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DT Journal

1 2022

Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology

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Official Journal of the
Ukrainian Association for
Maxillofacial and Oral Surgeons

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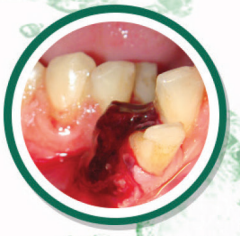
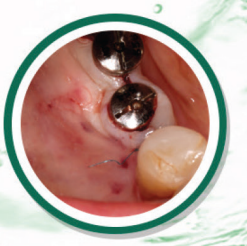
TANTUM VERDE®

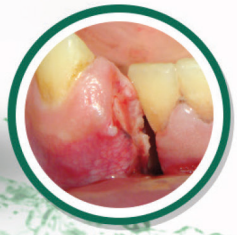
QUICK RELIEF FROM PAIN AND INFLAMMATION IN THE MOUTH AND THROAT[1]

AN INTEGRAL COMPONENT OF THE TREATMENT OF PAIN AND INFLAMMATION IN THE ORAL CAVITY IN 60 COUNTRIES WORLDWIDE![2]

- **JAWS FRACTURES[3]**
- **IMPLANTS PLACEMENT[4]**
- **WOUNDS OF ORAL CAVITY[5]**







Reg. № UA/3920/01/01

LOCAL ANESTHETIC AND ANTI-INFLAMMATORY EFFECT[1]

SUMMARY OF PRODUCT CHARACTERISTICS

NAME OF THE MEDICINAL PRODUCT. Tantum Verde 0.15% mouthwash. QUALITATIVE AND QUANTITATIVE COMPOSITION. Each 100 ml contains: active ingredient: benzydamine hydrochloride 0.15 g (equivalent to 0.134 g of benzydamine). **Therapeutic indications.** Treatment of symptoms such as irritation/inflammation including those associated with pain in the oropharyngeal cavity (e.g. gingivitis, stomatitis and pharyngitis), including those resulting from conservative or extractive dental therapy. **Posology and method of administration.** Pour 15 ml of Tantum Verde mouthwash into the measuring cup, 2-3 times per day, using it either at full concentration or diluted. If diluted, add 15 ml of water to the graduated cup. Do not exceed the recommended dosage. **Contraindications.** Hypersensitivity to benzydamine or to any of the excipient. **PHARMACOLOGICAL PROPERTIES. Pharmacodynamic properties.** Pharmacotherapeutic group: Stomatologic drugs: other agents for local oral treatment, ATC code: A01AD02. Clinical studies demonstrate that benzydamine is effective in relieving suffering from localised irritation of the mouth and pharynx. In addition, benzydamine possesses a moderate local anaesthetic effect. **Pharmacokinetic properties.** Absorption. Absorption through the oropharyngeal mucosa is demonstrated by the presence of measurable quantities of benzydamine in human plasma. These levels are insufficient to produce systemic effects. Distribution. When applied locally, benzydamine has been shown to accumulate in inflamed tissues where it reaches effective concentrations because of its capacity to penetrate the epithelial lining.

Information about medicines. Information for health care professionals for use in professional activities.

1. Інструкція для медичного застосування лікарського засобу Тантум Верде®, розчин для ротової порожнини, РП № UA/3920/01/01, затверджено Наказом Міністерства охорони здоров'я України № 636 від 01.10.2015.
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4. 4,5. Tymofieiev O.O. et al"Prevention of inflammatory complications upon surgeries in maxillofacial region". J Diagn Treat Oral Maxillofac Pathol. 2017;1:105–12.

Clinical and CT images are courtesy of: Ievgen Fesenko (Department of Oral & Maxillofacial Surgery, PHEI "Kyiv Medical University", Kyiv, Ukraine), Oleg Mastakov ("SCIEDECE—Scientific Center of Dentistry & Ultrasound Surgery" Kyiv, Ukraine)

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Dileo FARMA

About the Journal: Aims and Scope

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Official Title

Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology

Standard Abbreviation: ISO 4

J. Diagn. Treat. Oral Maxillofac. Pathol.

Acronym

JDTOMP

International Standard Serial Number (ISSN)

Electronic ISSN 2522-1965

Aims & Scope

This is a monthly peer-reviewed oral and maxillofacial surgery journal focused on: Microvascular and jaw reconstructive surgery, dental implants, salivary gland tumors/diseases, TMJ lesions, virtual surgical planning, implementation of ultrasonography into the practice of oral and maxillofacial surgeons.

Editorial Board (EB) Composition

- EB shows significant geographic diversity representing 29 opinion leaders from 13 countries: Brazil, Canada, Colombia, Greece, Hong Kong (SAR, China), India, Israel, Italy, Slovak Republic, Spain, Ukraine, United Arab Emirates, and United States.
- The majority of the EB Members have a discernible publication history in Scopus, Web of Science, and journals with a high impact factor.
- The publication records of all EB members are consistent with the stated scope and published content of the journal.
- The journal has a several full-time professional editors.
- Gender distribution of the editors: 10.34% women, 89.65% men, 0% non-binary/other, and 0% prefer not to disclose.

Frequency

12 print/online issues a year (from January 2020)

Publication History

2017: 4 issues a year
2018: 4 issues a year
2019: 10 issues a year
From 2020: 12 issues a year

Publishing Model

Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology is a fully open access and peer-reviewed publication.

Type of Peer Review

The journal employs "double blind" reviewing.

Article Publishing Charge (APC)

During hard times of Covid-19 pandemic our journal trying to support authors by reducing the APC by 50%. And by the end of March 2022 the APC will be 100 USD and 50 USD (excluding taxes) depending on the article`s type. Details at website: dtjournal.org.

13 Types of Articles Currently Published by the Journal

Editorials/Guest Editorials/Post Scriptum Editorials, Images, Case Reports/Case Series, Original Articles, Review Articles, Discussions, Paper Scans (*synonyms*: Review of Articles, Literature Scan), Book Scans (*synonym*: Book Reviews), Letters to the Editor (*synonym*: Letters), and Viewpoints.

State Registration: Ministry of Justice of Ukraine

Registration: Jul 28, 2016 (Certificate: КВ № 22251-12151 Р)
Re-registration: May 21, 2019 (Certificate: КВ № 23999-13839 ПР)
Re-registration: Aug 10, 2021 (Certificate: КВ № 24951-14891 ПР)

Co-Founders

1. Shupyk National Healthcare University of Ukraine (formerly known as Shupyk National Medical Academy of Postgraduate Education).
2. Private Higher Educational Establishment "Kyiv Medical University."
3. OMF Publishing, Limited Liability Company.

Publisher

OMF Publishing, LLC is an academic publisher focused on medical and linguistic sciences.
Address: 13-A Simferopolska Street, Office 121, Kyiv 02096, Ukraine.

Crossref Membership

OMF Publishing, LLC is a member of Publishers International Linking Association, Inc. which doing business as a Crossref. OMF Publishing`s active membership: From February 2017 to present.

Official Journal of the Association

Ukrainian Association for Maxillofacial and Oral Surgeons

Ukrainian Association for Maxillofacial and Oral Surgeons (UAMOS)

Address: 4-A Profesora Pidvysotskoho Street, Kyiv 01103, Ukraine.
Tel., fax: +38 044 528 35 17.
Website: uamos.org.

Editorial Board

JANUARY 2022 • VOLUME 6 • ISSUE 1
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TANTUM VERDE®

INFORMATION LEAFLET
for the medicinal product

Composition:
active substance: **benzydamine hydrochloride**;
100 mL of solution contain benzydamine hydrochloride 0.15 g;
excipients: ethanol 96%, glycerol, methyl parahydroxybenzoate (E 218), flavor (menthol), saccharin, sodium hydrocarbonate, Polysorbate 20, Quinoline Yellow (E 104), Patent Blue V (E 131), purified water.

Dosage form. Oromucosal solution.
Basic physical and chemical properties: a clear green liquid with a typical mint flavor.

Pharmacotherapeutic group. Dental preparations. Other agents for local oral treatment.
ATC code: A01A D02.

Pharmacological properties.
Pharmacodynamics.
Benzydamine is a non-steroidal anti-inflammatory drug (NSAID) with analgesic and antiexudative properties.

Clinical studies have shown that benzydamine is effective in the relief of symptoms accompanying localized irritation conditions of the oral cavity and pharynx. Moreover, benzydamine has anti-inflammatory and local analgesic properties, and also exerts a local anesthetic effect on the oral mucosa.

Pharmacokinetics.
Absorption through the oral and pharyngeal mucosa has been proven by the presence of measurable quantities of benzydamine in human plasma. However, they are insufficient to produce any systemic pharmacological effect. The excretion occurs mainly in urine, mostly as inactive metabolites or conjugated compounds.

When applied locally, benzydamine has been shown to cumulate in inflamed tissues in an effective concentration due to its ability to permeate through the mucous membrane.

Clinical particulars.
Indications.
Symptomatic treatment of oropharyngeal irritation and inflammation; to relieve pain caused by gingivitis, stomatitis, pharyngitis; in dentistry after tooth extraction or as a preventive measure.
Contraindications.
Hypersensitivity to the active substance or to any other ingredients of the product.

Interaction with other medicinal products and other types of interaction.
No drug interaction studies have been performed.

Warnings and precautions.
If sensitivity develops with long-term use, the treatment should be discontinued and a doctor should be consulted to get appropriate treatment.

In some patients, buccal/pharyngeal ulceration may be caused by severe pathological processes. Therefore, the patients, whose symptoms worsen or do not improve within 3 days or who appear feverish or develop other symptoms, should seek advice of a physician or a dentist, as appropriate.

Benzydamine is not recommended for use in patients hypersensitive to acetylsalicylic acid or other non-steroidal anti-inflammatory drugs (NSAIDs).

The product can trigger bronchospasm in patients suffering from or with a history of asthma. Such patients should be warned of this.

For athletes: the use of medicinal products containing ethyl alcohol might result in positive antidoping tests considering the limits established by some sports federations.

Use during pregnancy or breast-feeding
No adequate data are currently available on the use of benzydamine in pregnant and breastfeeding women. Excretion of the product into breast milk has not been studied. The findings of animal studies are insufficient to make any conclusions about the effects of this product during pregnancy and lactation.

The potential risk for humans is unknown.

TANTUM VERDE should not be used during pregnancy or breast-feeding.

Effects on reaction time when driving or using machines
When used in recommended doses, the product does not produce any effect on the ability to drive and operate machinery.

Method of administration and doses.
Pour 15 mL of TANTUM VERDE solution from the bottle into the measuring cup and gargle with undiluted or diluted product (15 mL of the measured solution can be diluted with 15 mL of water). Gargle 2 or 3 times daily. Do not exceed the recommended dose.

Children.
The product should not be used in children under 12 years due to a possibility of ingestion of the solution when gargling.

Overdosage.
No overdose has been reported with benzydamine when used locally. However, it is known that benzydamine, when ingested in high doses (hundreds times higher than those possible with this dosage form), especially in children, can cause agitation, convulsions, tremor, nausea, increased sweating, ataxia, and vomiting. Such acute overdose requires immediate gastric lavage, treatment of fluid/salt imbalance, symptomatic treatment, and adequate hydration.

Adverse reactions.
Within each frequency group, the undesirable effects are presented in order of their decreasing seriousness.

Adverse reactions are classified according to their frequency: very common (≥ 1/10); common (≥ 1/100 to <1/10); uncommon (≥ 1/1,000 to <1/100); rare (≥ 1/10,000 to <1/1,000); very rare (<1/10,000); frequency unknown (cannot be estimated from the available data).

Gastrointestinal disorders: rare – burning mouth, dry mouth; *unknown* – oral hypesthesia, nausea, vomiting, tongue edema and discoloration, dysgeusia.

Immune system disorders: rare – hypersensitivity reaction, *unknown* - anaphylactic reaction.

Respiratory, thoracic and mediastinal disorders: very rare –laryngospasm; *unknown* – bronchospasm.

Skin and subcutaneous tissue disorders: uncommon – photosensitivity; *very rare* – angioedema; *unknown* – rash, pruritus, urticaria.

Nervous system disorders: unknown – dizziness, headache.

TANTUM VERDE contains methyl parahydroxybenzoate, which can cause allergic reactions (including delayed-type reactions).

Shelf life. 4 years.

Storage conditions.
Do not store above 25°C. Keep out of reach of children.

Packaging.
120 mL of solution in a bottle with a measuring cup; 1 bottle per cardboard box.

Dispensing category.
Over-the-counter medicinal product.

Manufacturer.
Aziende Chimiche Riunite Angelini Francesco A.C.R.A.F. S.p.A., Italy.

Location of the manufacturer and its business address. Via Vecchia del Pinocchio, 22 – 60100 Ancona (AN), Italy.

Date of the last revision of the text.
September 26, 2018.

Information leaflet is
APPROVED by
Order of the
Ministry of Health of Ukraine
No. 636 dated 01.10.2015
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Our Supporters

JANUARY 2022 • VOLUME 6 • ISSUE 1
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FIGURE. Evangelos G. Kilipiris, MD, DMD from the National Institute of Children's Diseases and Faculty of Medicine at Comenius University, Bratislava, Slovak Republic. A kind support of Dr. Kilipiris during the 5 years at the position of Director, Journal Development Department helped our journal to move forward and to evolve. An honorary plaque was presented to him on behalf of the Chief Editor with words "To a Founding Director, Author of Multiple Articles and Reviews, Great Thanks and Appreciation." Photo was taken on November 23, 2021.

Content

of the Volume 6 • Issue 1 • January 2022

COURTESY

Journal`s cover image (virtual surgical planning for a segmental mandibular reconstruction with fibula transplant) is courtesy of Rui P. Fernandes, MD, DMD, FACS, FRCS.

Image was taken from the article: Fernandes RP, Quimby A, Salman S. Comprehensive reconstruction of mandibular defects with free fibula flaps and endosseous implants. *J Diagn Treat Oral Maxillofac Pathol* **2017**;1(1):6–10.

https://doi.org/10.23999/j.dtomp.2017.1.1

EDITORIAL

It Takes the Entire Healthcare World to End a Pandemic

Evangelos G. Kilipiris

Infectious diseases know no borders, and neither does the knowledge needed to fight them.
—Unknown author

The novel coronavirus, SARS-CoV-2, and the disease it causes, COVID-19, have driven the entire interconnected world for perhaps the first time in modern history to focus on solving a single problem. Globally, two years within this pandemic, physicians, scientists, healthcare leaders, governments, and citizens seek answers to a threat whose entire dimensions remain largely unknown. Experts are working together inside and outside hospitals, laboratories, and healthcare facilities to find the interventions that might best address the current health crisis. This outbreak has demonstrated in real-time how the mobilization of a global health crisis coalition can serve the global public good. Every medical specialty has something to give and something to gain in searching for answers to these burning questions. Oral and maxillofacial surgeons worldwide routinely share information and collaborate across borders.

But all of this is not new. Because, as impressive as this progress is, the world needs more and faster action.

In recent years increased geopolitical tensions and competition have also affected the collaborative nature of the global scientific enterprise. Fractured governments and their citizens tended to view health institutions more through a competitive rather than a cooperative lens. And in a global pandemic where the value of open collaboration is obvious, they are signaling that this emergency is yet another vehicle for competition rather than coordination.

The magnitude of this moment calls for the sharing of expertise and cooperation among physicians of different specialties from all nations and for informed, evidence-based, coordinated responses from national healthcare bodies and the national and global institutions of today, which will much change on the other side of the crisis.

Much more remains to be done to establish a high-level engagement and practical cooperation. However, the global Oral and Maxillofacial Surgery community is prepared for that. Our international scientific family entered this crisis with a strong foundation of shared objectives and interconnection with clear identification and demarcation of our comparative strengths and joint forces. One that we have built and maintained through collaborative projects, exchanges, international meetings, and engaging dialogues. All of

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them are potent links that are always beneficial, but they become crucial in times of crisis.

Personally, the relationships that I have cultivated with colleagues, scientists, and researchers over the years have helped me navigate beyond official channels in the uncharted territory of this multidimensional crisis, and this experience demonstrated the importance of sharing lessons learned. I boldly believe that international collaboration in science offers both the best hope for a solution to the current crisis and a model for all institutions to follow to build a better and safer shared future in Oral and Maxillofacial Surgery more precisely and in healthcare more broadly.

Because this pandemic won't end for anyone until it ends for everyone.

EDITORIAL

Meet the Founding Resident Ambassador: John M. Le, DDS, MD

Oleksii O. Tymofieiev[a] & Ievgen I. Fesenko[b,*]

On the road to academic surgery.[1]
—John M. Le, DDS, MD, Resident
Birmingham, Alabama, United States

We are happy to continue adopting the best global publishing experience and traditions into the new year of 2022. To start off, we are honored to adopt the progressive tradition held by *Plastic and Reconstructive Surgery* (*PRS*) journal. As a phenomenal journal with more than 75 years of publishing developments, *PRS* serves as a trailblazer for the *Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology*. The *PRS* Editorial Board founded the Resident Ambassador position in 2014 after an unofficial Resident Advisory Board (RAB) meeting of four residents at the 2013 Annual Meeting.[2] And now after 7 years, the *PRS* and *PRS Global Open* RAB includes more than 70 members across the world with six *PRS* and *PRS Global Open* Resident Ambassadors.[2] The RAB serves both *PRS* and their daughter journal – *Plastic and Reconstructive Surgery Global Open* (*PRS Global Open*).[3]

The key missions for the members of the RAB are to participate in three of five activities: (1) the *PRS* journal club on Facebook, (2) the *PRS* Grand Rounds (a multipronged and multitopic live lectures with question-and-answer series)[2] via Facebook, (3) creation of *PRS* promoting videos on their own social media pages, (4) supporting *PRS* and *PRS Global Open* as a peer-reviewers, and (5) voting on the journal's social media pages.[3]

The search for a true leader to take on the role as the Founding Resident Ambassador for the *Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology* was an uneasy task. After an extensive search, we are honored to start collaboration with an oral and maxillofacial surgery (OMS) resident from the state of Alabama in the United States of America. John M. Le, DDS, MD (Fig 1) and his colleagues in the Department of Oral and Maxillofacial Surgery at the University of Alabama at Birmingham have made a serious impact on global OMS specialty.[4–15] Moreover, their article contribution to our journal in 2020 made a huge influence by attracting an international community of readers to our journal, making us enormously proud. The masterpiece was dedicated to the use of zygomatic implants for restoration of complex nasal defects.[15] Thereby, the current academic achievements and research activities of Dr. Le serves as a model for other OMS

Kyiv, Ukraine

[a] Chief Editor, *JDTOMP*.

[b] Managing Editor, *JDTOMP*.

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E-mail: *i.i.fesenko@dtjournal.org* (Ievgen Fesenko)

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FIGURE 1. John M. Le, DDS, MD.

residents in training. In general, his clinical interests include, but is not limited to head, neck and oral oncology and reconstructive surgery.[16]

In our journal, the mission of the Resident Ambassador will be determined by Dr. Le as the Founding Ambassador and will be in-line the journal's aims & scope to attract a broad and diverse group of professionals around the globe.

To conclude, we would like to sincerely thank Dr. Le in accepting this role and welcome him into our continually evolving 5-year-old journal. We wish him all the best and look forward to the new year.

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RESPONSE

In Response to the Editorial "Meet the Founding Resident Ambassador: John M. Le, DDS, MD"

John M. Le

It is an honor and privilege to accept the invitation to be the founding resident ambassador (Fig 1) for the *Journal of Diagnostics and Treatment of Maxillofacial Pathology* (*JDTOMP*), also known as DT Journal.[1] I am excited to join an outstanding and diverse editorial board. In this new role, I aim to engage and recruit a diverse group of oral and maxillofacial surgery trainees from the United States and abroad to launch regular evidence-based discussions regarding the current therapies for maxillofacial pathology and advancements in oral and maxillofacial surgery. I hope to eventually create a board of resident advisors that will not only serve to promote DT Journal's presence on social media, but also as peer reviewers. The requirements for the future of the program and its incoming resident members will include the following:

1. Promotion of and sharing of issues published by the journal on social media outlets (i.e., Instagram, Facebook, LinkedIn) using #dtjournalorg and #jdtomp.
2. Creating and sharing posts on one's social media page as it relates to DT Journal using #dtjournalorg and #jdtomp.
3. Contributing to the journal by submitting an article of choice for peer review within two years of becoming a member.
4. Serve as a peer reviewer.

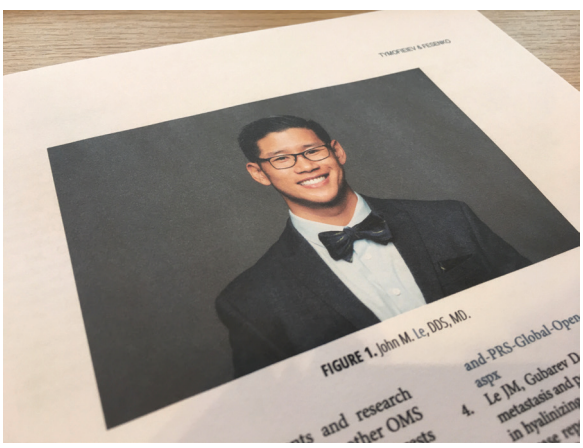

FIGURE 1. Printed PDF of the editorial.[1]

All in all, as an inaugural program for the DT Journal, the resident member requirements will remain dynamic and subject to change in accordance with the Editorial Board's missions and goals.

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Resident Ambassador, *Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology* (*JDTOMP*).
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EDITORIAL

Similar Evolutionary Steps: *Journal of American College of Surgeons* and *Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology*

Ievgen I. Fesenko

Being online only, we have the opportunity to use electronic/technical enhancements that will further benefit our readers.[1]
—Timothy J. Eberlein, MD, FACS
Editor-in-Chief, *JACS*

The *Journal of American College of Surgeons* (*JACS*) is a highly prestigious monthly peer-reviewed publication devoted to all aspects of surgery.[2] As of January 28, 2022 the *JACS* is number 10 among 456 journals in subject area "Medicine" category "Surgery."[3] The 2020 Impact Factor of *JACS* is 6.113.[4]

The *JACS*, which has 117 years of traditions of print issues publishing, from January 2022 became a digital-only publication (Table 1).[1] Such transition is another step of the journal evolution in a dynamically changing academic world. Moreover, in one year the *JACS* implemented two transitions—the change of publisher and movement to digital-only publication.[1]

We recognize five different forms of journal's evolution/transition: (1) language transition (from native to English),[5,6] (2) title transition (from longer to shorter one, changing journal's scope, etc.), (3) publisher transition, (4) publishing format transition (from print-and-online to digital-only),[7,8] (5) transition from subscription to open access model, etc.

The *Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology* (*JDTOMP*) has also made the publishing format transition from January 1, 2022. Being a digital-only journal, or more correct to say a "printable digital journal," brings a lot of advantages. The wave of such transitions is already growing. Multiple journals and publishers are on that wave. Among them, some journals with a long history of print issues publishing (before transition to digital-only format) like *JACS* (117 years) and *ANZ Journal of Surgery* (90 years),[8] others – with a shorter hisrtory like *Global Spine Journal* (9 years)[7] or *JDTOMP* (5 years).

What is interesting, simultaneously with a publishing format transition, the *JDTOMP* performed the transition from hybrid publishing model (print issues subscription at the "Presa" State Enterprise and open access via website www.dtjournal.org) to open access-only model. It was a 5-year period of collaboration with state institution focused on distribution of periodicals and we are

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TABLE 1. Comparison of Two Journals That Have Moved to Digital-only Format.[1,2,8]

#	Title	2020 Impact Factor	Number of Years of Print Format Publishing	Month and Year of Transition to Digital-only Format
1	*Journal of American College of Surgeons* (formerly known as *Surgery, Gynecology & Obstetrics* [1905–1994])[3]	6.113	117	January 2022
2	*Journal of Diagnostics and Treatment of Oral and Maxillofacial Pathology*	-	5	January 2022

grateful for every minute of that way together.

So, we are honored to be with such a famous publication as *JACS* at the same wave of journals' evolution. On behalf of the Editorial Board we are wishing them and other journals to use this and other advantages of the digital era.

You can't stop the waves, but you can learn to surf.
—John Kabat-Zinn
Professor, Founder of the Mindfulness-Bases stress reduction program

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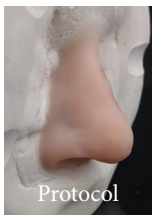

CASE SERIES: TREATMENT PROTOCOL

Surgical Reconstruction and Rehabilitation of Midface Defects using Osseointegrated Implant-supported Maxillofacial Prosthetics

John M. Le[a,*], Yedeh P. Ying[b], Michael T. Kase[c], & Anthony B. Morlandt[d]

ABSTRACT

Midface defects can be life-changing, both functionally and psychologically, for the affected patient. Additionally, restoration of form, function, and aesthetics can be challenging for the reconstructive surgeon. For defects affecting facial subunits such as the nose and orbit, a maxillofacial prosthetic can both obturate the defect and achieve aesthetically pleasing outcomes. Osseointegrated implants placed into sound bone at the defect site allow the maxillofacial prosthodontist to optimize prosthesis retention without the need for adhesive or a mechanical device. In this article, we will share our multidisciplinary treatment protocol and outcome for addressing large midface defects using osseointegrated implant-retained maxillofacial prosthetics. Finally, we will also share our experience and challenges in the incorporation of digital technology in the prosthetic processes of the treatment plan. In the evolving digital age, rapid prototyping technologies have provided the reconstructive surgeon and maxillofacial prosthodontist the ability to accurately plan and execute predictable and reproducible results for a complex array of maxillofacial defects.

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The word 'Protocol' at the upper right icon means that article highlights treatment protocol.

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INTRODUCTION

Maxillofacial defects involving the midface secondary to trauma or tumor surgery can be challenging to reconstruct and often requires a multi-staged surgical approach where local and/or distant vascularized tissue are needed to restore form, function, and aesthetics of the missing facial subunit(s). This is especially true when multiple tissue types such as skin, cartilage, and bone are missing.[1] Therefore, a successful reconstructive outcome will not only re-establish aesthetic facial form and function, but also aid in psychosocial reintegration for the patient.[2,3] Several midface defect classification systems have been published; however, none are universally applied. Two popular classification systems have been described in the literature.[4,5] In this article, we will use the Brown-Shaw classification system, a Liverpool-based system focusing on both prosthetic and cosmetic aspects of reconstruction which may be used to select both local and free flaps for each defect type (Fig 1). Based on this classification system, several fasciocutaneous and/or osteocutaneous vascularized free flaps can effectively obliterate the defect and may provide sufficient bone to house dental implants[4]. However, these surgeries are often long and often requiring multiple additional surgeries over an extended time to achieve aesthetically pleasing results.[6] On the other hand, prosthetic rehabilitation can provide an alternative shorter and simpler treatment option, lower initial cost, possibility for immediate new dentition, and ease for oncologic surveillance.[7] Currently, in a selected group of patients, the combination of reconstructive surgery with osseointegrated implant placement followed by prosthetic rehabilitation is commonly recommended at our institution for large midface defects involving multiple facial subunits as it results in the best outcome for restoration of form, function, and aesthetics. Our patient selection is limited by the costs associated with the prosthesis and the patient's commitment to follow through with the treatment.

Attempts to replace and restore maxillofacial defects using solely prosthetics have dated back centuries with reports in the historical records and texts.[8] Traditionally, adhesive alone or in addition to a mechanical device (e.g., glasses) was used for retention and camouflage of prosthesis margins (Figs 2 and 3). Following the introduction of osseointegrated implants for dental rehabilitation in the late 1970s by P.I. Branemark,[9] its application was expanded outside the oral cavity and onto the craniomaxillofacial complex.[10] With the success rate of 90-95% over a 10-year period, the stability and predictability of the osseointegrated implant has become the promising treatment option for dental rehabilitation and provides better retention for maxillofacial prostheses without the need for adhesive agents.[3,11] It also aids the patient in positioning the prosthesis accurately; thus, resulting in a better clinical and psychosocial outcome.[12–14]

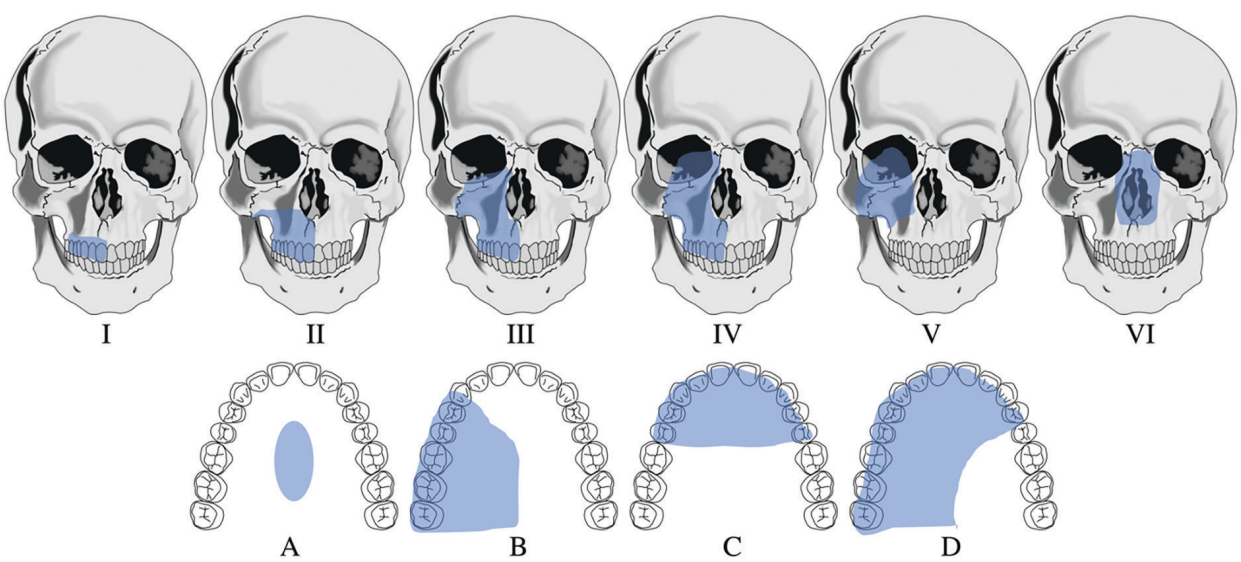

FIGURE 1. Brown and Shaw Maxilla and Midface Defect Classification.

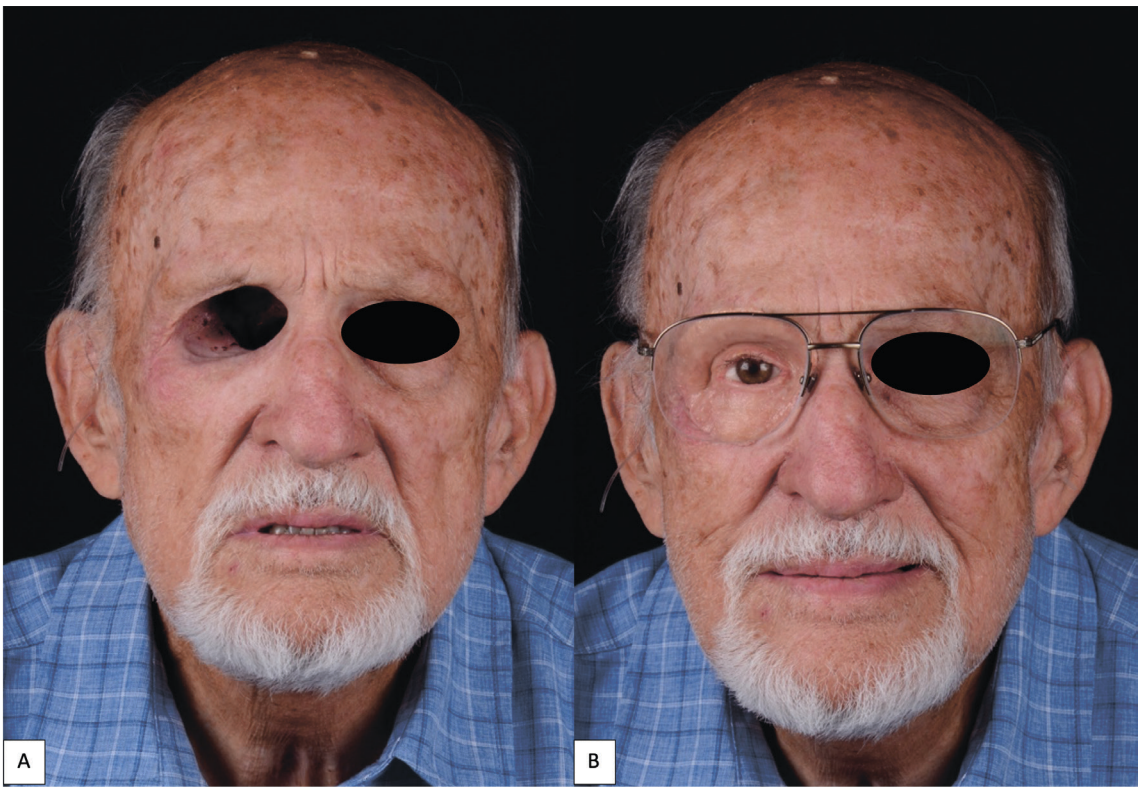

FIGURE 2. Orbital defect (**A**) with prosthesis and eyeglasses (**B**).

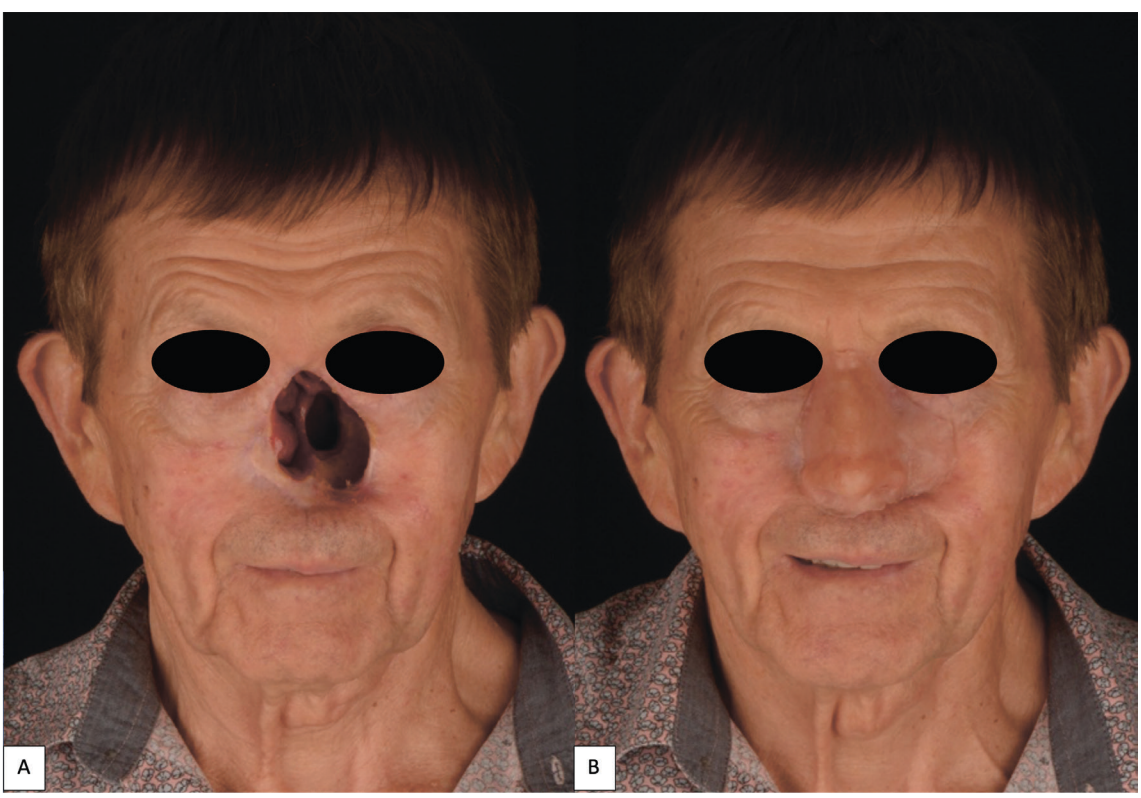

FIGURE 3. Nasal defect (**A**) with prosthesis in place (**B**).

Prosthetic rehabilitation of maxillofacial defects may provide several advantages for both the reconstructive surgeon and patient. Aside from providing good aesthetic outcomes for large facial defects that involve multiple facial subunits, it allows for visually accessible surveillance in oncologic cases. In addition, for patients requiring adjuvant radiotherapy, the risk for post-radiation wound healing complications (i.e., impaired wound healing, osteoradionecrosis) is greater in patients who undergo reconstructive surgery using local tissue in an irradiated field.[15–18] Therefore, to avoid these complications, if needed, implants are often treatment planned to be placed at the time of tumor extirpation and/or prior to adjuvant radiation therapy. Osseointegration of the implant(s) is evaluated clinically and radiographically at least 4 months post-operatively and then uncovered to initiate the prosthetic treatment process.[2,3,19]

CLINICAL EVALUATION AND TREATMENT PLANNING

Both primary referrals for benign and malignant oral and maxillofacial pathology and secondary referrals for reconstruction of maxillofacial defects are evaluated in our clinic by a multidisciplinary team of ablative and reconstructive surgeons and a maxillofacial prosthodontist. This clinical evaluation is especially crucial since the dentition and/or facial anatomy will be altered after the ablative surgery. For patients who need tumor resection and reconstruction, the appropriate CT imaging are obtained per American Joint Committee on Cancer (AJCC) guidelines to determine surgical margins. For patients who are referred for reconstructive surgery only, a CT maxillofacial and Panorex radiograph are obtained to evaluate the existing bone substructure and dentition for reconstruction using one of more of the following: allogenic bone graft, autologous vascularized tissue (non-osseous and osseous), and osseointegrated implants.

In our case series, we describe our surgical approach for dental and maxillofacial rehabilitation using osseointegrated implants for Brown's Class III-VI midface defects. Class I defects present as an intra-oral defect and can be treated using a dental prosthesis or reconstructed using a local or free flap.[4] However, when there are no contraindications for a microvascular free flap, the fasciocutaneous radial forearm serves as an excellent reconstructive solution to obturate a Class I or II defect, but rarely can support a dental prosthesis without the placement of osseointegrated implants in the bony substructure. Therefore, for long-spanning Class II defects, the vascularized osteocutaneous fibula free flap serves as an excellent reconstructive option as it can both obturate the dead space as well as house osseointegrated implants for dental rehabilitation.[20] For Class V defects, either a pedicled or soft tissue free flap can obturate the dead space. However, for this specific type of defect class, the anatomical boundary of the defect provides the ideal retention for an orbital prosthesis. For the cases presented in this article, all the osseointegrated implants were placed free-handed. The number, location, and angulation of the implants placed were decided intraoperatively by the reconstructive surgeon according to the bone quantity and quality available. Both traditional lab-based and digital-based technologies were used for the prosthetic portion of the study cohort. Finally, we will highlight the challenges and limitations that we encountered during the treatment process.

CASE REPORTS

Case 1: Brown's Class IIIC

We previously described a case of a 68-year-old male that underwent a total rhinectomy, partial maxillectomy, and partial excision of the upper lip due to recurrent basal cell carcinoma (BCC) of the nose and was treated with horizontally placed zygomatic implants and a multi-component extra- and intra-oral prosthesis (Fig 4).[21] Traditional impression techniques were used to replicate the midface defect and wax up. The stone model impressions were then digitized, 3-D printed, and used for the design of the implant-facial prosthesis abutment connector, and final silicone prosthesis staining (Fig 5).

Case 2: Brown's Class IVD

A 71-year-old male with a history of advanced stage oral squamous cell carcinoma of the left maxilla diagnosed in 2013 who underwent primary proton and chemotherapy followed by a total maxillectomy, partial rhinectomy, excision of facial skin, neck dissection and reconstruction with latissimus dorsi free flap in 2014. He then underwent

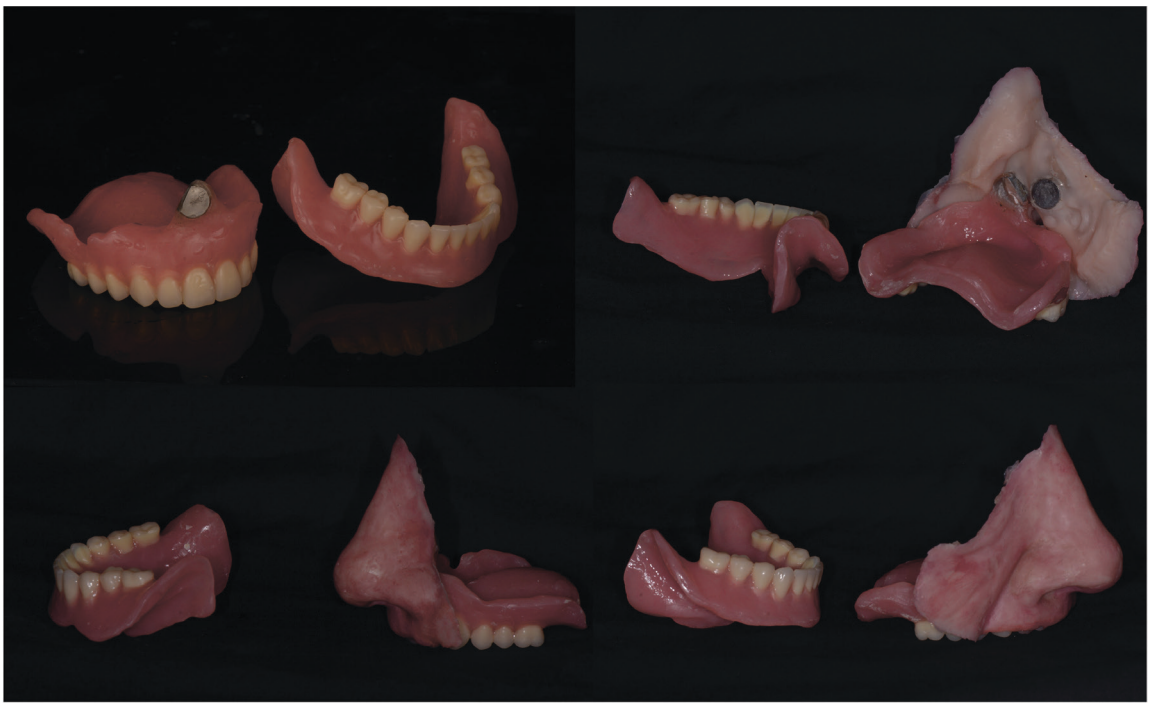

FIGURE 4. Case 1. Anterior, posterior, and lateral views of the final upper and lower dentures with the magnetic component located at the superior and middle portion of the maxillary denture and inner nasal portion of the silicone prosthesis.

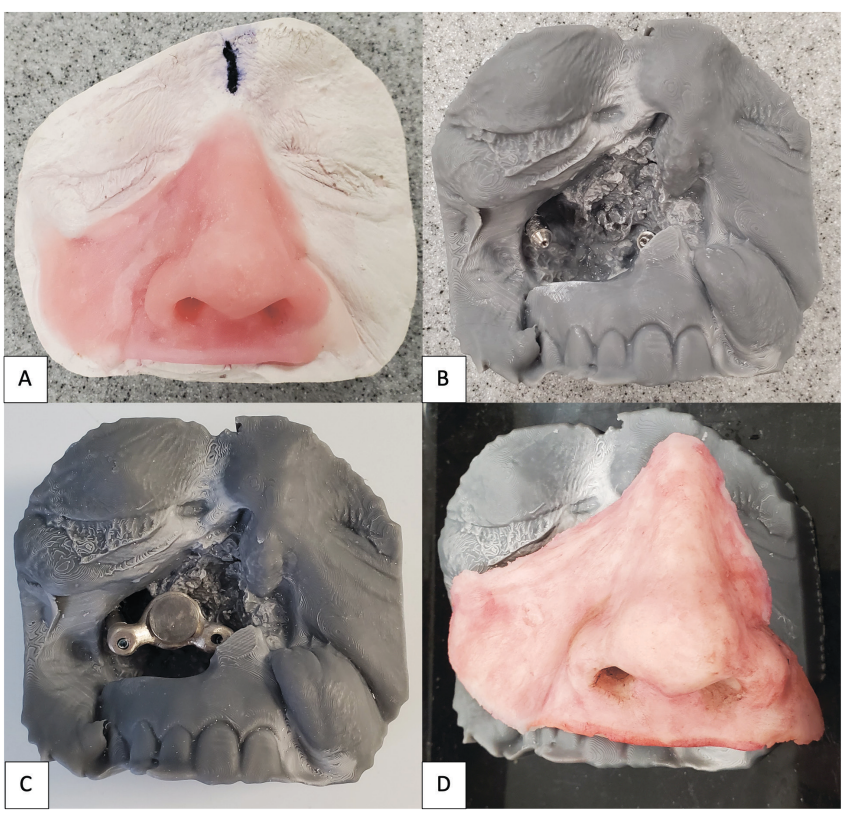

FIGURE 5. Case 1. Stone case and wax-up (**A**). 3D-printed model with implant abutments in place (**B**), magnetic connector in place (**C**), and silicone prosthesis attached (**D**).

three additional vascularized free tissue transfers (osteocutaneous fibula, anterior lateral thigh, and fasciocutaneous radial forearm) and skin grafting procedures from 2016 to 2019 to reconstruct the maxilla and restore the upper lip and left malar volume. Unfortunately, the patient developed left eye blindness due to chronic exposure keratitis secondary to scar contracture and lack of periorbital tissue volume. He was then referred to our clinic for left orbital exenteration and placement of an orbital prosthesis. Due to his prior history of proton therapy and multiple free vascularized tissue transfers, we decided that placement of osseointegrated implants would be a minimally invasive reconstructive option and provide the best retention for a large orbital prosthesis. We did, however, take into consideration the risk for implant failure due the history of radiation. Following the orbital exenteration, three osseointegrated implants measuring 3.8 mm × 9 mm (BioHorizons®, Birmingham, AL, USA) were placed into the superior lateral orbital rim (Fig 6) because there was no additional adjacent maxillary or nasal bone thick enough to receive the implants. After 4 months postoperatively, the patient was seen by the maxillofacial prosthodontist for prosthetic fabrication. A combination of digital-based and traditional lab-based techniques were utilized to fabricate the final prosthesis. Photogrammetry and Meshmixer, a 3D modeling software, were used to capture and edit the 3D image, respectively. A digital cast model was then created (Model Builder; 3Shape) and then printed using light-cured engineering resin (Form 2; Formlab) where a wax-up was completed (Fig 7). Traditional polyvinyl siloxane (PVS) impressions were used to pick up the orbital implants and adjacent anatomy to fabricate the attachment unit of the prothesis (Fig 8). The final silicone-based orbital prosthesis provided an excellent aesthetic outcome (Fig 9).

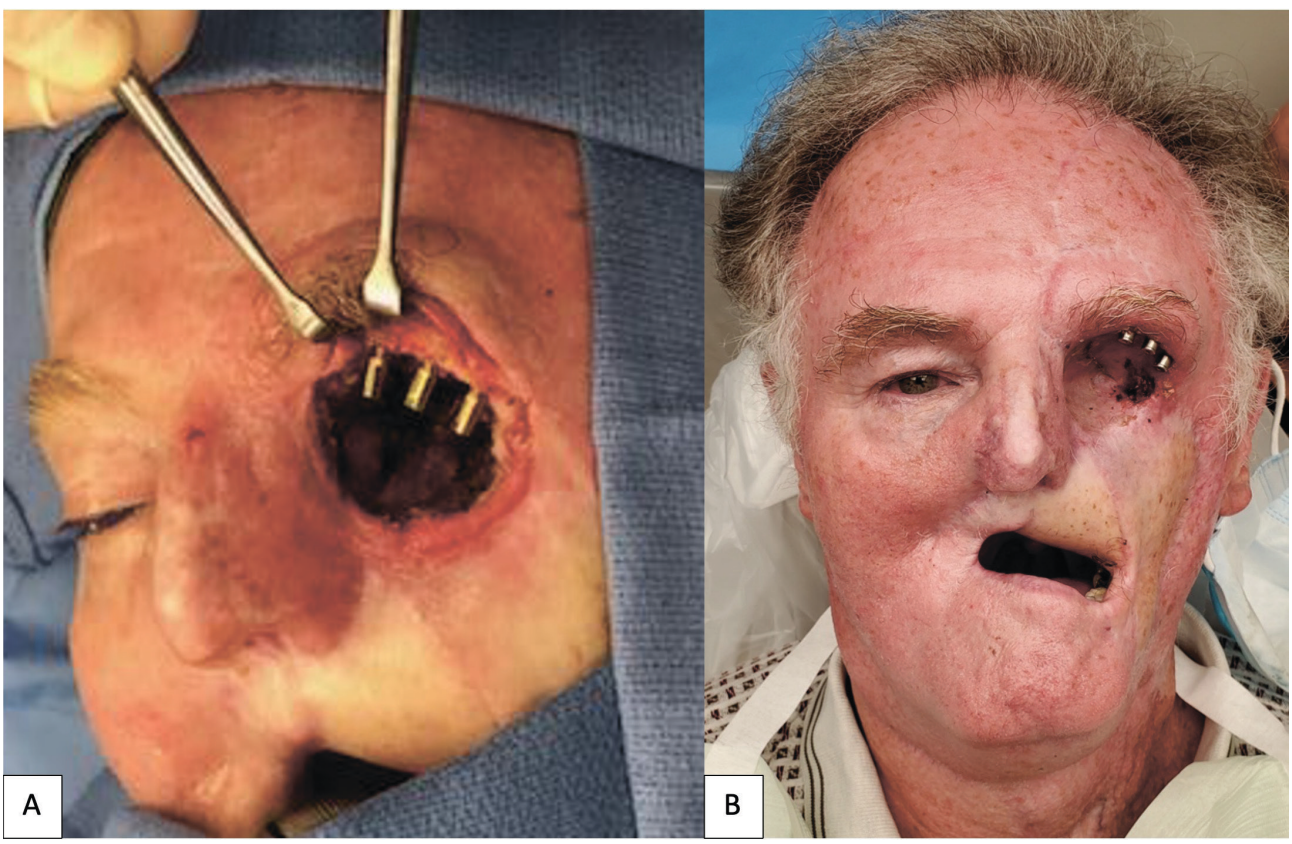

FIGURE 6. Case 2. Positioning of osseointegrated implants in the left supero-lateral orbital rim at the time placement (**A**), and after complete healing with impression abutments in place (**B**).

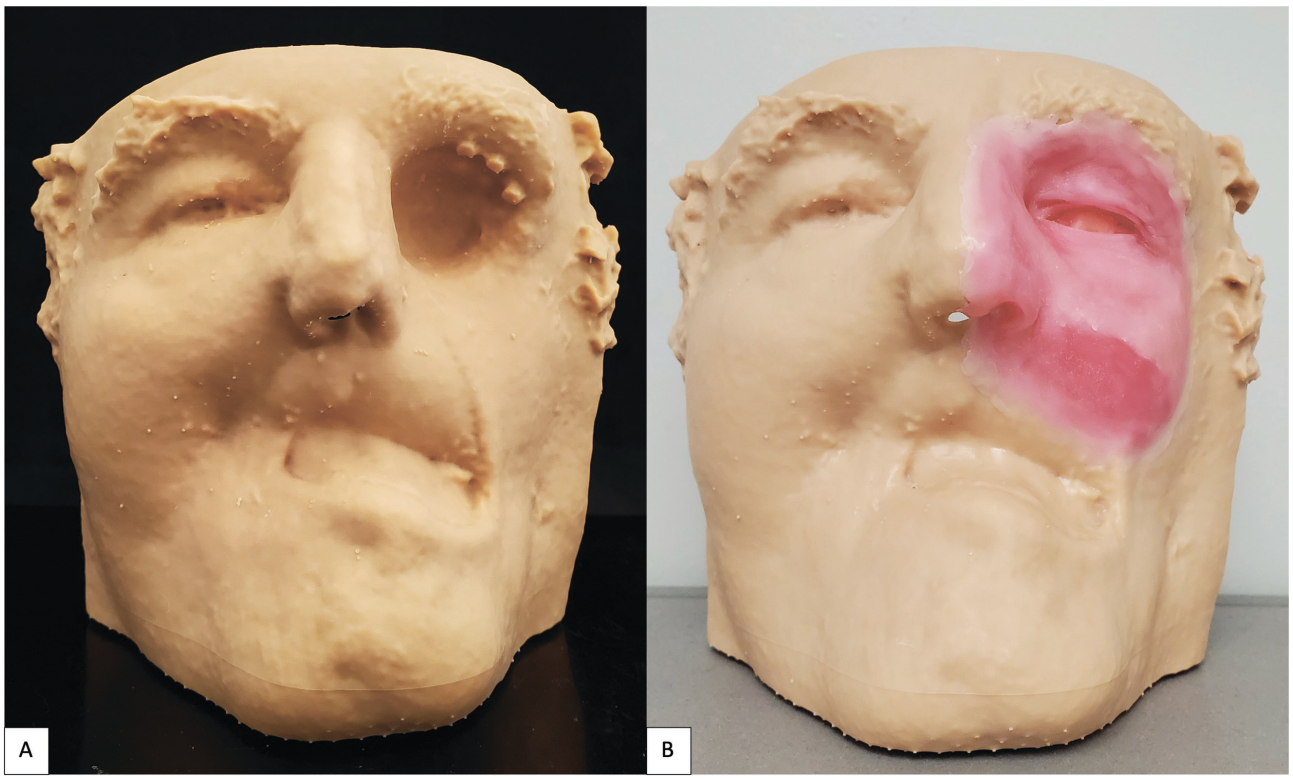

FIGURE 7. Case 2. 3D-printed resin model created from a facially scanned digital case model (**A**), and wax-up of the left orbit, partial nasal and malar (**B**).

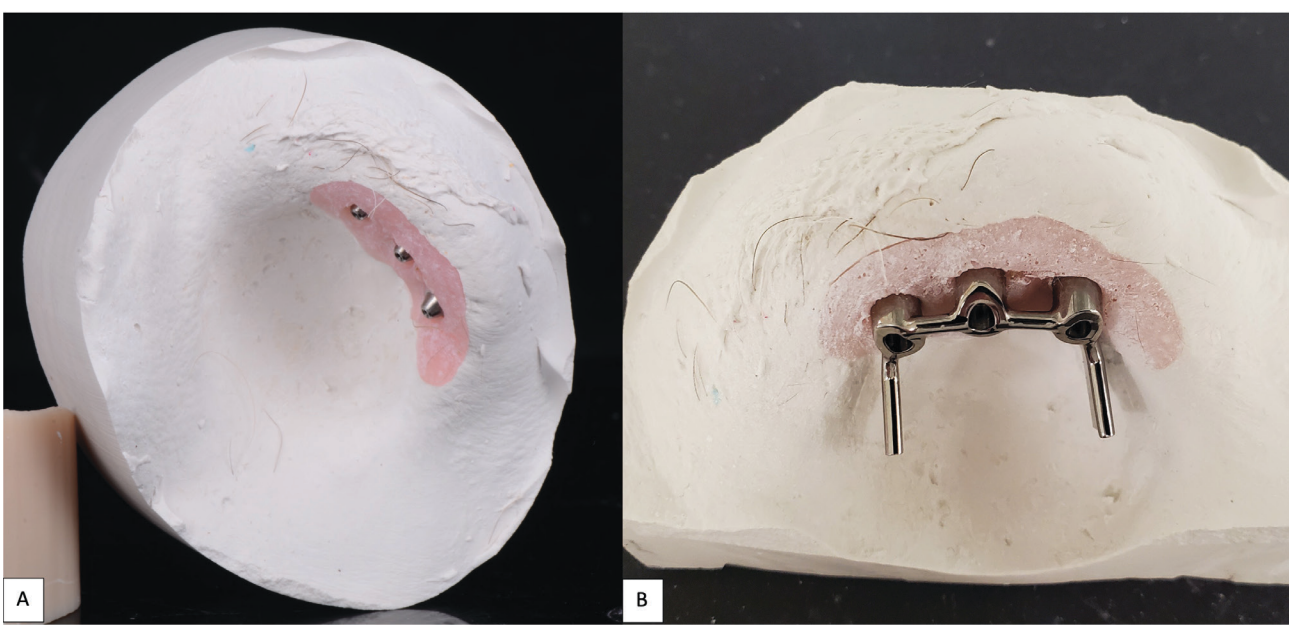

FIGURE 8. Case 2. Stone case mold of the defect with the healing abutments (**A**) and bar substructure attachment in place (**B**).

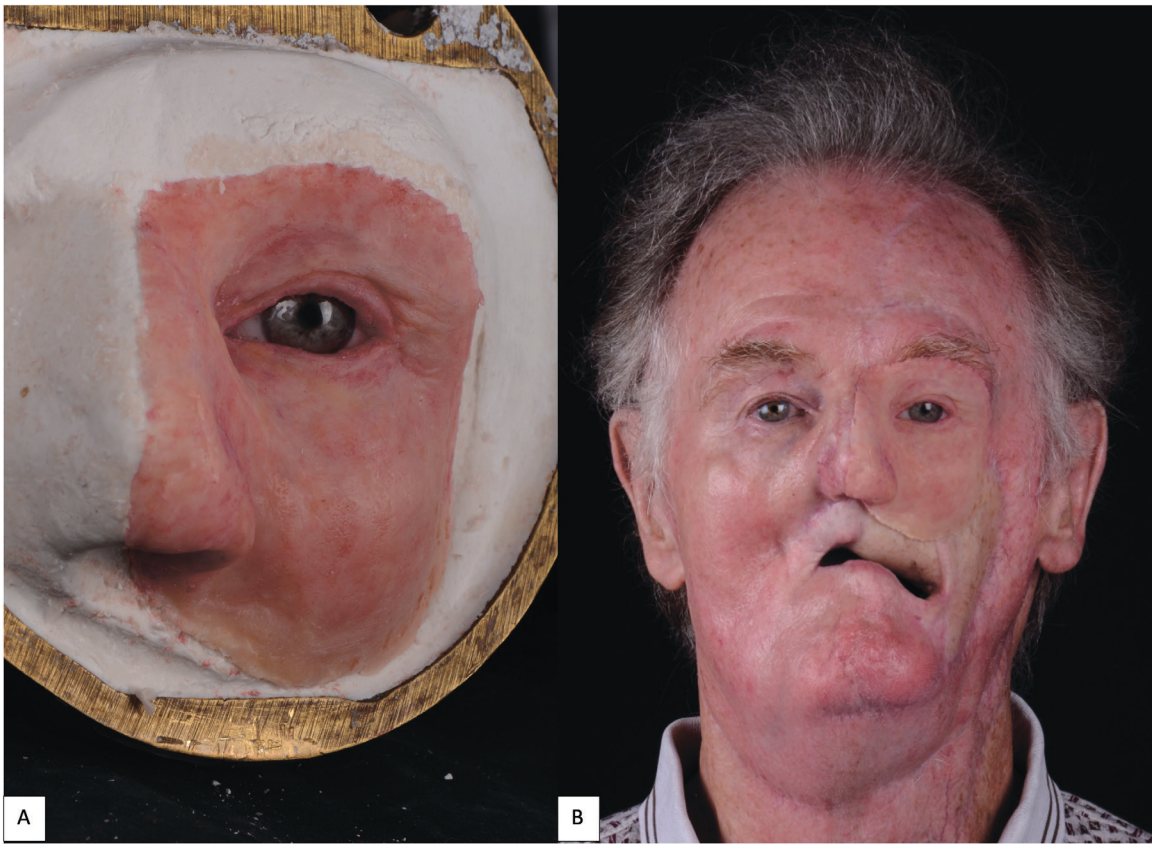

FIGURE 9. Case 2. Final touches for color staining completed on the stone case (**A**), and final prosthesis placement with an excellent aesthetic outcome (**B**).

Case 3: Brown's Class IVD

A 63-year-old female presented to our clinic with a longstanding untreated pT3Nx basal cell carcinoma that initially started at the nasal alar crease and treated with topical ointments prescribed by a homeopathic doctor. Unfortunately, the tumor continued to progress for nearly 10 years prior to her seeking surgical treatment. When she presented to our clinic, the tumor had eroded her entire midface (right lower lid, right malar, upper lip, underlying maxilla, and complete nose). Due to the size of the tumor and the extent of its infiltration into the surrounding hard and soft tissue structures, the patient underwent a radical maxillectomy, right orbital exenteration, total rhinectomy, excision of facial skin, and reconstruction with a vascularized anterior lateral thigh (ALT) to obturate the right maxillary sinus space. The surgical margins and extent of the resection are shown in a 3-D reconstruction CT image of the face (Fig 10). Fortunately, adjuvant radiotherapy was not indicated based on the final pathological staging. With no evidence of disease at the one-year mark confirmed with MRI, the patient was evaluated by the maxillofacial prosthodontist for dental and facial prosthetic rehabilitation via the placement of osseointegrated implants into the remaining maxillofacial bones. The patient received 6 osseointegrated implants (BioHorizons®, Birmingham, AL, USA) were placed in conjunction with flap debulking and recontouring of the soft tissue around the right orbit. Two implants were placed into the supero-lateral orbital rim (3.8 mm × 9 mm), 1 was placed into the glabella (3.8 mm × 9 mm), 2 were placed into the right mandible (3.8 mm × 10.5 mm), and 1 placed into the left zygoma (3.4 mm × 10.5 mm). The implants were uncovered at the 7-month mark and the patient proceeded with the prosthetic phase of treatment. Of note, the implant in the left zygoma was not incorporated into the substructure of final facial prosthesis design and did not lead to any future complications that would require its removal.

Like Case 2, both traditional lab-based and digital techniques were used to fabricate impression trays and models for the dental and facial prostheses.

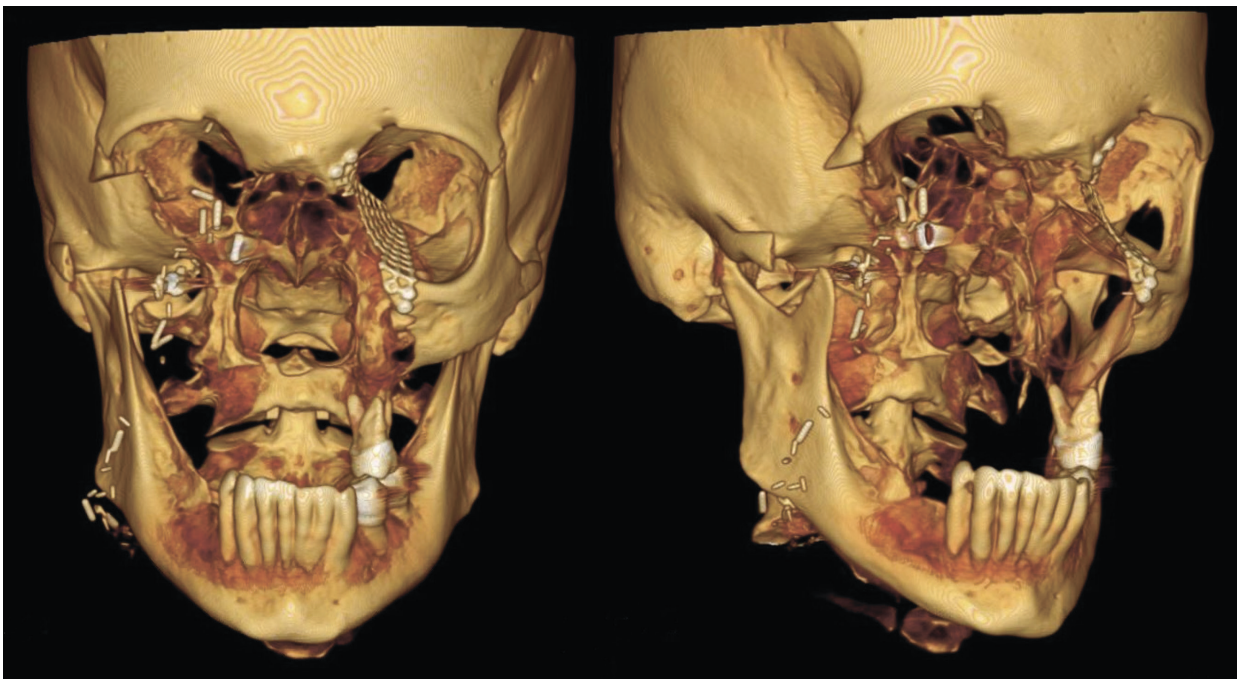

FIGURE 10. Case 3. 3D reconstructed maxillofacial image of the midface defect after tumor extirpation.

A facial scanner (Sense 2 Scanner; 3D Systems) was used to assist in the designing of the custom impression trays. Localized conventional impressions using the open tray technique with polyvinyl siloxane material (Aquasil Ultra; Dentsply Sirona) were taken around the orbital and intraoral implant areas, and then poured in two separate casts using type IV dental stone (Silky-Rock Low-Expansion Die Stone; Whip Mix Corp) (Fig 11). An implant-retained prosthesis was then fabricated by designing a magnet attachment at the medial aspect of the orbit, and locator bar attachment at mandibular area, with two-piece prosthetic design in medical grade silicone (VST-50; Factor II) to allow mandibular movements. Because there was limited tongue mobility and large palatal defect, a palatal cameo surface impression was incorporated into the prosthetic substructure and as an extension of the upper lip and midface silicone component (Fig 12). At the time of final placement of the prostheses, the patient had better articulation, deglutition, and an excellent aesthetic outcome (Fig 13).

Case 4: Brown's Class VI

A 62-year-old female with a history of pT2Nx squamous cell carcinoma (SCC) of the nose was referred to our clinic after having undergone a total rhinectomy. The patient opted to have a prosthesis after having discussed the reconstructive options with her primary surgeon. After confirmation of negative surgical margins with no indications for adjuvant radiotherapy, the patient received 2 osseointegrated implants into the nasal floor of the anterior maxilla (3.8 mm × 13 mm and 3.8 × 15 mm) and 1 osseointegrated implant into the glabella (3.8 mm × 9 mm) (BioHorizons®, Birmingham, AL, USA) (Fig 14A-B). The three implants were placed at an angulation which provided a tripod-based bar attachment for the fabrication of the final prosthesis (Fig 14C). Traditional lab-based methods were used to wax up and fabricate the final nasal prosthesis (Fig 14D). Due to the angle divergence of the implant platforms and abutments, a digital bar pattern could not be outputted from the digital software. The final nasal prosthesis provided an excellent color match and aesthetic outcome for the patient (Fig 15).

In summary, for selected reconstructive cases where an implant-supported maxillofacial prosthesis is desired by the patient, our recommendations for the location of the implants to be placed based on orbital, nasal, and maxillary defects are shown in Figure 16. Generally, for cases where dental rehabilitation is also considered, it is ideal to place the implants into the existing native- or neo-mandible/maxilla (e.g., fibula free flap) to oppose the remaining dentition.

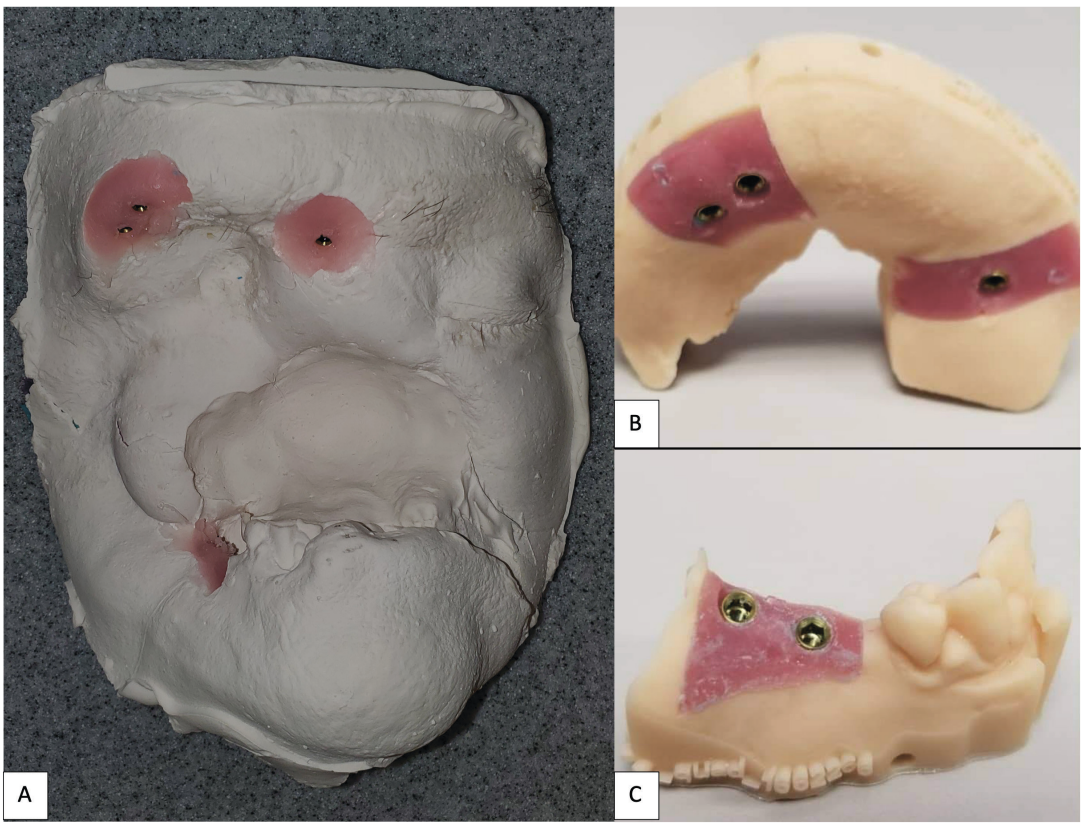

FIGURE 11. Case 3. Traditional dental stone model of the face (**A**). 3D-printed models of the orbital (**B**) and mandibular implant sites (**C**).

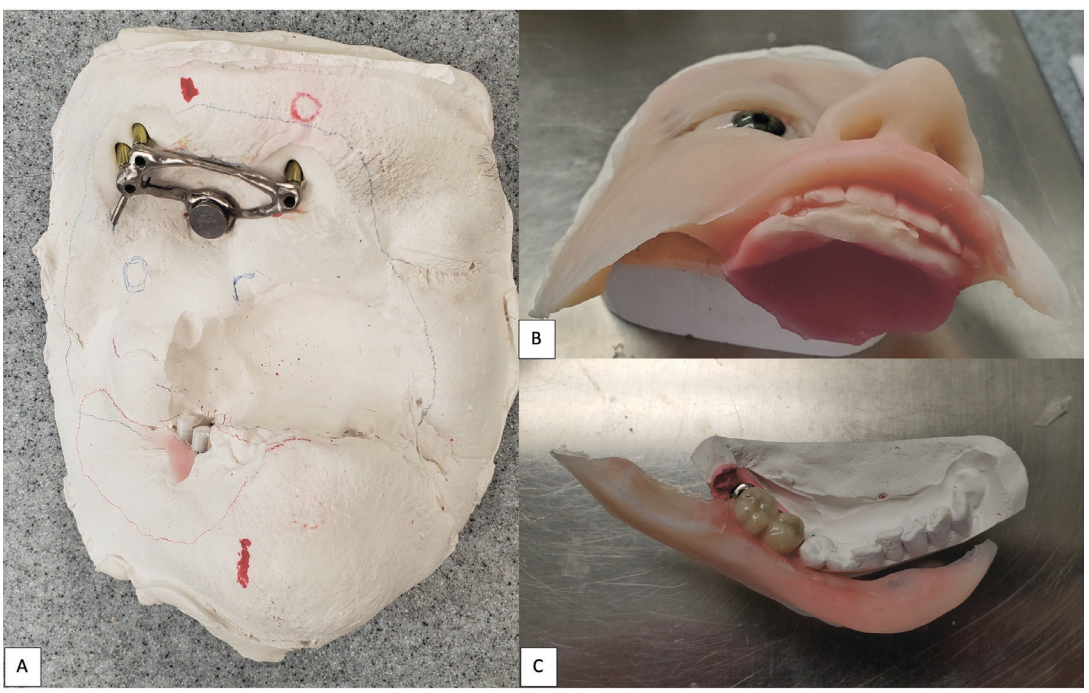

FIGURE 12. Case 3. Locator bar attachment with magnet at the medial aspect of the orbital defect (**A**). The primary silicone-based facial prosthesis with the incorporation of a palatal augmentation to facilitate deglutition and articulation (**B**). The second portion of the prosthesis including a silicone-based lower lip incorporated into the mandibular implant locator bar attachment to facilitate mandibular movement (**C**).

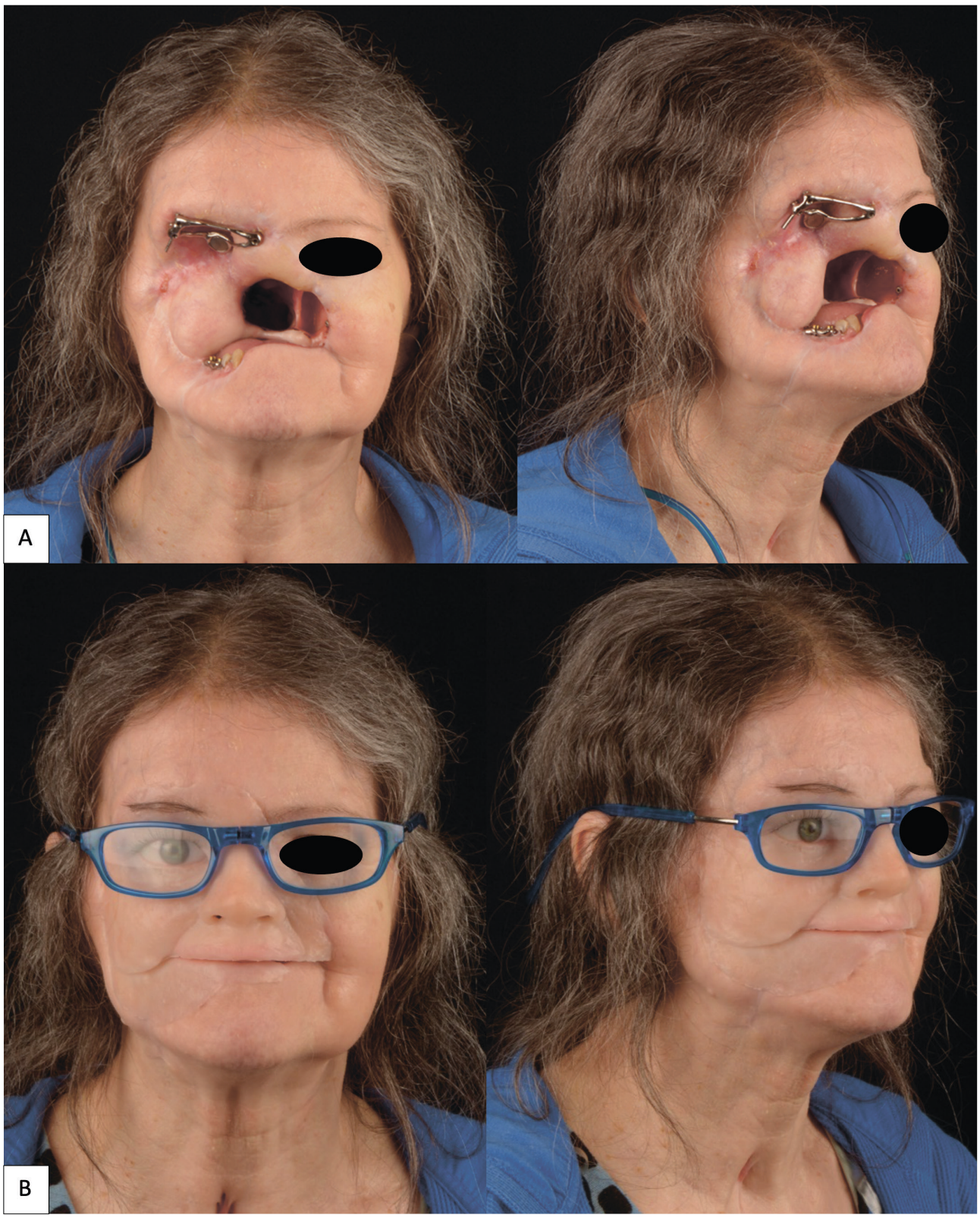

FIGURE 13. Case 3. Frontal and three-quarter views prior to (**A**) and after the placement of the final facial prostheses (**B**).

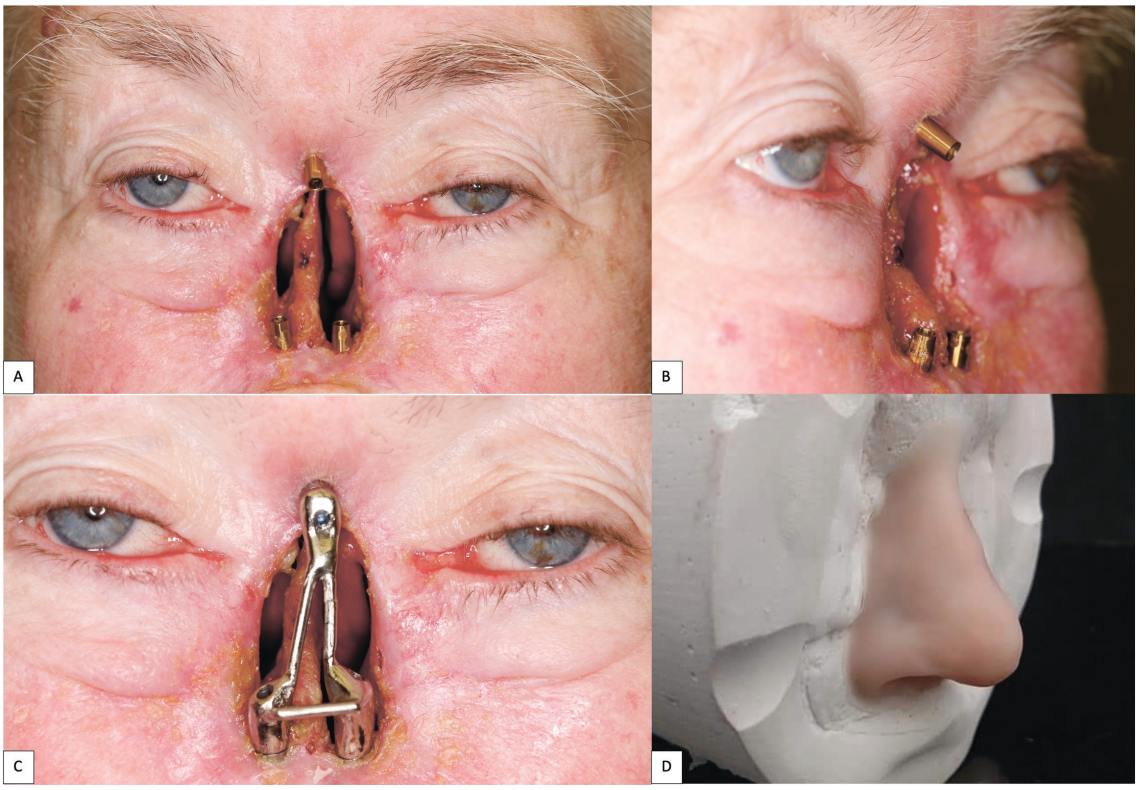

FIGURE 14. Case 4. Frontal (**A**) and lateral views (**B**) of the implants placed into the glabella and anterior maxilla. Tripod bar locator in place (**C**). Wax up of the prosthesis on stone cast model (**D**).

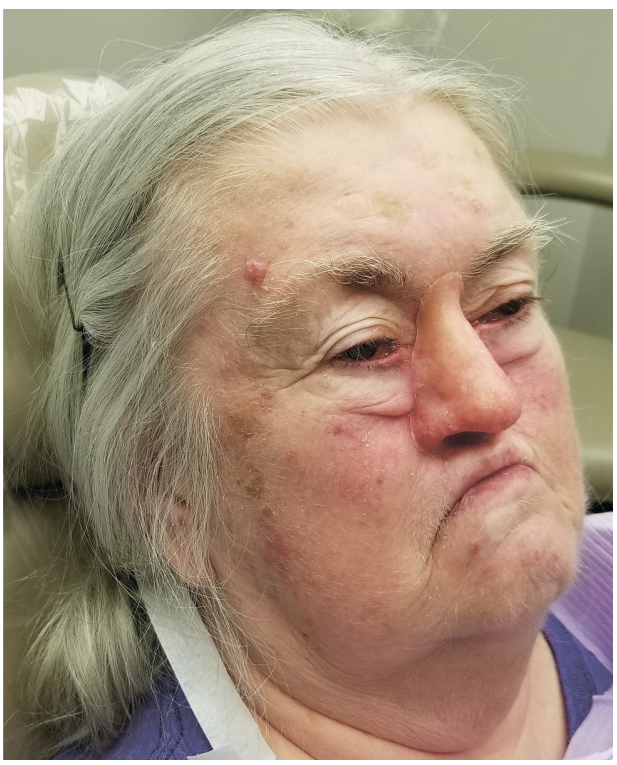

FIGURE 15. Case 4. Three-quarter view of the patient with the nasal prosthesis in place.

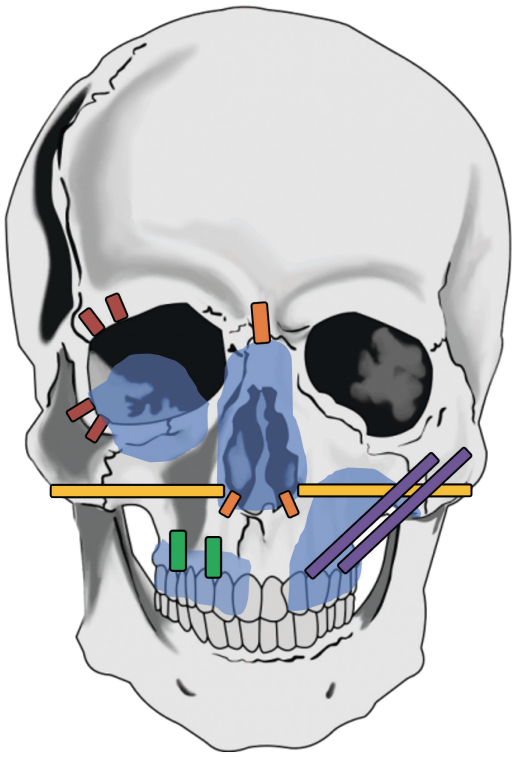

FIGURE 16. Preferred implant placement for osseointegrated implants where bone density is sufficient on CT imaging and/or intraoperatively is shown for orbital (*red*), isolated nasal (*orange*), nasomaxillary (*yellow*), maxillary alveolus (*green*), and partial maxillectomy (*purple*) defects. Traditional implant lengths are illustrated in *red*, *orange*, and *green* while longer length zygomae implants are illustrated in *yellow* and *purple*.

DISCUSSION

Midface defects resulting from ablative surgeries or trauma can be detrimental not only for the patient's psychosocial status but can also be a challenge for a reconstructive surgeon when multiple facial subunits and dentition are involved. In these cases, a maxillofacial prosthesis can provide a satisfactory outcome in terms of restoring form and oral function. Since the initial application of osseointegrated implants for dental rehabilitation, its placement in the craniomaxillofacial complex has allowed for better retention of extraoral prosthetics.

Osseointegrated Implants for Dental Rehabilitation

Since its inception in the 1970s, the predictability and success of osseointegrated implants for dental rehabilitation has dramatically improved with a survival rate of approximately 96% at 10-years.[22] Its high success rate can be attributed to the evolution in its structural design and build, biomaterial surface coating, and technical modifications at the time of placement.[23] Furthermore, there continues to be ongoing studies defining clinical factors such as age, bone quality, and implant characteristics, and the long-term stability and success of osseointegrated implants to guide clinicians in selecting the right surgical candidate for a successful implant-based dental rehabilitation.[24] In our practice, we provide the option for dental implant-based dental rehabilitation based on clinical factors such as the quantity and quality of the soft (keratinized mucosa) and hard (bone) tissue. Additionally, we also take into consideration the patient's medical comorbidities and social behaviors that have a negative impact on the success of the implant such as smoking and prior head and neck radiation therapy.

Osseointegrated Implants for Craniomaxillofacial Rehabilitation

Although lower than traditional intraoral implants, the overall success rate of extraoral implants varies by site location (e.g., auricular, orbital, and

nasal) and local tissue factors. Extraoral implant survival rates are on average greater when placed into non-irradiated vs. radiated bone as shown in the existing literature[25–27] with a reduction in 7% survival as shown in the most recent systematic review.[28] The lower survival rate of endosseous implants in irradiated tissue are attributed to the side effects following radiation such as fibrosis, osteonecrosis, and impaired wound healing.[22] Therefore, in oncologic cases where prosthetic rehabilitation is planned, osseointegrated implants are placed at the time of the ablative surgery and prior to adjuvant radiotherapy to mitigate those negative side effects. In our series (Table 1), only one patient (Case 1) received radiotherapy prior to implant placement. All the implants were successfully osseointegrated and loaded at the final facial prosthesis. With regards to implant site, the auricular region has been shown the lowest probability of failure, followed by the orbital and nasal regions.[25,28,30,31]

TABLE 1. Case Details at the Time of Implant Placement.

Case	Brown's Defect	Prior Reconstructive Surgery	Prior Radiotherapy	No. (Size of Implants)	Location
1	IIIC	None	No	2 (4.4 mm × 47.5 mm and 4.4 mm × 37.5 mm)	Bilateral zygoma
2	IVD	Latissimus dorsi free flap, fibula free flap, anterior lateral thigh free flap, radial forearm free flap	Yes	3 (3.8 mm × 9 mm)	Supero-lateral orbital rim
3	IVD	Anterior lateral thigh free flap	No	3 (3.8 mm × 9 mm), 2 (3.8 mm × 10.5 mm), 1 (3.4 mm × 10.5 mm)	Supero-lateral orbital rim, glabella, right mandibular alveolus, and left zygoma
4	VI	None	No	3 (3.8 mm × 13 mm, 3.8 mm × 15 mm, 3.8 mm × 9 mm)	Anterior maxilla and glabella

Digital Technology and Maxillofacial Rehabilitation

Within the past decade, there has also been a rapid increase in the utilization of all digital technologies in maxillofacial reconstructive surgery and prosthetics.[32] The use of photogrammetry, 3D printing, and virtual planning has provided more accurate and predictable results as well as decreased conventional laboratory processes for complex multi-staged maxillofacial reconstructive and rehabilitation. From the surgical standpoint, the use this technology has been extremely helpful in the preoperative and intraoperative timepoints. For example, when compared to conventional reconstructive surgery, virtual surgical planning allows the reconstructive surgeon to visualize the shape and form of the underlying bone and vascular supply at the recipient and donor sites, aids in the osteotomies to optimize bone contact, and reduces the total operative time.[1,33–35] With regards to the restorative (prosthetic) aspect, the incorporation of the technology reduces the manual workload, which in turn, decreases the overall cost and production time. Additionally, digital records can be quickly accessed and stored indefinitely. However, the learning curve and equipment for this innovative workflow can require greater time commitment and investment upfront. This is especially true when the workflow has not been standardized yet among laboratories and anaplastologists.

Limitations and Challenges

Our case series demonstrated a high success rate (100%) of extraoral osseointegrated implants and incorporated several digital methods to streamline the prosthetic workflow used in the both the laboratory and chairside to optimize the clinical and aesthetic outcome of prosthetically-restored midface defects. However, this case series only shows the successful outcomes in a selected group of patients who were able to follow through with the prosthetic rehabilitation to completion. Long-term follow-up for this patient population is not feasible as these patients tend to be lost to follow-

up after the placement of the prosthesis. Of note, all the osseointegrated implants were placed free-handed and that the angulation and number of implants placed were decided intraoperatively by the reconstructive surgeon according to the bone quantity and quality. Several challenges have been identified during the digitalization process associated with maxillofacial prosthetics. Firstly, while a desktop 3D printer is adequate for processing costs associated with intraoral defects, its application for large maxillofacial defects requires a larger and more costly printer as full-face casts may be indicated. Secondly, the dental software and manufacturer ends have not been streamlined with the specific needs for extraoral prosthetic rehabilitation. As a result, innovative or off-label approaches are often used, and requires additional time investment associated with trial-and-error processes. Finally, while the existing analog workflow has been well-established for decades, the transition to a completely digital and lab-free workflow for prosthetics may not be preferred for the traditional and experienced prosthodontist or anaplastologists.[1] As digital technology continues to be incorporated more into the planning processes of maxillofacial reconstructive surgery and prosthetic rehabilitation, the clinical outcome will continue to become more reliable, reproducible, and predictable for both simple and complex midface rehabilitation.

Finally, the technologies, materials, and services provided to achieve the clinical outcomes described in this case series can be a challenge to achieve for a reconstructive surgeon outside of the academic setting where there is limited access to a maxillofacial prosthodontist with the expertise in maxillofacial prosthetics. In addition, the financial costs associated with providing this complex multi-staged treatment may not be feasible for the patient as well. Currently, there are no comparative studies demonstrating whether reconstructive surgery only versus prosthetic rehabilitation provides superior clinical outcomes. Historically, both types of treatments have been resulted with excellent aesthetic and functional outcomes. Therefore, this case series provides the reader with the basic knowledge regarding the current implant-based maxillofacial prosthetic treatment options for midface defects. Midface reconstruction and rehabilitation should be planned on a case-by-case basis with the inclusion of a multidisciplinary team of maxillofacial reconstructive surgeon and maxillofacial prosthodontist when the dentition is involved to decrease surgical morbidity and improve psychosocial well-being for the patient.

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AUTHORS' CONTRIBUTIONS

All authors made substantial contributions to the conception, design of the study, analysis and interpretation, composition of the manuscript, and final approval of the manuscript.

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CONFLICTS OF INTEREST

All authors declared that there are no conflicts of interest.

ETHICAL APPOVAL AND CONSENT TO PARTICIPATE

IRB: 300004743 Role of osseointegrated implants in maxillofacial reconstruction. The study protocol was reviewed and approved by the University Institutional Review Board (IRB) for Human Use.

CONSENT FOR PUBLICATION

The author declares that signed Informed Consents were obtained for publication of patient's images in this manuscript.

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