgery to improve routine care for a wide range of diseases that impact patient health. Furthermore, it is necessary to consider how a patient-specific approach has become necessary for optimal management of each individual clinical scenario.

3. Conclusions

In light of these considerations, clinicians and researchers should be aware of the need to implement notions coming from the medical and surgical fields with modern technological systems that benefit from engineering concepts for new therapeutic approaches that are changing the clinical scenario of facial pathologies. The relevance of breakthroughs in oral and maxillofacial surgery has become even more evident in the field of precision medicine, where tailored treatment strategies are designed based on individualized patient profiles.

Conflicts of Interest: The author declares no conflicts of interest.

References

1. Singhal, I.; Kaur, G.; Neefs, D.; Pathak, A. A Literature Review of the Future of Oral Medicine and Radiology, Oral Pathology, and Oral Surgery in the Hands of Technology. *Cureus* **2023**, *15*, e45804. [CrossRef]
2. Reddy, C.L.; Patterson, R.H.; Wasserman, I.; Meara, J.G.; Afshar, S. Oral and Maxillofacial Surgery: An Opportunity to Improve Surgical Care and Advance Sustainable Development Globally. *Oral Maxillofac. Surg. Clin. N. Am.* **2020**, *32*, 339–354. [CrossRef] [PubMed]
3. Meglioli, M.; Naveau, A.; Macaluso, G.M.; Catros, S. 3D printed bone models in oral and cranio-maxillofacial surgery: A systematic review. *3D Print Med.* **2020**, *6*, 30. [CrossRef] [PubMed]
4. Chen, Z.; Mo, S.; Fan, X.; You, Y.; Ye, G.; Zhou, N. A Meta-analysis and Systematic Review Comparing the Effectiveness of Traditional and Virtual Surgical Planning for Orthognathic Surgery: Based on Randomized Clinical Trials. *J. Oral Maxillofac. Surg.* **2021**, *79*, e1–e471.e19. [CrossRef] [PubMed]
5. Mazzola, F.; Smithers, F.; Cheng, K.; Mukherjee, P.; Hubert Low, T.H.; Ch'ng, S.; Palme, C.E.; Clark, J.R. Time and cost-analysis of virtual surgical planning for head and neck reconstruction: A matched pair analysis. *Oral Oncol.* **2020**, *100*, 104491. [CrossRef] [PubMed]

6. Sivolella, S.; Brunello, G.; Panda, S.; Schiavon, L.; Khoury, F.; Del Fabbro, M. The Bone Lid Technique in Oral and Maxillofacial Surgery: A Scoping Review. *J. Clin. Med.* **2022**, *11*, 3667. [CrossRef] [PubMed]
7. Barone, S.; Antonelli, A.; Averta, F.; Diodati, F.; Muraca, D.; Bennardo, F.; Giudice, A. Does Mandibular Gonial Angle Influence the Eruption Pattern of the Lower Third Molar? A Three-Dimensional Study. *J. Clin. Med.* **2021**, *10*, 4057. [CrossRef] [PubMed]
8. Assouline, S.L.; Meyer, C.; Weber, E.; Chatelain, B.; Barrabe, A.; Sigaux, N.; Louvrier, A. How useful is intraoperative cone beam computed tomography in maxillofacial surgery? An overview of the current literature. *Int. J. Oral Maxillofac. Surg.* **2021**, *50*, 198–204. [CrossRef]
9. Barone, S.; Antonelli, A.; Bocchino, T.; Cevidanes, L.; Michelotti, A.; Giudice, A. Managing Mandibular Second Molar Impaction: A Systematic Review and Meta-Analysis. *J. Oral Maxillofac. Surg.* **2023**, *81*, 1403–1421. [CrossRef]
10. Zhao, Y.J.; Xiong, Y.X.; Wang, Y. Three-Dimensional Accuracy of Facial Scan for Facial Deformities in Clinics: A New Evaluation Method for Facial Scanner Accuracy. *PLoS ONE* **2017**, *12*, e0169402. [CrossRef]
11. Antonelli, A.; Barone, S.; Bennardo, F.; Giudice, A. Three-dimensional facial swelling evaluation of pre-operative single-dose of prednisone in third molar surgery: A split-mouth randomized controlled trial. *BMC Oral Health* **2023**, *23*, 614. [CrossRef]
12. Antonacci, D.; Caponio, V.C.A.; Troiano, G.; Pompeo, M.G.; Gianfreda, F.; Canullo, L. Facial scanning technologies in the era of digital workflow: A systematic review and network meta-analysis. *J. Prosthodont. Res.* **2023**, *67*, 321–336. [CrossRef]
13. Rasteau, S.; Sigaux, N.; Louvrier, A.; Bouletreau, P. Three-dimensional acquisition technologies for facial soft tissues—Applications and prospects in orthognathic surgery. *J. Stomatol. Oral Maxillofac. Surg.* **2020**, *121*, 721–728. [CrossRef]
14. Schwendicke, F.; Krois, J. Precision dentistry-what it is, where it fails (yet), and how to get there. *Clin. Oral Investig.* **2022**, *26*, 3395–3403. [CrossRef]
15. Aziz, Y.; Rademacher, W.M.H.; Hielema, A.; Wishaw, S.B.P.; van Diermen, D.E.; de Lange, J.; Vissink, A.; Rozema, F.R. Oral adverse effects: Drug-induced tongue disorders. *Oral Dis.* **2021**, *27*, 1528–1541. [CrossRef]
16. Fung, P.; Bedogni, G.; Bedogni, A.; Petrie, A.; Porter, S.; Campisi, G.; Bagan, J.; Fusco, V.; Saia, G.; Acham, S.; et al. Time to onset of bisphosphonate-related osteonecrosis of the jaws: A multicentre retrospective cohort study. *Oral Dis.* **2017**, *23*, 477–483. [CrossRef] [PubMed]
17. Amigo-Basilio, M.; Álvarez-González, C.; Cobo-Vázquez, C.; Leco-Berrocal, I.; Sáez-Alcaide, L.M.; Méniz-García, C. Management of Patients under Treatment with Monoclonal Antibodies and New Biological Therapies. *Appl. Sci.* **2021**, *11*, 4865. [CrossRef]
18. Otto, S.; Aljohani, S.; Fliefel, R.; Ecke, S.; Ristow, O.; Burian, E.; Troeltzsch, M.; Pautke, C.; Ehrenfeld, M. Infection as an Important Factor in Medication-Related Osteonecrosis of the Jaw (MRONJ). *Medicina* **2021**, *57*, 463. [CrossRef] [PubMed]
19. Kuehn, S.; Scariot, R.; Elsalanty, M. Medication-Related Osteonecrosis: Why the Jawbone? *Dent. J.* **2023**, *11*, 109. [CrossRef] [PubMed]
20. Zimmermann, M.; Nkenke, E. Approaches to the management of patients in oral and maxillofacial surgery during COVID-19 pandemic. *J. Craniomaxillofac. Surg.* **2020**, *48*, 521–526. [CrossRef]
21. Gangwani, P.; Mooneyham, R.; Feng, C.; Kopycka-Kedzierawski, D.; Kolokythas, A. Accuracy of Telemedicine Consultations in Oral and Maxillofacial Surgery During the COVID-19 Pandemic. *J. Oral Maxillofac. Surg.* **2023**, *81*, 65–71. [CrossRef]
22. Alterman, M.; Nassar, M.; Rushinek, H.; Cohen, A.; Shapira, L.; Casap, N. The efficacy of a protective protocol for oral and maxillofacial surgery procedures in a COVID-19 pandemic area-results from 1471 patients. *Clin. Oral Investig.* **2021**, *25*, 5001–5008. [CrossRef]
23. Sbricoli, L.; Schiavon, L.; Brunello, G.; Brun, P.; Becker, K.; Sivolella, S. Efficacy of different mouthwashes against COVID-19: A systematic review and network meta-analysis. *Jpn. Dent. Sci. Rev.* **2023**, *59*, 334–356. [CrossRef]
24. Zhurakivska, K.; Troiano, G.; Pannone, G.; Caponio, V.C.A.; Lo Muzio, L. An Overview of the Temporal Shedding of SARS-CoV-2 RNA in Clinical Specimens. *Front. Public Health* **2020**, *8*, 487. [CrossRef] [PubMed]
25. Heboyan, A.; Zafar, M.S.; Karobari, M.I.; Tribst, J.P.M. Insights into Polymeric Materials for Prosthodontics and Dental Implantology. *Materials* **2022**, *15*, 5383. [CrossRef] [PubMed]
26. Ivanovski, S.; Breik, O.; Carluccio, D.; Alayan, J.; Staples, R.; Vaquette, C. 3D printing for bone regeneration: Challenges and opportunities for achieving predictability. *Periodontology* **2023**, *93*, 358–384. [CrossRef]
27. Gupta, Y.; Iyer, R.; Dommeti, V.K.; Nutu, E.; Rana, M.; Merdji, A.; Biswas, J.K.; Roy, S. Design of dental implant using design of experiment and topology optimization: A finite element analysis study. *Proc. Inst. Mech. Eng. H* **2021**, *235*, 157–166. [CrossRef]
28. Antonelli, A.; Barone, S.; Attanasio, F.; Salviati, M.; Cerra, M.G.; Calabria, E.; Bennardo, F.; Giudice, A. Effect of Implant Macro-Design and Magnetodynamic Surgical Preparation on Primary Implant Stability: An In Vitro Investigation. *Dent. J.* **2023**, *11*, 227. [CrossRef] [PubMed]
29. Linn, T.Y.; Salamanca, E.; Aung, L.M.; Huang, T.K.; Wu, Y.F.; Chang, W.J. Accuracy of implant site preparation in robotic navigated dental implant surgery. *Clin. Implant. Dent. Relat. Res.* **2023**, *25*, 881–891. [CrossRef]
30. Bhargava, N.; Perrotti, V.; Caponio, V.C.A.; Matsubara, V.H.; Patalwala, D.; Quaranta, A. Comparison of heat production and bone architecture changes in the implant site preparation with compressive osteotomes, osseodensification technique, piezoelectric devices, and standard drills: An ex vivo study on porcine ribs. *Odontology* **2023**, *111*, 142–153. [CrossRef]
31. Stacchi, C.; Troiano, G.; Montaruli, G.; Mozzati, M.; Lamazza, L.; Antonelli, A.; Giudice, A.; Lombardi, T. Changes in implant stability using different site preparation techniques: Osseodensification drills versus piezoelectric surgery. A multi-center prospective randomized controlled clinical trial. *Clin. Implant. Dent. Relat. Res.* **2023**, *25*, 133–140. [CrossRef]

32. El-Kholey, K.E.; Elkomy, A. Does the Drilling Technique for Implant Site Preparation Enhance Implant Success in Low-Density Bone? A Systematic Review. *Implant Dent.* **2019**, *28*, 500–509. [CrossRef]
33. Mello-Machado, R.C.; Sartoretto, S.C.; Granjeiro, J.M.; Calasans-Maia, J.A.; de Uzeda, M.J.P.G.; Mourão, C.F.A.B.; Ghiraldini, B.; Bezerra, F.J.B.; Senna, P.M.; Calasans-Maia, M.D. Osseodensification enables bone healing chambers with improved low-density bone site primary stability: An in vivo study. *Sci. Rep.* **2021**, *11*, 15436. [CrossRef] [PubMed]
34. Yu, X.; Chang, C.; Guo, W.; Wu, Y.; Zhou, W.; Yu, D. Primary implant stability based on alternative site preparation techniques: A systematic review and meta-analysis. *Clin. Implant Dent. Relat. Res.* **2022**, *24*, 580–590. [CrossRef] [PubMed]
35. Guglielmotti, M.B.; Olmedo, D.G.; Cabrini, R.L. Research on implants and osseointegration. *Periodontology* **2019**, *79*, 178–189. [CrossRef] [PubMed]
36. Bosshardt, D.D.; Chappuis, V.; Buser, D. Osseointegration of titanium, titanium alloy and zirconia dental implants: Current knowledge and open questions. *Periodontology* **2017**, *73*, 22–40. [CrossRef] [PubMed]
37. Tomar, S.; Saxena, D.; Kaur, N. Marginal bone loss around implants with platform switching and platform matched connection: A systematic review. *J. Prosthet. Dent.* **2023**. *Online ahead of print*. [CrossRef]
38. Marconcini, S.; Giammarinaro, E.; Covani, U.; Mijiritsky, E.; Vela, X.; Rodríguez, X. The Effect of Tapered Abutments on Marginal Bone Level: A Retrospective Cohort Study. *J. Clin. Med.* **2019**, *8*, 1305. [CrossRef]
39. Stacchi, C.; Lamazza, L.; Rapani, A.; Troiano, G.; Messina, M.; Antonelli, A.; Giudice, A.; Lombardi, T. Marginal bone changes around platform-switched conical connection implants placed 1 or 2 mm subcrestally: A multicenter crossover randomized controlled trial. *Clin. Implant. Dent. Relat. Res.* **2023**, *25*, 398–408. [CrossRef]