

Leveraging Clinical Care Pathways and Technology to Move Beyond Facial Reconstruction to Facial Restoration

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14 September 2023 1330-1430 ET

Presenter

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CDR Daniel Hammer is a Navy board-certified Oral and Maxillofacial Surgeon with a certificate of added qualification in Head and Neck Oncology and Reconstructive Surgery. After completing his dental education at the University of the Pacific, he completed his residency at Walter Reed National Military Medical Center. Most recently, he completed his fellowship at John Peter Smith Hospital in Fort Worth, Texas. It was during his time at Walter Reed caring for the numerous Wounded Warriors from Operation Enduring Freedom (OEF) that sparked his passion to advance maxillofacial reconstructive techniques and patient outcomes.

CDR Hammer is currently the Director of the Naval Medical Center, San Diego (NMCSD) Maxillofacial Restorative Surgery Platform and Vice Chair and Director of Research for their Department of Oral and Maxillofacial Surgery. In addition, he is an Associate Professor of Surgery at the Uniformed Services University School of Medicine.

His operational tours include the USS ABRAHAM LINCOLN (CVN 72) and 2nd Marine Expeditionary Force where he earned his Surface Warfare and Fleet Marine Force Warfare Qualifications.





Disclosures

- Navy CDR Daniel Hammer has no relevant financial or non-financial relationships to disclose relating to the content of this activity.
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Learning Objectives

At the conclusion of this activity, participants will be able to:

- 1. Discuss new technologies and their application to reconstructive surgery and warfighter rehabilitation.
- 2. Demonstrate how patient care and health care delivery value is enhanced through multidisciplinary care and associated education initiatives.
- Outline application of computer-aided design and manufacturing to enhance patient outcomes.





"The team, the team, the team..."

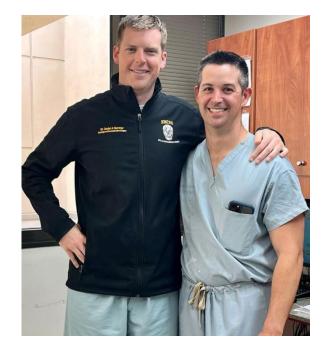
- Bo Schembechler



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Poem





Ameloblastoma

Q

•••

Friends and family try, but quite honestly they don't understand.

This isn't a toothache type of pain.

Tired of resting, healing

Missing work, hiding my face.

I'd do anything to feel normal again.

To feel like me.

To look like me.

Coping with the fact- that may not be.

What they don't tell you is the days you'll feel like you are losing hope.

The author of this text is unknown





Walter Reed National Military Medical Center 2011-2017



(https://walterreed.html)





Maxillofacial defects are horrible and incredibly complex

- They take away many of the things that make us feel human and require a specialized team to restore
 - Loss/Compromised speech
 - Loss/Compromised swallow function
 - Loss/Compromised taste
 - Pain
 - Changes to breathing (trach?)
 - Facial disfigurement
 - Social isolation and Depression/Anxiety
 - Loss of intimacy



(https://www.inquirer.com/art-can-reveal-trauma-in-soldiers.html)





What is Maxillofacial Reconstructive Surgery?

- Maxillofacial Reconstructive Surgery
 - A procedure to repair the face, mouth and/or jaws affected by congenital, pathologic or traumatic defects





What is Maxillofacial Restoration?

A process to restore the patient's health and quality of life following management of congenital, pathologic or traumatic conditions of the mouth, face and/or jaws through training, therapy and/or procedures

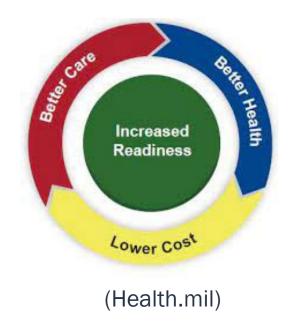
• It is a longitudinal process with the **patient at the center**, not a finite end-point or event (procedure)





Goals of Maxillofacial Restoration

- Maximize patient function through a coordinated, multi-disciplinary care protocol across all phases of care (Better care and optimized readiness)
- Minimize the <u>lifelong maintenance</u> required to continue the achieved level of function
 - Every step in the process optimizes sustainment of the outcome (better health and lower cost)







Technological advances and integration have facilitated the development of Restorative Surgery

In-House Digital Workflow for the Management of Acute Mandible Fractures

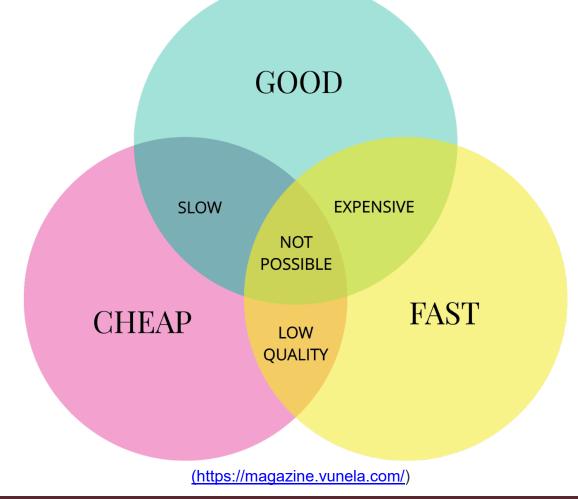
Jeffrey S. Marschall, DMD, MD, MS, * Vinicius Dutra, DDS, MBA, PhD, †
Robert L. Flint, DMD, MD, ‡ George M. Kushner, DMD, MD, § Brian Alpert, DDS, ||
William Scarfe, BDS, ¶ and Bruno Azevedo, DDS, MS#

In-House Surgeon-Led Virtual Surgical Planning for Maxillofacial Reconstruction

Haider Abo Sharkh, DMD, MD, CM, * and Nicholas Makhoul, DMD, MD†

An In-House Computer-Aided Design and Computer-Aided Manufacturing Workflow for Maxillofacial Free Flap Reconstruction is Associated With a Low Cost and High Accuracy

Justine Moe, MD, DDS, * Jessica Foss,† Racbel Herster,‡ Corey Powell, PbD,§
Joseph Helman, DMD, || Brent B. Ward, MD, DDS, # and Kyle VanKoevering, MD**

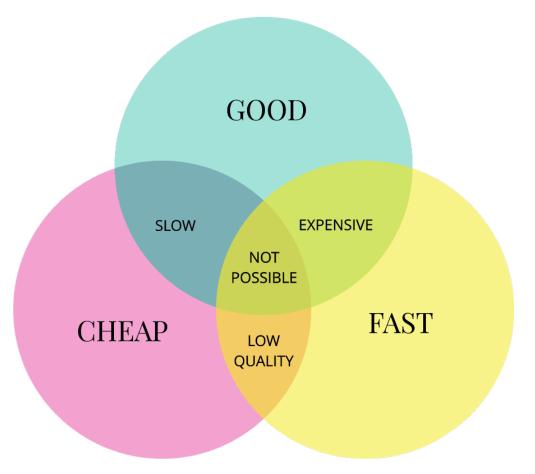


(Marschall et al., 2019) (Sharkh & Makhoul, 2020) (Moe et al., 2021)





The Healthcare Value Proposition





(https://www.raslss.com/)







Acceptance of prolonged treatment times and inadequate reconstruction leads to "Burnout"

Reconstructive Burnout after Mastectomy: Implications for Patient Selection

Sameer H. Halani, MD, MSc¹
Kaitlin Jones, BS¹
Yulun Liu, PhD²
Sumeet S. Teotia, MD¹
Nicholas T. Haddock, MD¹

Background: The reconstructive journey after mastectomy can be a long road, with many hurdles to achieve an ideal aesthetic result. Cancer therapy, operative complications, and comorbidities impact patients physically and emotionally. This study introduces the term *reconstructive burnout* and aims to evaluate which factors predict and contribute to patients prematurely stopping reconstruction.

~77.6% completed reconstruction in 3 years

Significant factors for **BURNOUT** include:

Age, diabetes, smoking, BMI, radiation, tissue expander complications, and **delayed reconstruction**

(Halani et al., 2023)

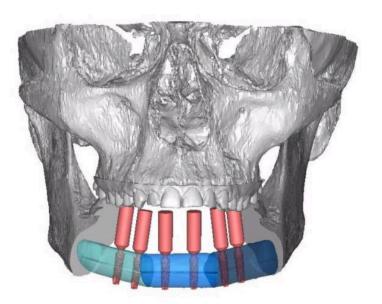




Lack of knowledge, coordinated care, and collaboration have stifled innovation

Oral rehabilitation of the cancer patient: A formidable challenge

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Ivana Petrovic DMD<sup>1</sup> | Evan B. Rosen DMD, MPH<sup>2</sup> | Evan Matros MD, MMSc, MPH<sup>3</sup> | Joseph M. Huryn DDS<sup>2</sup> | Jatin P. Shah MD, PhD<sup>4</sup>
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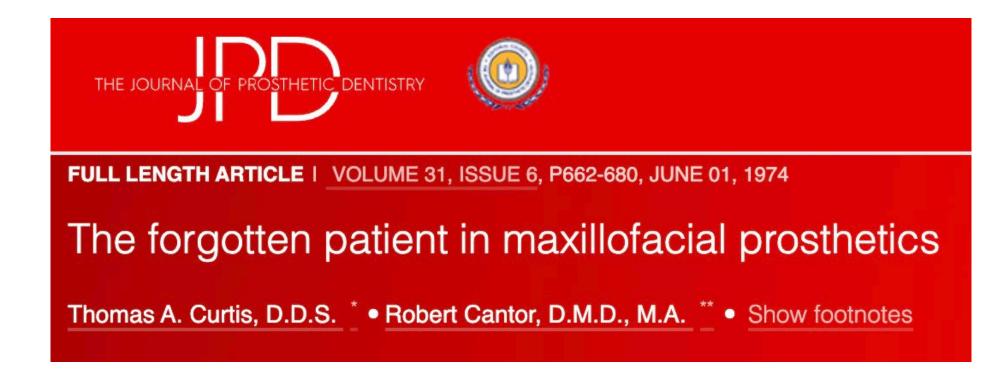


(Petrovic et al., 2018)





These challenges have destined this patient population to remain, "The Forgotten Patient," for the last 50 years



(Curtis and Cantor, 1974)





Common misconceptions perpetuate assumptions...

- "My patient does not care about replacing their teeth, they have (fill in the blank)."
- "My patient can not afford implants and a denture."
- "The patient can just get implants and teeth later."
- "The time to make the denture is too long for patients with malignancies. Are you just going to let their cancer grow so they can get teeth?"
- "You can not have immediate teeth in fibula flaps with skin paddles. You will compromise the flap!"





The evolution of Immediate Dental Rehabilitation in Free Flaps (Jaw-in-a-Day)



(istockphoto.com)



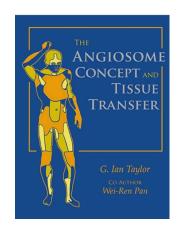


Step 1: Immediate Bone

> Plast Reconstr Surg. 1975 May;55(5):533-44. doi: 10.1097/00006534-197505000-00002.

The free vascularized bone graft. A clinical extension of microvascular techniques

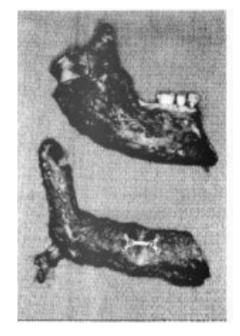
G I Taylor, G D Miller, F J Ham





Fibula Free Flap: A New Method of Mandible Reconstruction

David A. Hidalgo, M.D.



(Taylor, Miller & Ham, 1975) (Taylor & Pan, 2013) (Hidalgo, 1989)

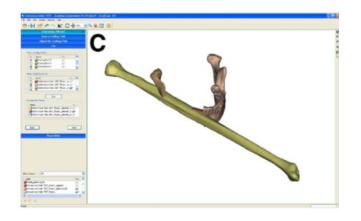




Step 1.5: Immediate bone in the right place: Bone-Driven vs. Occlusion-Driven Maxillofacial Reconstruction

Use of Computer-Aided Design and Computer-Aided Manufacturing to Produce Orthognathically Ideal Surgical Outcomes: A Paradigm Shift in Head and Neck Reconstruction

David L. Hirsch, DDS, MD,* Evan S. Garfein, MD,†
Andrew M. Christensen, BS,‡ Katherine A. Weimer, MS,↓
Pierre B. Saddeh, MD,|| and Jamie P. Levine, MD¶



The Alberta Reconstructive Technique: An Occlusion-Driven and Digitally Based Jaw Reconstruction

Hadi Seikaly, MD ; Sherif Idris, MD ; Richelle Chuka, MSc; Caroline Jeffery, MD;

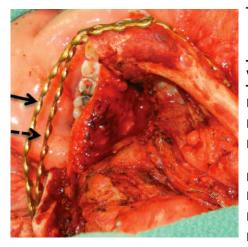


TABLE V.
Reconstructive Procedure Complexity, Effectiveness, Accuracy, and Timeliness.

Variable	ART	BDD	P Value
Bone osteotomies, (mean)	21 (1.4)	16 (1.1)	.190
No. of procedures, (mean)	39 (2.6)	89 (5.9)	.0003
Mean operative time to dental occlusal rehabilitation, min	1142.1 n	1778.5	.040
No. of implants.	57	53	.900
Implant loss (%)	2 (4%)	2 (4%)	.00
Implant utilization (%)	55 (96%)	44 (83%)	.040
Mean time to occlusal rehab, mo	21.4	73.1	.000

This image is the property of Daniel Hammer

(Hirsch et al., 2009) (Seikaly et al., 2019)

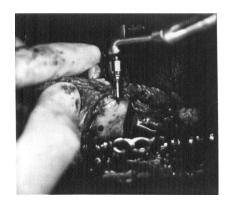




Step 2: Immediate Implants

Primary placement of osseointegrated implants in microvascular mandibular reconstruction

MARK L. URKEN, MD, DANIEL BUCHBINDER, DMD, HUBERT WEINBERG, MD, CARLIN VICKERY, MD, ALAN SHEINER, DDS, and HUGH F. BILLER, MD, New York, New York



(Urken et al., 1989) (Ch'ng et al., 2016) Panchel et al., 2020) Dental Implant Survival in Vascularized Bone Flaps: A Systematic Review and Meta-Analysis

Hina Panchal, M.D., M.P.H.
Meghana G. Shamsunder,
M.P.H.
Ivana Petrovic, D.M.D.
Evan B. Rosen, D.M.D.,
M.P.H.
Robert J. Allen, Jr., M.D.
Marisol Hernandez, M.L.S.,
M.A.
Ian Ganly, M.D., Ph.D.
Jay O. Boyle, M.D.
Evan Matros, M.D., M.M.Sc.,
M.P.H.
Jonas A. Nelson, M.D., M.P.H.

- Implant survival 92.9%
 - Before RT > After RT

Osseointegrated implant-based dental rehabilitation in head and neck reconstruction patients

Sydney Ch'ng, MD, PhD, 1.2.3 Roman J. Skoracki, MD, 1 Jesse C. Selber, MD, 1 Peirong Yu, MD, 1 Jack W. Martin, DDS, MS, 4 Theresa M. Hofstede, DDS, Mark S. Chambers, DMD, MS, 4 Jun Liu, MD, PhD, 1 Matthew M. Hanasono, MD1*

- Implant survival 96.3%
- Implants are reliable in patients with head and neck cancer





Step 3: Immediate Teeth

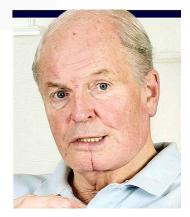
Daily Mail

The doctors mademe a new jaw from my shoulder — with ready fitted teeth

13 Mar 2007 THE PATIENT THE SURGEON







Jaw in a Day: Total Maxillofacial Reconstruction Using Digital Technology

Jamie P. Levine, M.D.
Jin Soo Bae, D.D.S., M.D.
Marc Soares, M.D.
Lawrence E. Brecht, D.D.S.
Pierre B. Saadeh, M.D.
Daniel J. Ceradini, M.D.
David L. Hirsch, D.D.S., M.D.

New York, N.Y.

(https://safe.menlosecurity.com/doc/docview/viewer/doc)





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(Levine, 2013)



Case Study

Immediate Teeth in Fibulas: Planning and Digital Workflow With Point-of-Care 3D Printing

Fayette C. Williams, DDS, MD, *Daniel A. Hammer, DDS, †
Todd R. Wentland, DDS, MD, ‡ and Roderick Y. Kim, DDS, MD§



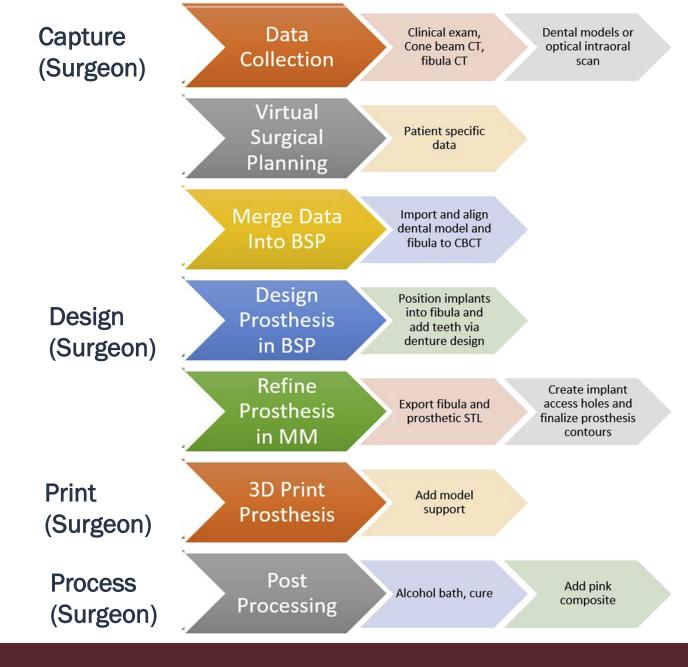
(Williams et al., 2020)





In-House Digital Workflow

- Turnaround for prosthesis in 1 day
- Out-of-pocket cost to patient
- Huge software learning curve
- Easy communication between surgeons and prosthodontist
- Several man hours for design, print and processing



(Williams et al., 2020)





Case Study

Immediate Teeth in Fibulas: Expanded Clinical Applications and Surgical Technique

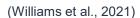
Fayette C. Williams, DDS, MD,* Daniel A. Hammer, DDS, † Todd R. Wentland, DDS, MD, ‡ and Roderick Y. Kim, DDS, MD §











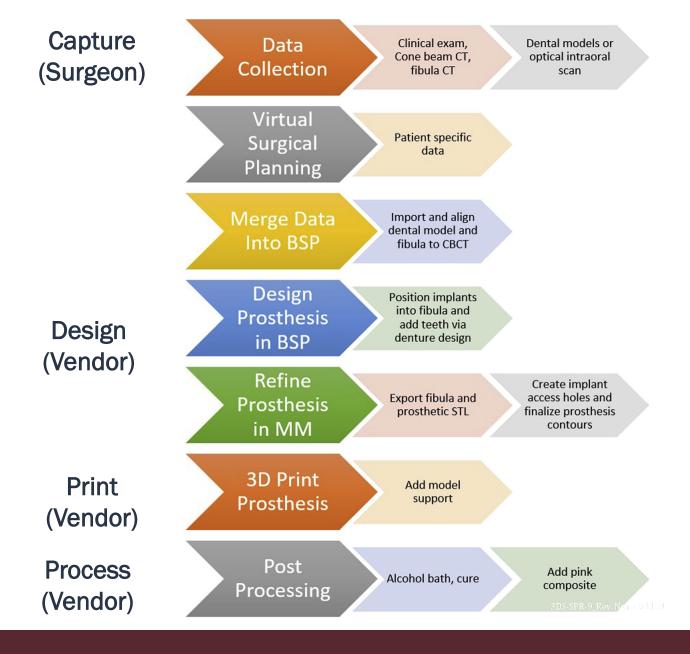
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Teeth-in-the-Box Digital Workflow

- Turnaround for prosthesis 12 days
- No out-of-pocket cost to patient
- No software learning curve
- Easy communication between surgeons and prosthodontist
- Hours saved in design, print and processing

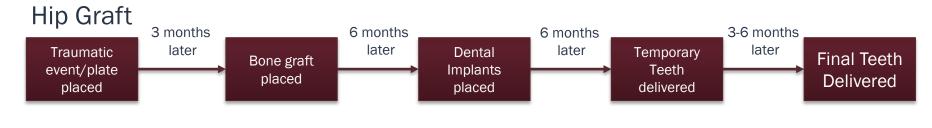


(Williams et al., 2020)



Our Capabilities: Digital Jaw-in-a-Day

Current Standards of Care



Free Flap 6 months 4-6 months



NMCSD Jaw-in-a-Day using 3D printing



(Hammer, 2023)





Our Outcomes vs. Standard of Care

Technique	Total Treatment Time to Final Teeth Delivery (Months)	Number of Surgeries
Hip graft with delayed dental rehabilitation	20-24	At least four
Fibula Flap with delayed dental rehabilitation	At least 12 (<20% restored at 24 months)	At least two
NCMSD Jaw-in-a- Day	<5	1

(Hammer, 2023)





Example Case





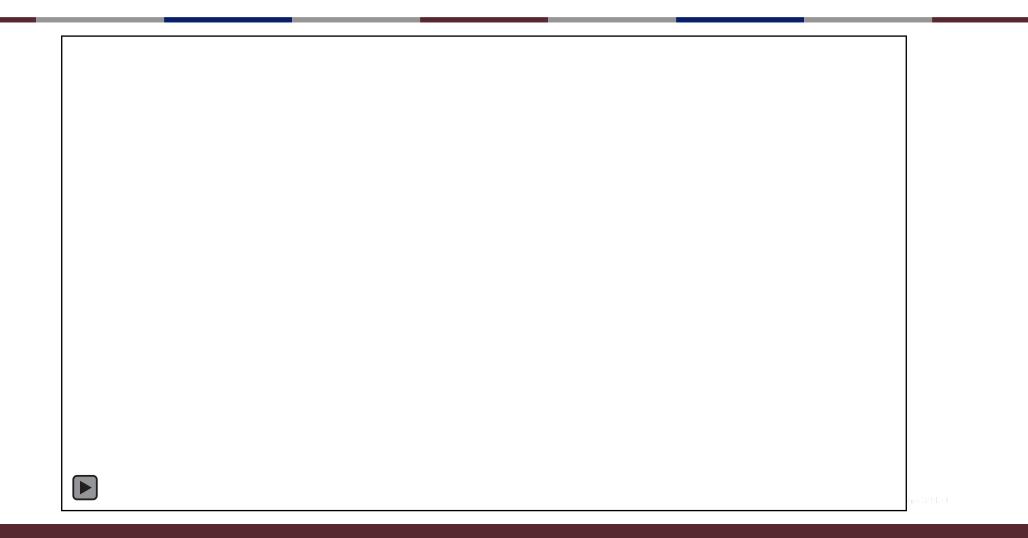
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- 308 SPR 9 Rev. Rouge 3/UE





Virtual Surgical Planning and Prosthetic Design





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Oncologic Resection





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[308.57 C9] Rev. Rouge 3/UE9





Guided Implant Osteotomies







GI



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nt







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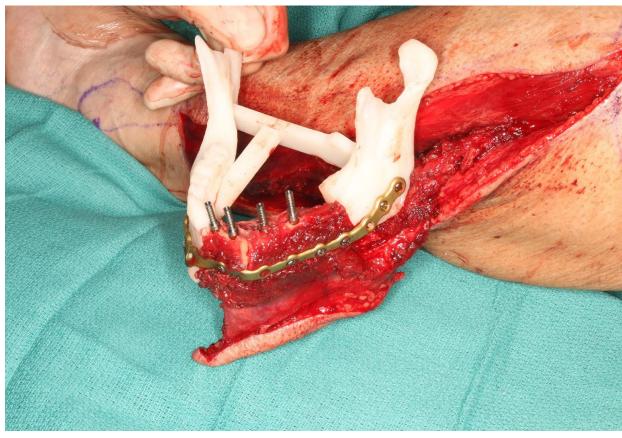


P 3 9 Rev. Rouge 3/1439



Bone Segment Alignment





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308 SPR 9 Rev. Route 3/US3





Indexing the Teeth





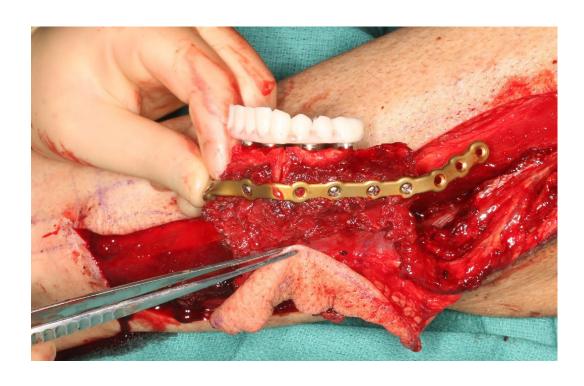
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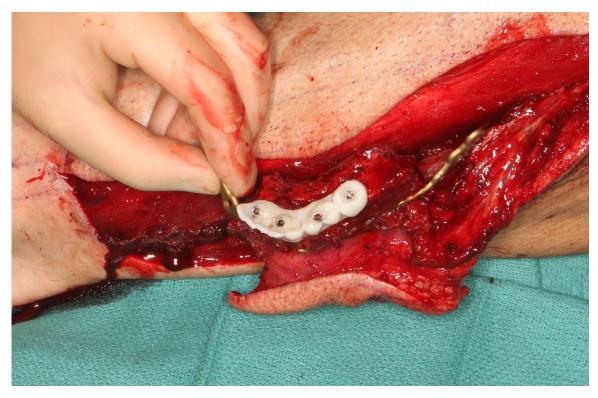
- 306 SEC9 Rev. Route 3/0139





Final Registration of the Teeth





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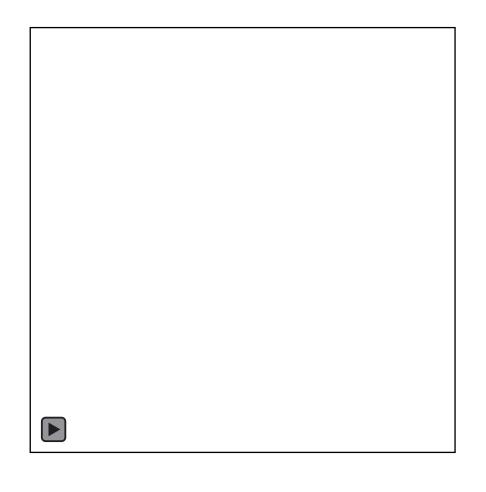
201160 R P 2 301 Bloom (Promos 20111030





Final Delivery of the Teeth





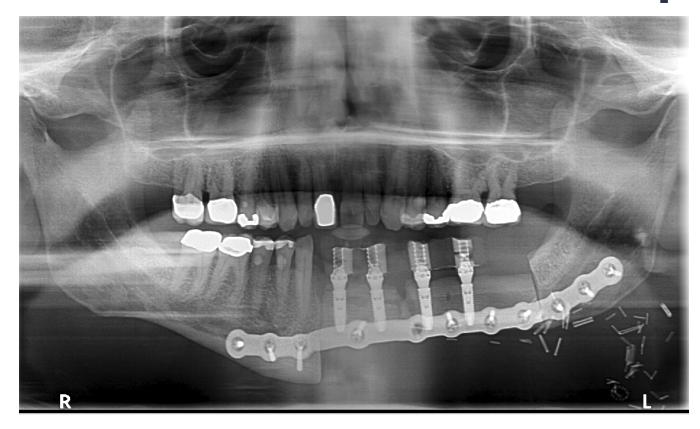
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3306 SPR 9 Rev. Route [345]39





Patient-Three months Post-Op



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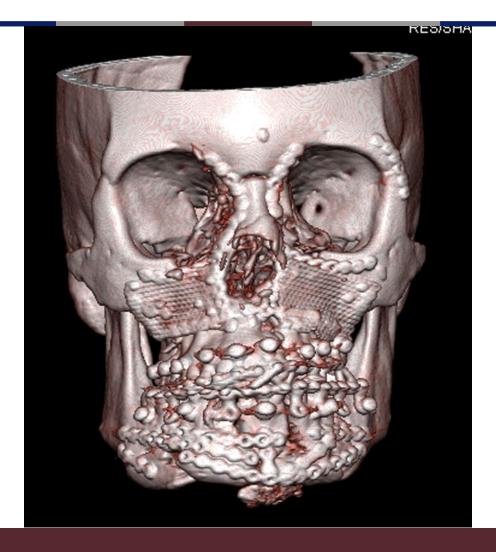








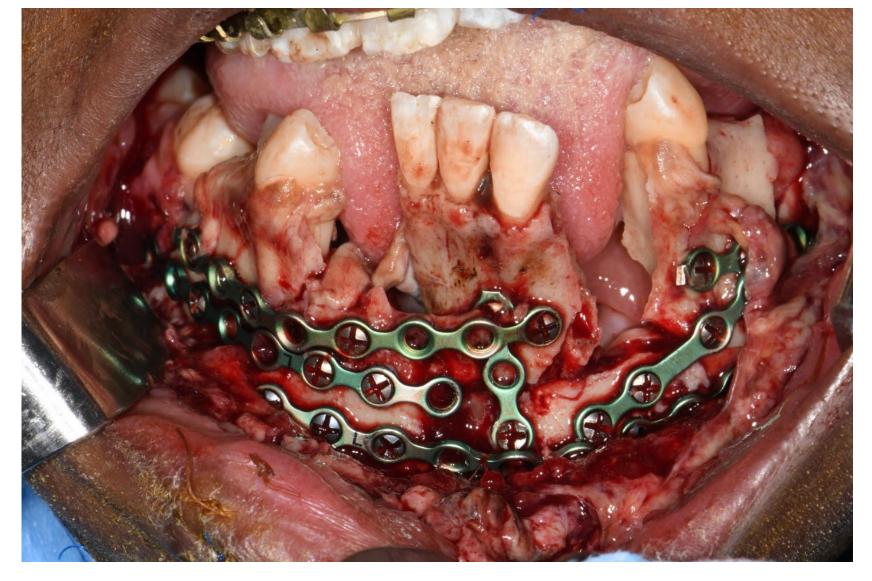
Expanded Application to Trauma







Debridement of the Necrotic Bone



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Segmental Defect of Necrotic Bone

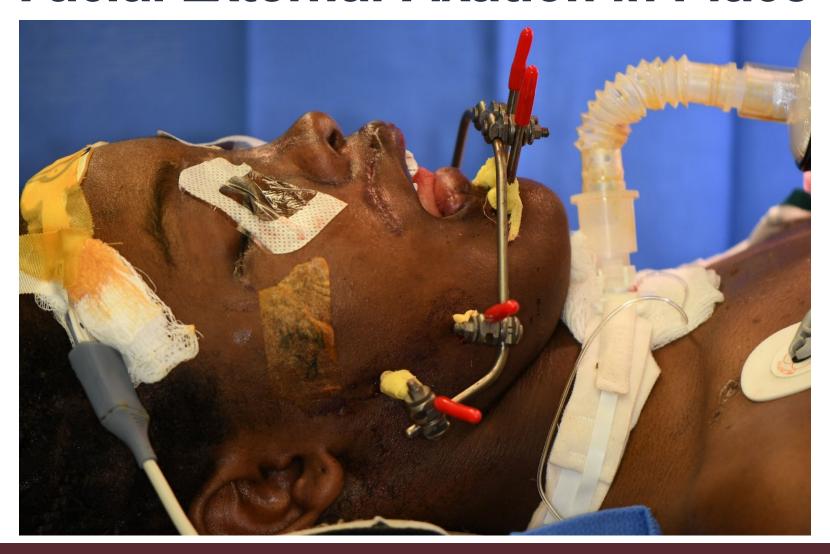


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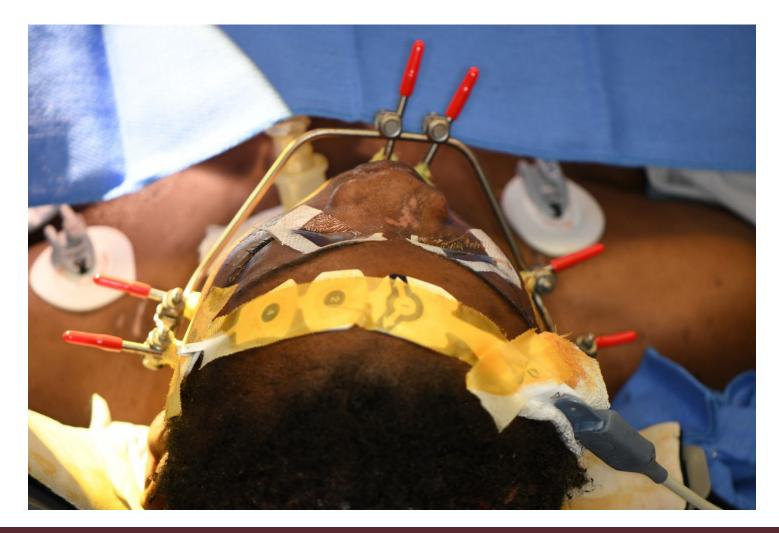
Facial External Fixation in Place







Anterior Projection of External Fixation







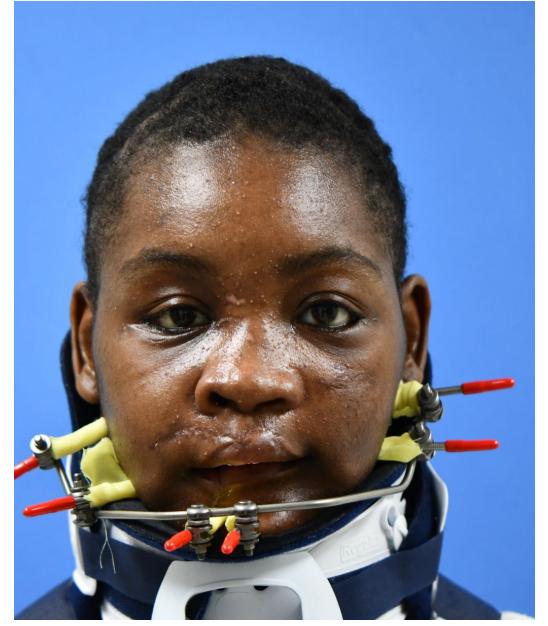
CT Demonstrating use of Necrotic Bone







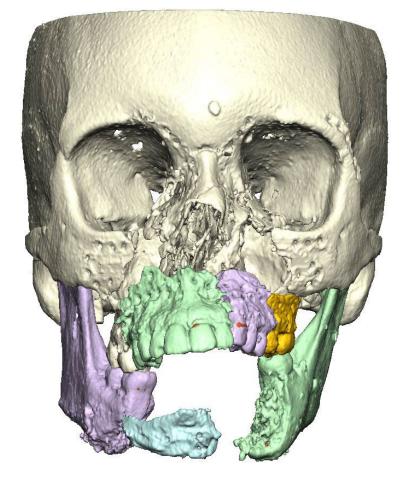
One Week Post-Op

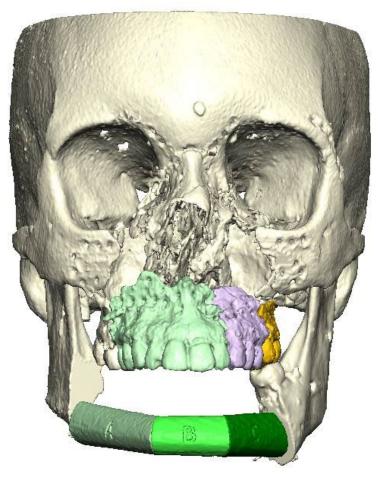






Virtual Surgical Plan





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Prosthesis Pickup from Initial Surgery







Stage 2 with Prosthesis Delivery





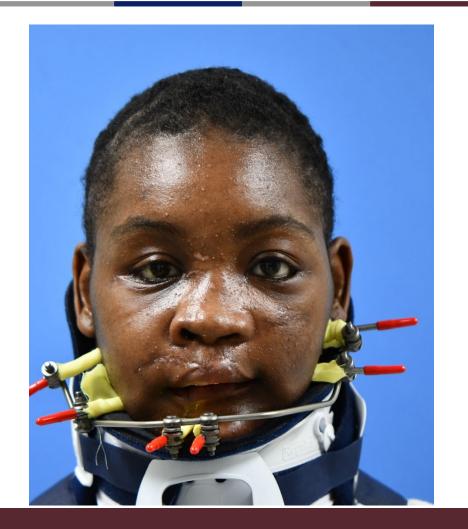


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1 year after injury





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2 years after Reconstruction





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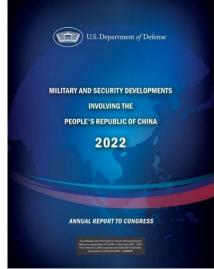


Our Mission at Naval Medical Center, San Diego (NMCSD)

- We must be ready tonight for our Warfighters across many Combatant Commands in their Areas of Responsibility (COCOM AORs)
- Early reports from Ukraine demonstrate high number of head and neck injuries
- In Operation Iraqi Freedom (OIF) and Operation Enduring Freedom in Afghanistan (OEF), the Head and Neck was the 2nd most common body region injured (30%)
 - No Center of Excellence (CoE) or reconstruction registry established, minimal publications and numerous lessons learned lost



https://www.timesfreepress.com/



https://navyleaguehonolulu.org/





The NMCSD Maxillofacial Restorative Surgery Platform

- Vision
 - To shape the future of Maxillofacial Restorative Surgery
- Mission
 - To be the global leader in the development and delivery of comprehensive maxillofacial restoration of our patients with unprecedented outcomes and treatment timelines





Our Outcomes since November, 2020

- 50 Patients have been cared for by our Platform (Majority have been active duty service members [AD SM])
- 21 Jaw-in-a-Day Patients (14 AD SM)
 - USA, USAF, USN, USMC, VA, Retiree and Dependent (Continental US [CONUS] and Outside the Continental US [OCONUS])
 - Unprecedented clinical outcomes...
 - ✓ ONLY 1 patient on limited duty (LIMDU) and Med Board
 - ✓ Nearly all patients with unit 16 weeks post-op
 - ✓ Nearly all patients returned to unit fit for full duty
 - ✓ Hospital Length of Stay average 7 days
 - √ 100% of patients discharged on a nothing by mouth (PO) diet
 - √ 100% of patients ambulating without assistive at 6 weeks post-op





Services of our Platform

- Our platform provides comprehensive care for patients with the following conditions of the face, mouth and jaws:
 - Benign pathology
 - Malignant pathology
 - Congenital anomalies
 - Primary (acute) trauma
 - Secondary (delayed) trauma
 - Secondary dental restoration following previous free flap





Additional Services of our Maxillofacial Restorative Surgery Platform

- Complex Head and Neck Microvascular Surgery
 - Immediate Sensate Dental Rehabilitation in Free Tissue Transfer (Jaw-in-a-Day with nerve restoration)
- Delayed Dental Rehabilitation (Teeth-in-a-Day)
- Temporomandibular Joint Reconstruction
- Trigeminal Nerve Restoration
- Anaplastology (Eyes, Ears and Noses) with or without implants
- Obturators with or without implants





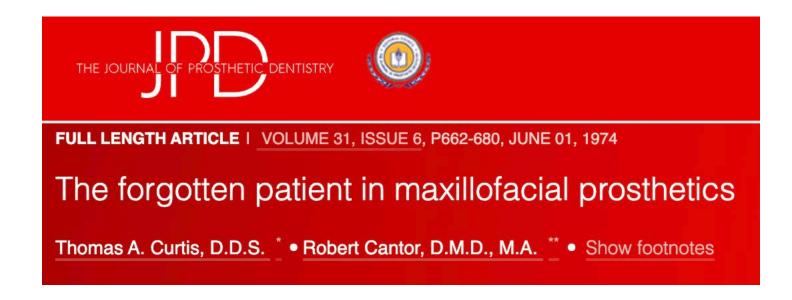
Our Platform Consists of Eight Integrated Clinical Care Pathways (>125 team members, 10 Departments)

- 1. Oral, Head and Neck Cancer Care Team
- 2. Preoperative Patient Optimization (Virtual Medicine Operational Center [VMOC])
- 3. Anesthesia and Pain Management
- 4. Inpatient Early Recovery After Surgery (ERAS)
- 5. Speech and Swallow Restoration
- 6. Rapid Dental Restoration (Activities of Daily Living [ADL])
- 7. Functional Restoration Pathway (Physical Therapy [PT], Occupational Therapy [OT] and Gait)
- 8. Research (Patient Reported Outcome Measures [PROMs]), Education and Training





Will we be any better in 50 years?



(Curtis and Cantor, 1974)





Key Takeaways

- The application of current technologies paired with comprehensive clinical care pathways can lead to unprecedented outcomes
- Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM)
 Capabilities at MTFs will enhance our ability to improve outcomes, drive costs down and improve overall health of our patients
- By leveraging technology and multi-disciplinary care we can return the Warfighter back to the fight with restored form, function and purpose





Questions?







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