

The history of oral cavity reconstruction

ALEXANDRA E. KEJNER, MD FACS

ASSOCIATE PROFESSOR

HEAD&NECK SURGICAL ONCOLOGY/MICROVASCULAR
RECONSTRUCTION



Speaker honorarium for Cooper Surgical

Speaker honorarium for Vioptix Inc

The presenter has no relevant nonfinancial relationship to disclose

disclosures

~600–700 BCE –
Sushruta (India)

-

14th–16th Century

-
- A portrait of a man with a beard and mustache, wearing a dark robe with a white collar. He is holding an open book in his left hand and a small object in his right hand. The background is dark, and there is a small emblem in the top left corner.

1790s-1816

- 
- L. C. CARTER, Esq.



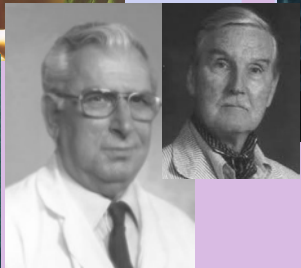
WWI–WWII

-



1950s–1960s – Regional Pedicled Flaps

-



1970s–1980s –
Microsurgical Era

-



1990s-2000s –
Refinement
& Functional Focus

- 



2010s–Present – Digital and Precision Reconstruction

- 
- Dr. Yoonhee Park is an Assistant Professor at the Department of Health, Behavior, and Society, Johns Hopkins University. She is also a senior research advisor at the Center for Communications Programs, Johns Hopkins University. Dr. Park has a PhD in Epidemiology from Johns Hopkins University and a Master of Public Health from the University of California, Berkeley. She has been working in the field of reproductive health and family planning for over 10 years. Dr. Park is currently leading a research team that is studying the impact of a new contraceptive method on women's health and family planning. She is also involved in several other research projects related to reproductive health and family planning. Dr. Park is a frequent speaker at international conferences and has published several articles in peer-reviewed journals. She is also a member of several professional organizations, including the American Society for Human Sexuality and the International Society for Family Planning.



600-700BCE: Sushruta Samhita *Suśrutasaṃhitā*



Combination of several medical texts and authors and considered the foundational text of Ayurvedic medicine



The Sushruta Samhita is mainly known for nasal reconstruction, however, many oral reconstructive techniques described as well



16th chapter is dedicated to oral pathologies as well as acknowledgement of the carcinogenic tendency of betel quid



Described cheek and local flaps for reconstructing lips, oral lining, and facial defects.



Introduced flap design, skin grafting, and suturing principles.



Later re-introduced by Western surgeons as the "Indian techniques"



> [World J Surg Oncol.](#) 2012 Oct 30;10:227. doi: 10.1186/1477-7819-10-227.

Nasolabial flap reconstruction in oral cancer



Seema Singh ¹, Rajesh Kumar Singh, Manoj Pandey

Affiliations + expand

PMID: 23110587 PMCID: [PMC3544680](#) DOI: [10.1186/1477-7819-10-227](#)



14th–16th Century - Innovators

- Developed 'Italian method' using pedicled oral/cheek repairs.
- Branca Family (Catania, Sicily)
→ Performed cheek and lip reconstruction flaps.
- Gaspare Tagliacozzi (Bologna, Italy, 1545-
→ First described the concept of the distal upper arm
 - Published *De Curtorum Chirurgia per Insitione* reconstruction.
→ His method was difficult to replicate and thus satire
- Less commonly used today but considered



Fig 2. The portion of the Marrow of Surgery mentioning Tagliacozzi (fourth edition, 1685). (From the collection of Dr. Bard Cosman and Dr. Madeleine Pelner Cosman.)



Reconstruction

Original Article | Published: 01 April 2011

Volume 25 | Number 4 | April 2011 | www.surgicalsciences.com

18th–Early 19th Century — European Revival

- **Joseph Carpue** (England, 1764–1846)
 - Adapted Indian flap (forehead) methods; performed the first modern rhinoplasty in England (1814)
 - Early applications extended to oral and perioral defects.
 - Restored Tagliacozzi's reputation by re-introducing pedicled techniques
- **Karl Ferdinand von Gräfe** (Germany, 1787–1840)
 - Developed refinements in local flap reconstruction for lips and cheeks, influencing intraoral techniques
- Von Hacker described Wanderlappentransplantation (Walking flap transfer)



International Journal of Surgery Case Reports

Volume 89, December 2021, 106521



Case report

The pedicled lateral forehead flap in reconstructing oral floor defect - The last resort; case report

Ahmed S. Alotaibi ^a, Qutaiba N.M. Shah Mardan ^b, Mohammed A. Almarshoud ^c,
Nehal A. Mahabbat ^a, Felwa A. Almarshad ^a, Fuad K. Hashem ^a 

Quick detour into the history of tubed flaps

The tubed pedicle flap centennial: its concept, origin, rise and fall

Klaas W. Marck¹ · Roman Palyvoda² · Andrew Bamji³ · Jan J. van Wingerden⁴

Filatov definitely tubed first – 1916
Ganzer reported tubing in March 1917
Gillies tubed 10/3/1917
Aymard 15 days later
But Gillies didn't publish til 1920 and Aymard got salty that Gillies called it "my method"

Table 1 Bibliographic data and references about the first use of the tubed pedicle flap (operation, public presentation, publication) for Aymard, Filatov, Ganzer and Gillies

	First operation	First public presentation	First publication
Aymard	18 October 1917 [14]	Not known	15 Dec. 1917 [7]
Filatov	9 Sept. 1916 [8]	22 Nov. 1916 [8]	April/May 1917 [8]
Ganzer	Not known	30 March 1917 [10]	July 1917 [9]
Gillies	3 October 1917 [17]	Not known	1920 [18]



Fig. 2 Six photographs illustrating the first tubed pedicle flap of Filatov performed in 1916 [8]

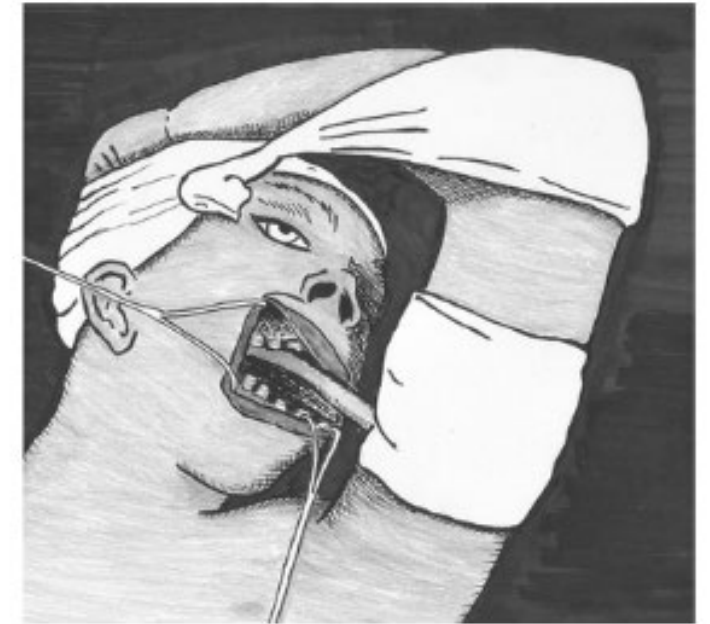


Fig. 3 Closure of a palatal defect with a tubed forearm flap by Ganzer, published in 1917. [10] Drawing from the original illustration, made by K.W.M.

Late 19th – Early 20th Century — Foundational Oral Techniques

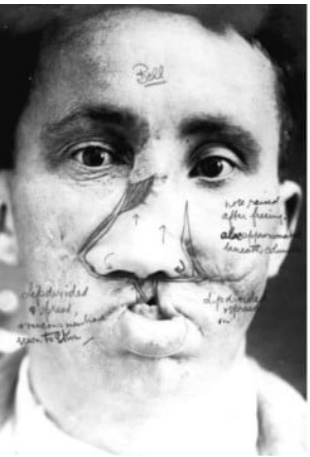
- **Harold Gillies** (New Zealand/UK, 1882–1960)
 - Pioneered tubed flaps, bone grafts, and prosthetics for WWI facial/oral reconstruction
- **Varaztad Kazanjian** (Armenia/USA, 1879–1974)
 - “Father of modern plastic and oral surgery”; advanced mandibular reconstruction and lip repairs, combining bone grafts with prosthetics.



Harold Gillies:

(6/17/1882 – 9/10/1960)

- Pioneering otolaryngologist who advanced war-time and post-traumatic reconstruction during WWI
- Established the “Gillies Hospital” the Queen’s Hospital in Sidcup, KENT to treat severe facial injuries of soldiers in WWI
- Developed a team of dentists, maxillofacial surgeons, anesthetists, and prosthodontists to take care of war time facial injuries
- He is credited with many of the techniques we continue to use today
 - bony grafting, tubed flaps, skin grafts, delayed flaps



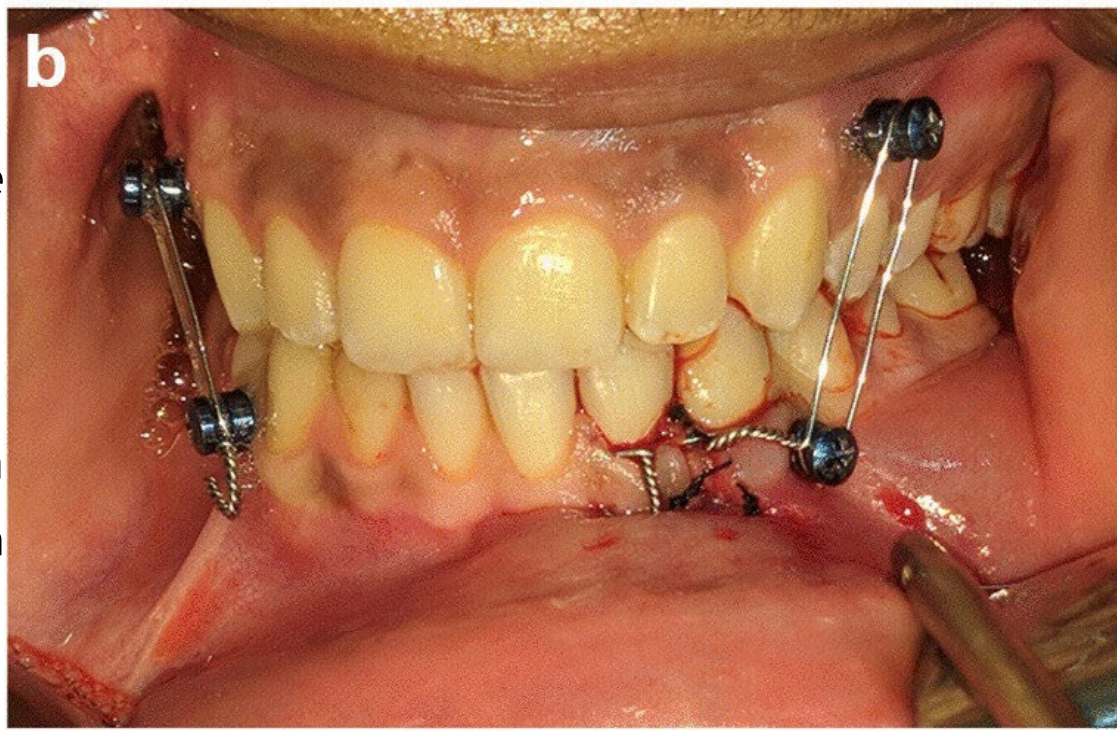
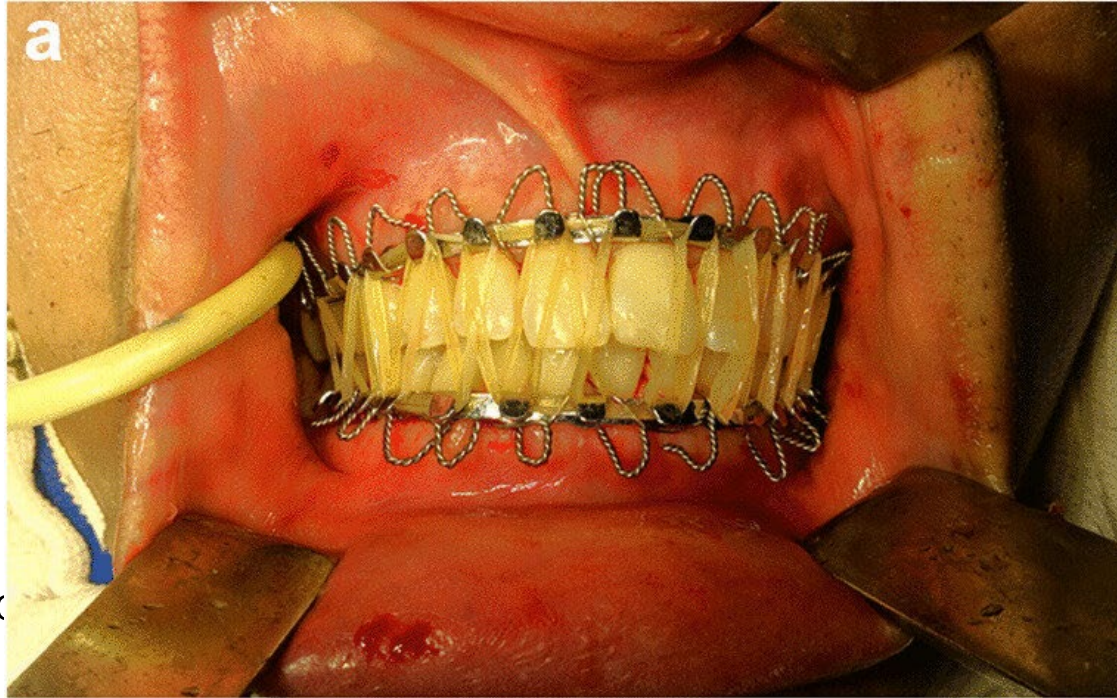
The dental team: 'I'll take the hard tissues. You take the soft part.' – attributed to Kesley Fry



- Sir Auguste Charles Valadier 1/12/1871-8/31/1931
French/American dentist who set up a 50-bed oral surgery unit to treat facial injuries that he funded himself*
 - Pioneered the use of bone grafting, splinting, and wound irrigation
- Sir William Kesley Fry 3/18/1889-10/26/1963
 - Developed airway management techniques for ppl with facial injuries
 - Ultimately developed techniques for cleft palate and other facial deformities
- Henry Pickerell 8/3/1879-8/10/1956
 - Helped pioneer bone/skin/fat grafting, jaw wiring (despite no training in the field)
 - Helped to develop a facial injuries hospital in NZ at conclusion of the war

Varaztad Kazanjian

- Armenian descent, escaped Ottoman Empire
- Worked at a wire mill in New York City in 1902
- Was in dental practice in New York City
- Developed interdental arch bars to reconstruct soldiers' jaws
- Designed the Kazanjian arch bar to immobilize the mandible



1919/1974

Harvard Dental School

Orthodontics and surgery to

Kazanjian button – used
for treatment of nasal fractures

Egyptian masks
Susruta Samhita
Rhinokopia

Anna Coleman Ladd
Facial silicones
Facial transplants

**Antiquity
and
Early Middle Ages**

**Late Middle Ages
and
Modern times**

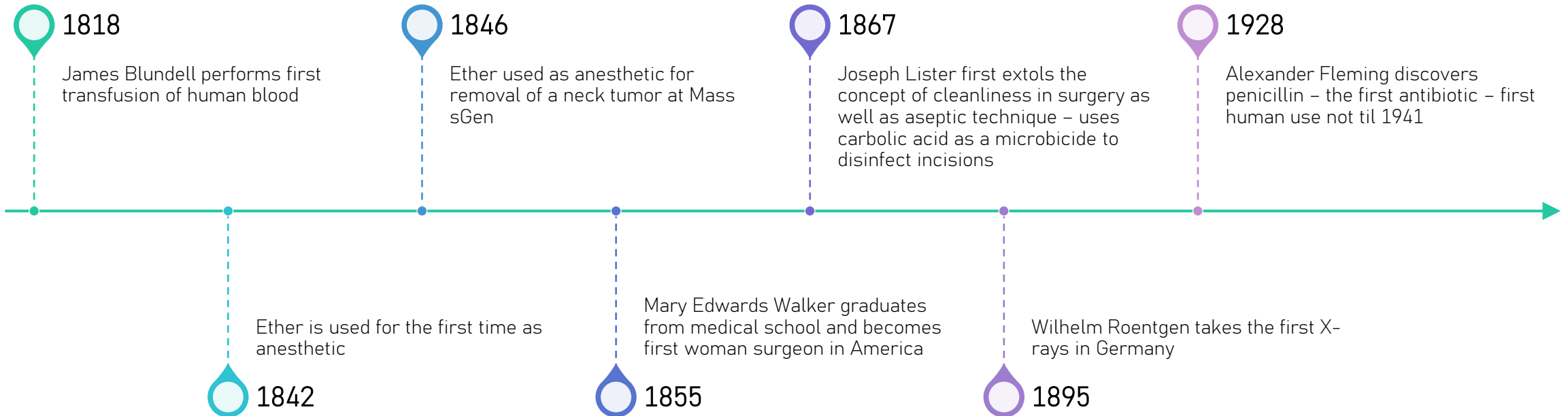
**Contemporary
Age**

**Transhuman
Era**

Ambroise Paré
Pierre Fauchard
Claude Martin

Cybergology
Amplification prosthesis
Bioengineering evolution

Surgical discoveries during this time period



The Origins of Deltopectoral Flaps and the Pectoralis Major Myocutaneous Flap



Kun Hwang¹

Affiliations + expand

PMID: 27763977 DOI: 10.1097/SCS.0000000000003057

- 1917: hotly contested who actually came up with it
- 1953: John Conley NY,NY – laterally based DP flap
- 1965: Bakamjian: medially based DP flap for pharyngoesophageal reconstruction (similar to Aymard flap) – Bakamjian did not cite Aymard
- 1968: Hueston, Melbourne, Australia – included pec major as a compound flap
- 1972: Krizek New Haven, CT – cited both Aymard and Bakamjian
- 1979: Ariyan, New Haven, CT and Baek NY, NY – both described PMMC compound flap. Also described the TAP (thoracoacromial perforator flap)
- 1980: PMMC first used for reconstruction of head and neck

1940s–1960s: Pedicled flap era and the beginning of the microsurgery

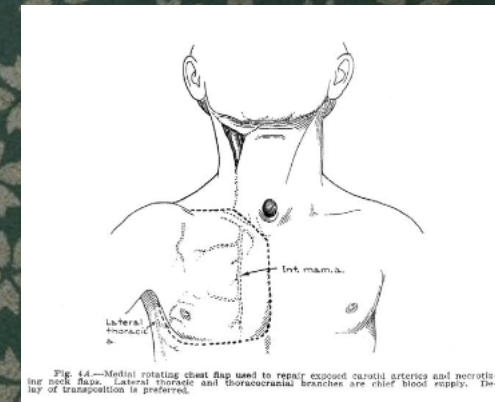
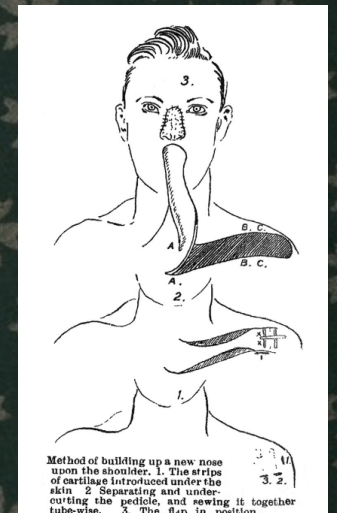


Fig. 4A.—Medial rotating chest flap used to repair exposed carotid arteries and necrotizing neck flaps. Lateral thoracic and thoracoacromial branches are chief blood supply. The flap of transposition is preferred.



Method of building up a new nose upon the shoulder. 1. The strip of cartilage introduced under the skin. 2. Separating and undercutting the pedicle, and sewing it together tube-wise. 3. The flap in position.

Immediate Reconstruction of the Cervical Esophagus by a Revascularized Isolated Jejunal Segment *

BERNARD SEIDENBERG, M.D., STEPHEN S. ROSENAK, M.D.
ELLIOTT S. HURWITT, M.D., MAX L. SOM, M.D.

*From the Head and Neck Group and the Surgical Division, the Montefiore Hospital,
New York City*

* Submitted for publication March 5, 1958.

This work was done in the Henry and Lucy
Moses Research Laboratories.

Aided by a grant from the A. Shapiro Surgical
Research Fund.

170

SEIDENBERG, ROSENAK, HURWITT AND SOM

Annals of Surgery
February 1959

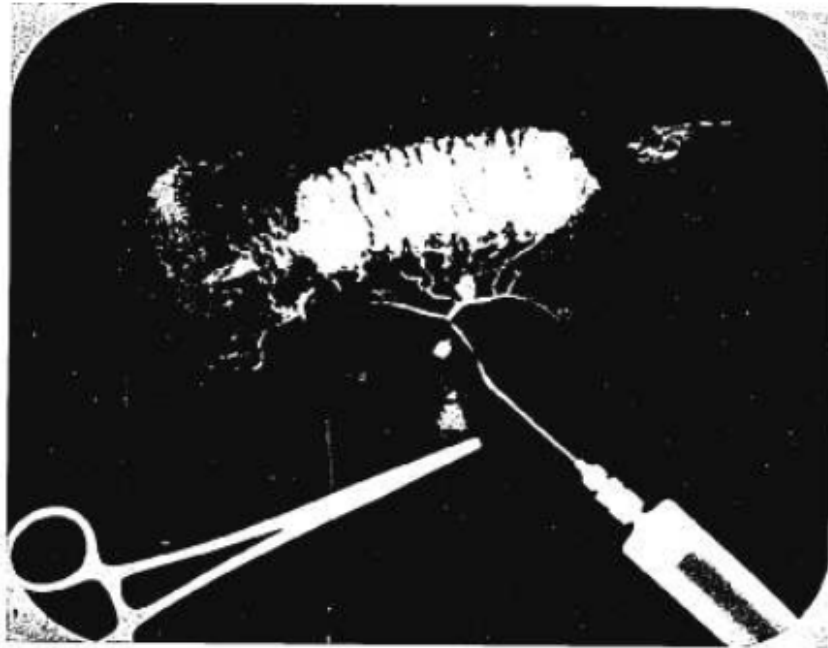


FIG. 10. The specimen in Figure 9 was perfused with diodrast through the inferior thyroid artery, and a roentgenogram showed patency of its entire vasculature.

Volume 149
Number 2

IMMEDIATE RECONSTRUCTION OF THE CERVICAL ESOPHAGUS

163

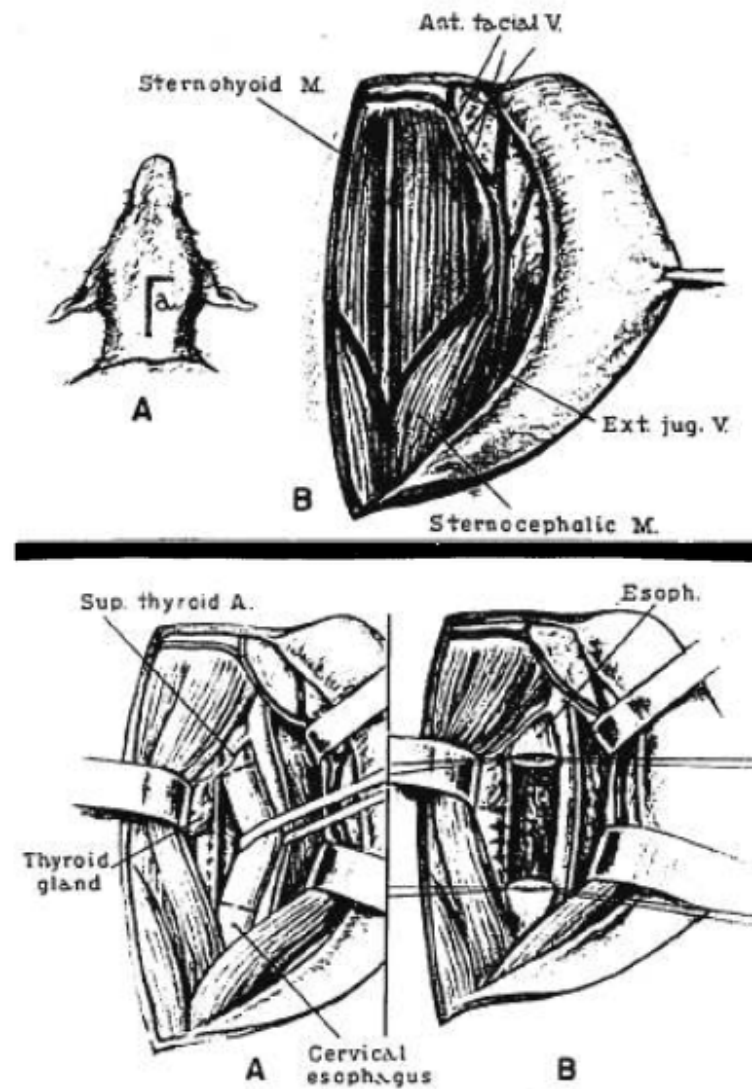
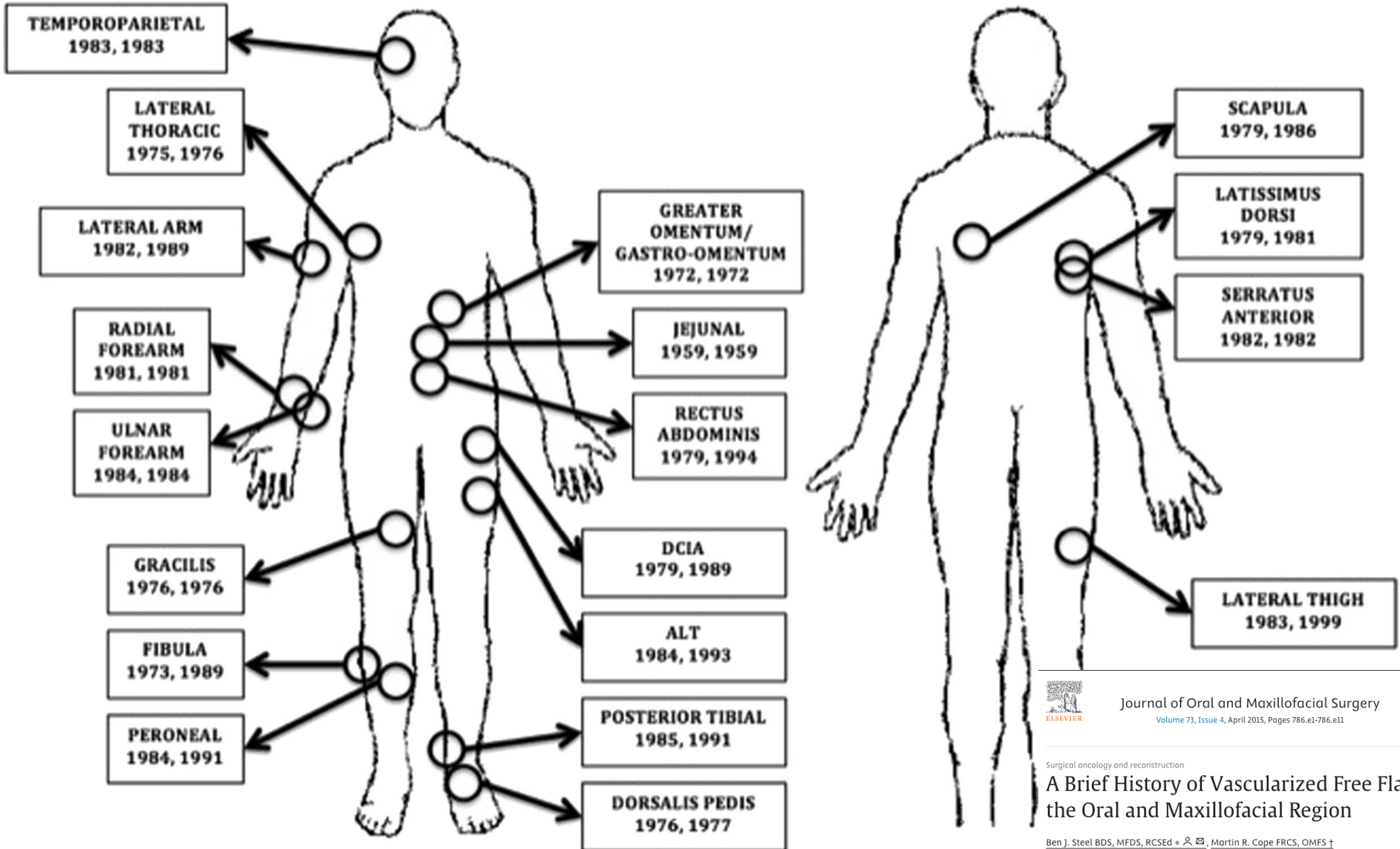


FIG. 1A (upper). Midline neck incision with a left lateral limb at the level of the hyoid bone. B. Skin and platysma flap developed to the external jugular vein laterally. The anterior facial vein is mobilized.

FIG. 2A (lower). The superior thyroid artery and the cervical esophagus are dissected and mobilized. B. The entire circumference of the cervical esophagus is resected.

1970's-1980's – the microsurgical era





Journal of Oral and Maxillofacial Surgery
Volume 73, Issue 4, April 2015, Pages 786.e1-786.e11

Surgical oncology and reconstruction

A Brief History of Vascularized Free Flaps in the Oral and Maxillofacial Region

Ben J. Steel BDS, MFDS, RCSEd * Martin R. Cope FRCS, OMFS †

Free Flap Type	First Published Clinical Use	First Published Use in Head and Neck
Jejunal	Seidenberg et al, 1959	Seidenberg et al, 1959
Greater omentum/gastro-omentum	McLean and Buncke, 1972	McLean and Buncke, 1972
Fibula	Ueba and Fujikawa,1983	Hidalgo, 1989
Lateral thoracic	Boeck and DeConinek, 1975	Baudet et al,1976
Gracilis	Harii et al, 1976	Harii et al, 1976
Dorsalis pedis	Robinson, 1976	Leeb et al, 1977
Rectus abdominis	Holmstrom, 1979	Hasegawa et al, 1994
Iliac crest/deep circumflex iliac artery	Taylor et al, 1979	Urken et al, 1989
Latissimus dorsi	Maxwell et al, 1979 Watson et al,1979 Bostwick et al, 1979	Fujino et al, 1981
Scapular	Gilbert, 1979	Swartz et al, 1986
Radial forearm	Yang et al, 1981	Yang et al,1981
Serratus anterior	Takayanagi and Tsukie, 1982	Harii et al, 1982
Lateral arm	Song et al, 1982	Martloub et al, 1989
Temporoparietal fascia	Brent and Byrd, 1983	Brent and Byrd, 1983
Lateral thigh	Baek, 1983	Hayden and Deschler, 1999; based on cases treated from 1984
Peroneal	Yoshimura et al, 1984	Noda et al, 1991
Ulnar forearm	Lovie et al, 1984	Lovie et al, 1984; based on cases treated from 1982
Anterolateral thigh	Song et al, 1984	Koshima et al, 1993
Posterior tibial	Hwang et al, 1985	Chen et al, 1991

Fibula flap

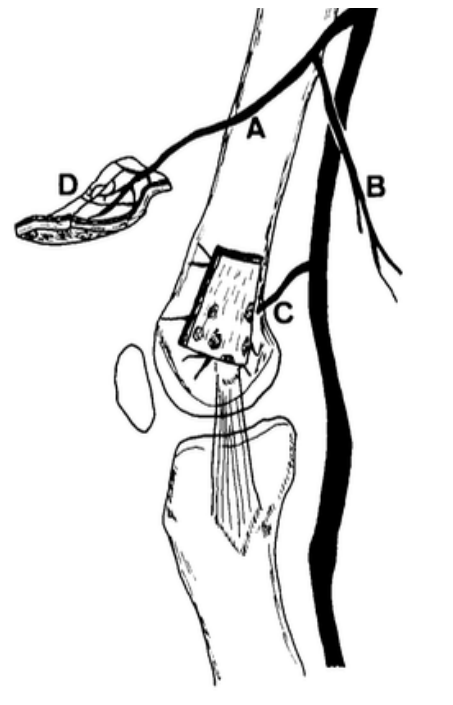
- Japan and Australia simultaneous development in 1973
- 1983– Chen and Yan first to describe osseocutaneous flap
- Wei et al 1986 – defined the septocutaneous perforators of the peroneal artery
- 1989 – first use by Hidalgo in the mandible and then maxilla in 1994
- 1993 – wide use of osseointegrated implants
- 2009 Hirsch



Innovative designs

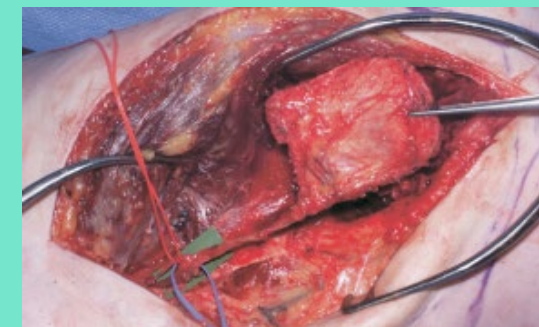
Free Vascularized Thin Corticoperiosteal Graft

Kazuhiro Sakai, M.D., Kazuteru Doi, M.D., and Shinya Kawai, M.D.
Yamaguchi, Japan



Medial femoral condyle (mfc) corticoperiosteal free flap

- FIRST DESCRIBED IN 1990 FOR ORTHOPAEDIC RECONSTRUCTION BY DR. KAZUHIRO SAKAI
- FIRST DESCRIBED IN ENGLISH LITERATURE FOR ORAL CAVITY IN 2008 BY DR. MICHAEL CHIARI
- FIRST DESCRIBED FOR MAXILLA 2009 BY DR. STEVEN MORAN



J Oral Maxillofac Surg
67:661-665, 2009

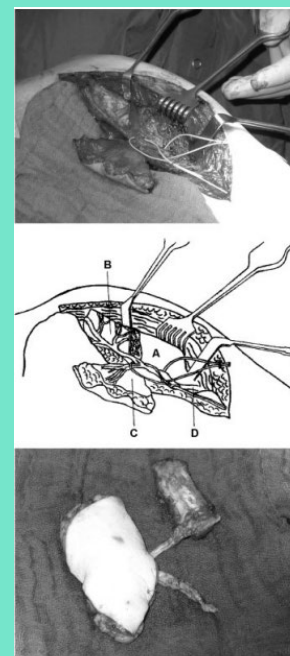
Medial Femoral Periosteal Microvascular Free Flap: A New Method for Maxillary Reconstruction

Deepak Kademani, DMD, MD,* Thomas Salinas, DDS,† and
Steven L. Moran, MD‡



The Microvascular Osteocutaneous Femur Transplant for Covering Combined Alveolar Ridge and Floor of the Mouth Defects: Preliminary Report

Alexander Gaggl, M.D., D.D.S., Ph.D.,¹ Heinz Bürger, M.D.,²
and Friedrich Michael Chiari, M.D., D.D.S., Ph.D.¹



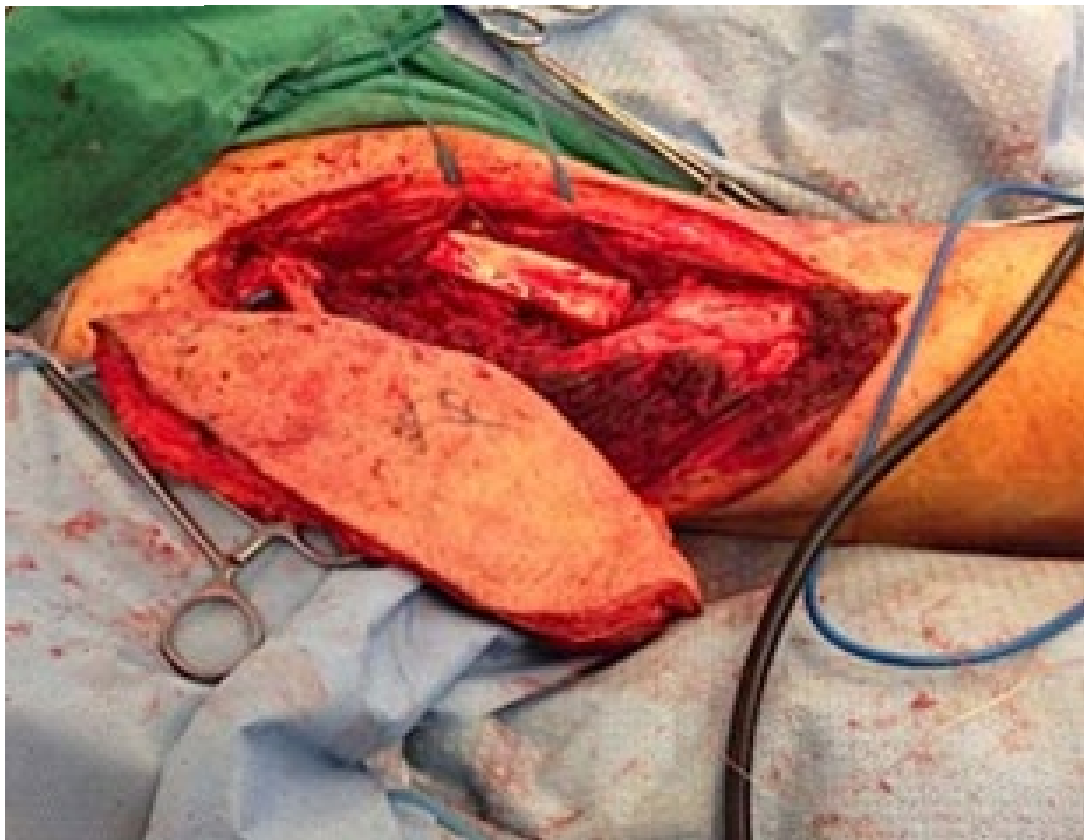
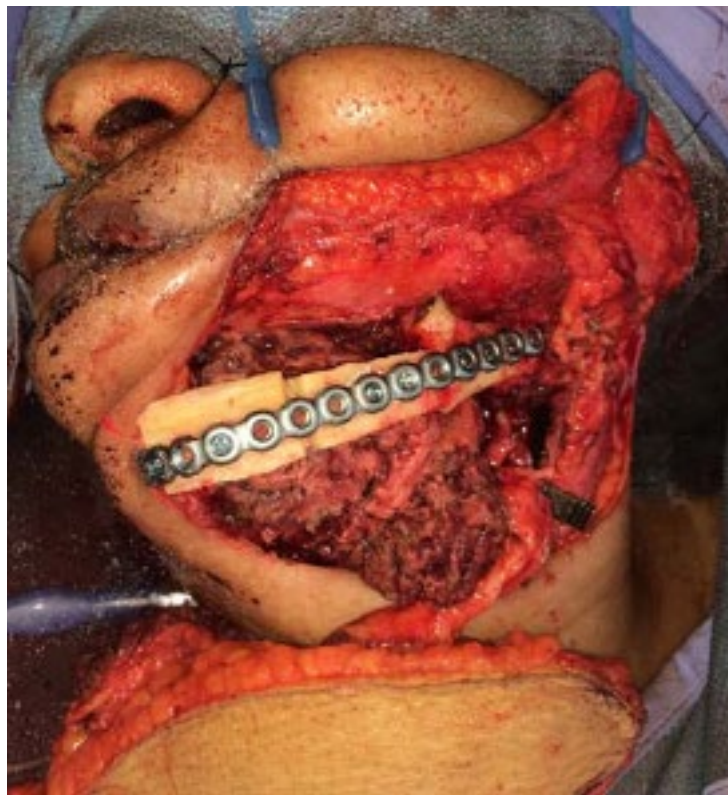
Anterior lateral thigh osteomyocutaneous free flap reconstruction in the head and neck: The anterolateral thigh osteomyocutaneous femur bone flap

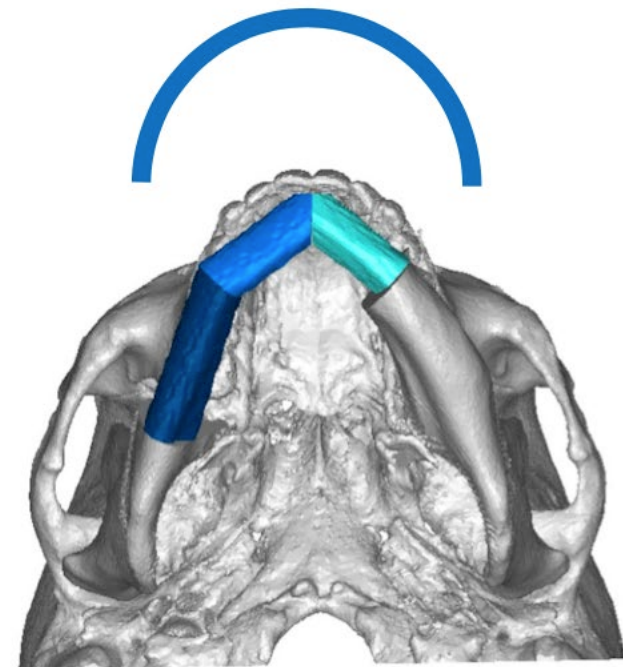
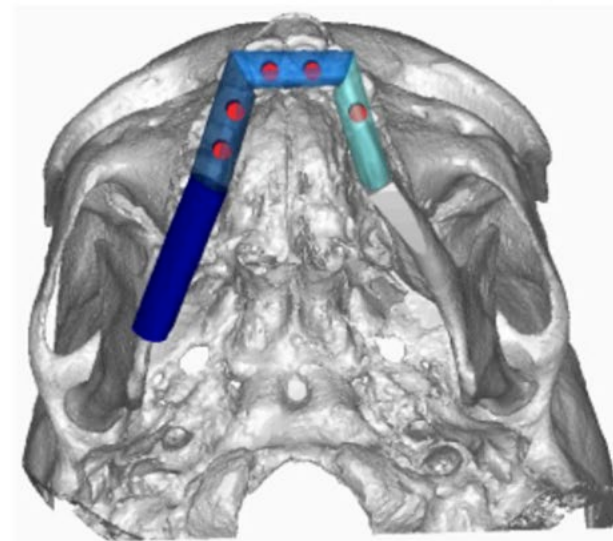
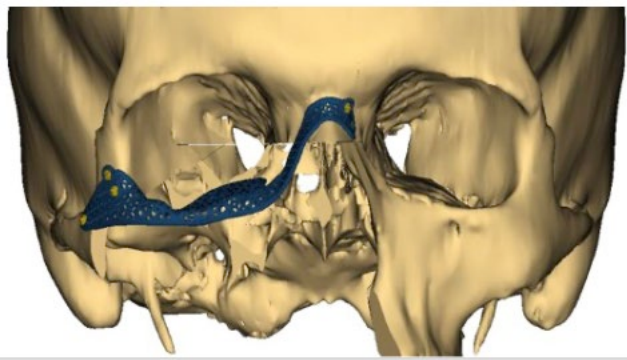
Robert M. Brody, MD,¹ Nirnimesh C. Pandey, MD,² Andrés M. Bur, MD,¹ Bert W. O'Malley Jr, MD,¹ Christopher H. Rassekh, MD,¹ Gregory S. Weinstein, MD,¹ Ara A. Chalian, MD,¹ Jason G. Newman, MD,¹ Steven B. Cannady, MD^{1*}

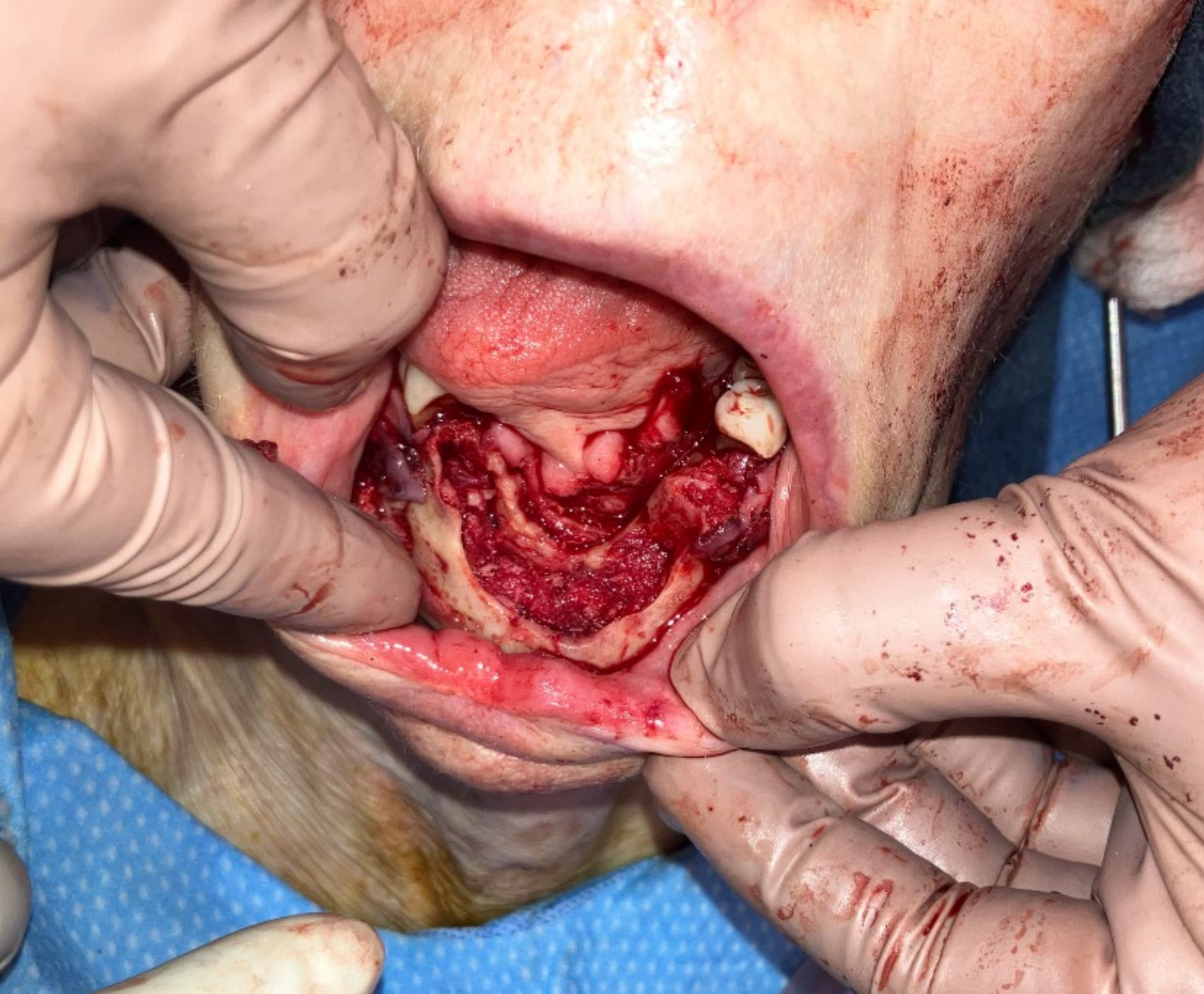
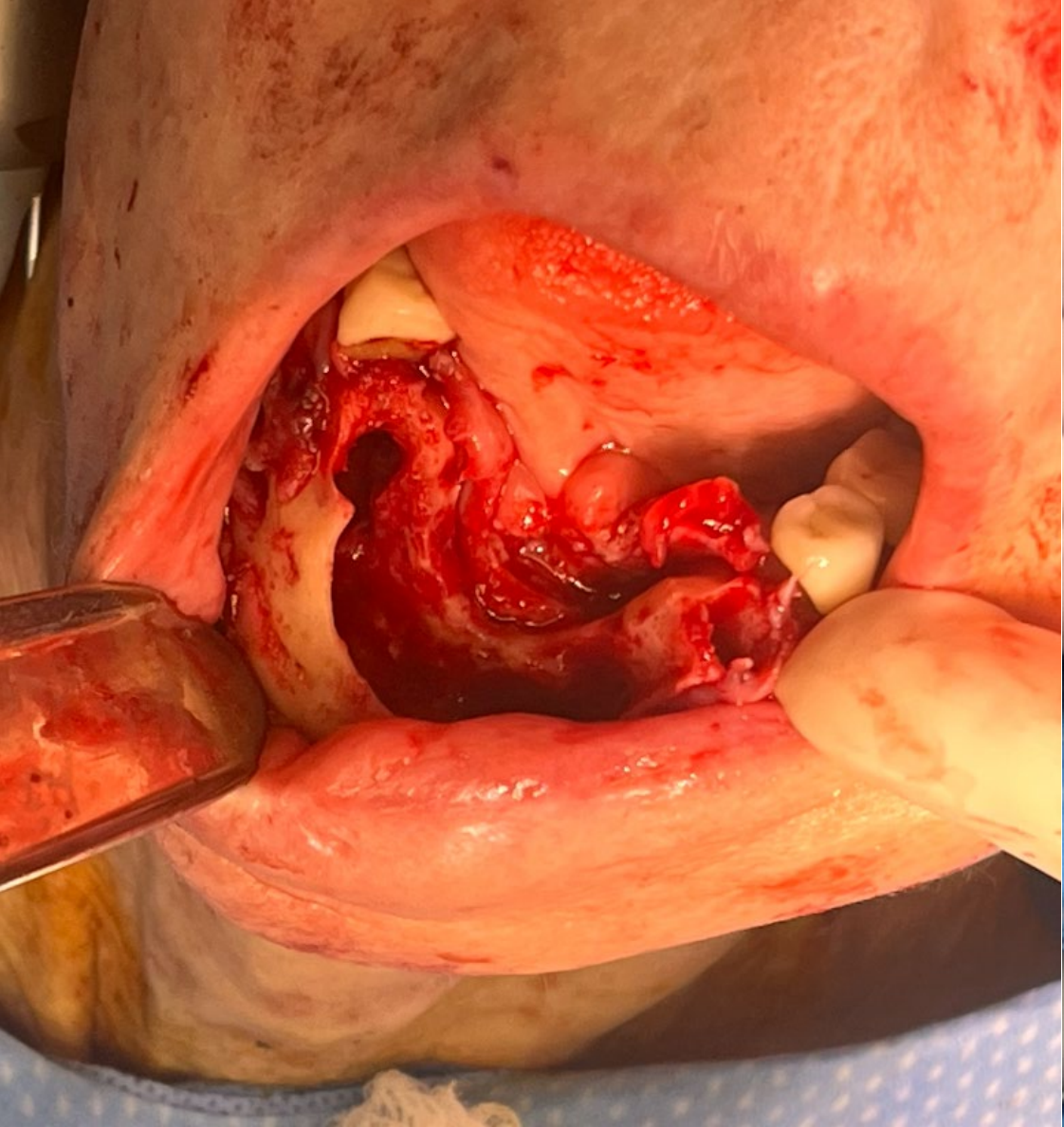
¹Department of Otorhinolaryngology – Head and Neck Surgery, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, ²Department of Radiology, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania.

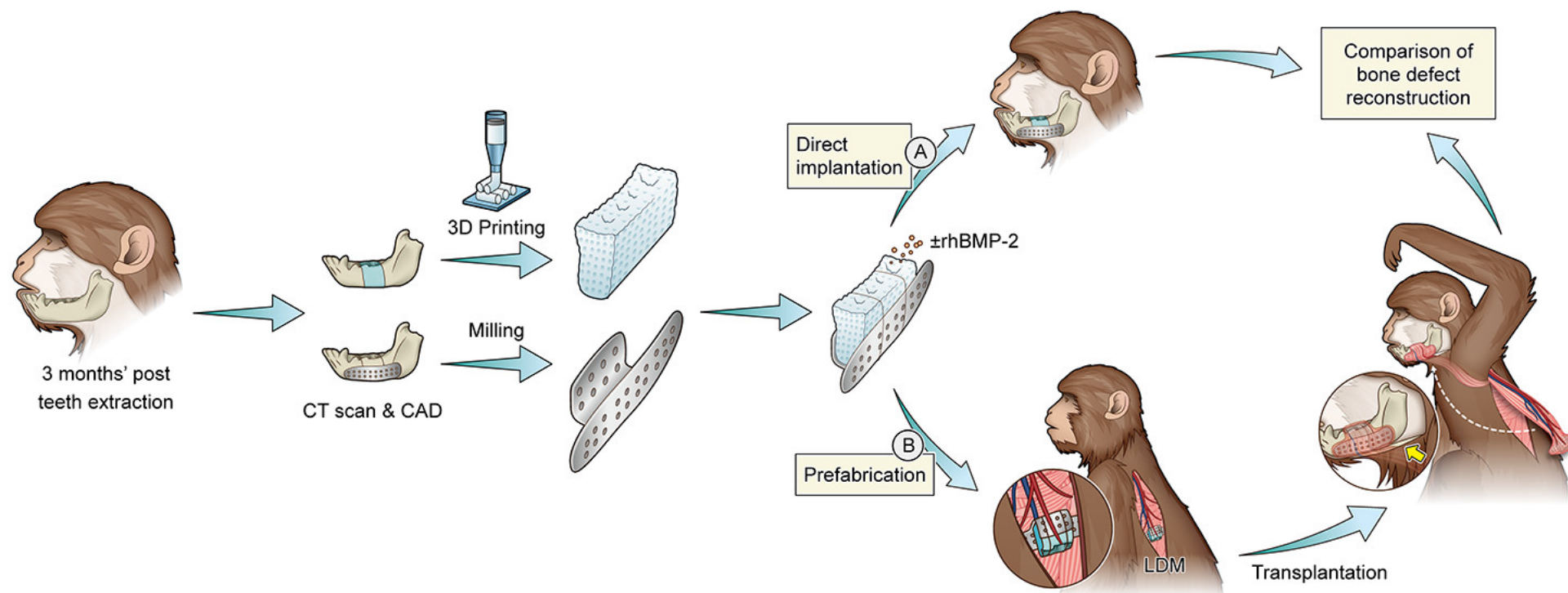
Accepted 5 May 2016

Published online 16 June 2016 in Wiley Online Library (wileyonlinelibrary.com). DOI 10.1002/hed.24521









Prefabricated 3D-Printed Tissue-Engineered Bone for Mandibular Reconstruction: A Preclinical Translational Study in Primate

Shuai-shuai Cao,[^] Shu-yi Li,[^] Yuan-ming Geng,[^] Kausik Kapat, Shang-bin Liu, Fidel Hugo Perera, Qian Li, Hendrik Terheyden, Gang Wu, Yue-juan Che,^{*} Pedro Miranda,^{*} and Miao Zhou^{*}



Cite This: *ACS Biomater. Sci. Eng.* 2021, 7, 5727–5738



Read Online

