Fourth Edition
Volume Three

Editor-in-Chief
Peter C. Neligan

Plastic Surgery

Craniofacial, Head and Neck Surgery

Volume Editor
Eduardo D. Rodriguez

Pediatric Plastic Surgery

Volume Editor
Joseph E. Losee

ELSEVIER

Copyrighted Material

Fourth Edition

Plastic Surgery

Craniofacial, Head and Neck Surgery

Pediatric Plastic Surgery

Volume Three

Content Strategist: Belinda Kuhn
Content Development Specialists: Louise Cook, Sam Crowe, Alexandra Mortimer
e-products, Content Development Specialist: Kim Benson
Project Managers: Anne Collett, Andrew Riley, Julie Taylor
Designer: Miles Hitchen
Illustration Managers: Karen Giacomucci, Amy Faith Heyden
Marketing Manager: Melissa Fogarty
Video Liaison: Will Schmitt

Fourth Edition

Plastic Surgery

Craniofacial, Head and Neck Surgery

Pediatric Plastic Surgery

Volume Three

Part 1 Volume Editor

Eduardo D. Rodriguez

MD, DDS

Helen L. Kimmel Professor of Reconstructive Plastic Surgery

Chair, Hansjörg Wyss Department of Plastic Surgery

NYU School of Medicine

NYU Langone Medical Center

New York, NY, USA

Part 2 Volume Editor

Joseph E. Losee

MD

Ross H. Musgrave Professor of Pediatric Plastic Surgery

Department of Plastic Surgery

University of Pittsburgh Medical Center;

Chief Division of Pediatric Plastic Surgery

Children's Hospital of Pittsburgh

Pittsburgh, PA, USA

Editor-in-Chief

Peter C. Neligan

MB, FRCS(I), FRCSC, FACS

Professor of Surgery

Department of Surgery, Division of Plastic Surgery

University of Washington

Seattle, WA, USA

Multimedia Editor

Daniel Z. Liu

MD

Plastic and Reconstructive Surgeon

Cancer Treatment Centers of America at

Midwestern Regional Medical Center

Zion, IL, USA

For additional online figures, videos and video lectures visit Expertconsult.com

ELSEVIER London, New York, Oxford, Philadelphia, St Louis, Sydney 2018

ELSEVIER

First edition 1990
Second edition 2006
Third edition 2013
Fourth edition 2018

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

With respect to any drug or pharmaceutical products identified, readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of practitioners, relying on their own experience and knowledge of their patients, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Volume 3 ISBN: 978-0-323-35698-5
Volume 3 Ebook ISBN: 978-0-323-35699-2
6 volume set ISBN: 978-0-323-35630-5

Printed in Canada
Last digit is the print number: 9 8 7 6 5 4 3 2 1

Video Contents

Volume One:

Chapter 15: Skin graft

15.1: Harvesting a split-thickness skin graft
Dennis P. Orgill

Chapter 34: Robotics in plastic surgery

34.1: Robotic microsurgery
34.2: Robotic rectus abdominis muscle flap harvest
34.3: Trans-oral robotic surgery
34.4: Robotic latissimus dorsi muscle harvest
34.5: Robotic lymphovenous bypass
Jesse C. Selber

Volume Two:

Chapter 6.2: Facelift: Principles of and surgical approaches to facelift

6.2.1: Parotid masseteric fascia
6.2.2: Anterior incision
6.2.3: Posterior incision
6.2.4: Facelift skin flap
6.2.5: Facial fat injection
Richard J. Warren

6.2.6: Anthropometry, cephalometry, and orthognathic surgery
Jonathon S. Jacobs, Jordan M. S. Jacobs, and Daniel I. Taub

Chapter 6.3: Facelift: Platysma-SMAS plication

6.3.1: Platysma-SMAS plication
Dai M. Davies and Miles G. Berry

Chapter 6.4: Facelift: Facial rejuvenation with loop sutures – the MACS lift and its derivatives

6.4.1: Loop sutures MACS facelift
Patrick L. Tonnard
From Aston SJ, Steinbrech DS, Walden JL, eds. Aesthetic Plastic Surgery, Saunders Elsevier; 2009; with permission from Elsevier

Chapter 6.7: Facelift: SMAS with skin attached – the "high SMAS" technique

6.7.1: The high SMAS technique with septal reset
Fritz E. Barton Jr.
© Fritz E. Barton Jr.

Chapter 6.8: Facelift: Subperiosteal midface lift

6.8.1: Subperiosteal midface lift: Endoscopic temporo-midface
Oscar M. Ramirez

Chapter 9: Blepharoplasty

9.1: Periorbital rejuvenation
Julius Few Jr. and Marco Ellis
© Julius Few Jr.

Chapter 11: Asian facial cosmetic surgery

1.1: Medial epicanthoplasty
11.2: Eyelidplasty: Non-incisional method
11.3: Rhinoplasty
11.4: Subclinical ptosis correction (total)
11.5: Secondary rhinoplasty: Septal extension graft and costal cartilage strut fixed with K-wire
Kyung S. Koh, Jong Woo Choi, and Clyde H. Ishii

Chapter 12: Neck rejuvenation

12.1: Anterior lipectomy
James E. Zins, Colin M. Morrison, and C. J. Langevin

Chapter 13: Structural fat grafting

13.1: Structural fat grafting of the face
Sydney R. Coleman and Alesia P. Saboeiro

Chapter 14: Skeletal augmentation

14.1: Chin implant
Michael J. Yarumchuk
© Mesa J, Havlik R, Mackay D, Buchman S, Losee J, eds. Atlas of Operative Craniofacial Surgery, CRC Press, 2019.

14.2: Mandibular angle implant
14.3: Midface skeletal augmentation and rejuvenation
Michael J. Yarumchuk
© Michael J. Yaremchuk

Chapter 16: Open technique rhinoplasty

16.1: Open technique rhinoplasty
Allen L. Van Beek

Chapter 20: Otoplasty and ear reduction

20.1: Setback otoplasty
Leila Kasrai

Chapter 23: Abdominoplasty procedures

23.1: Abdominoplasty
Dirk F. Richter and Alexander Stoff

Chapter 24: Lipoabdominoplasty

24.1: Lipoabdominoplasty (including secondary lipo)
Osvaldo Saldanha, Sérgio Fernando Dantas de Azevedo, Osvaldo Ribeiro Saldanha Filho, Cristianna Bonnetto Saldanha, and Luis Humberto Uribe Morelli

Chapter 26.2: Buttock augmentation: Buttock augmentation with implants

26.2.1: Buttock augmentation
Terrence W. Bruner, Jose Abel De la Peña Salcedo, Constantino G. Mendieta, and Thomas L. Roberts III

Chapter 27: Upper limb contouring

27.1: Brachioplasty
27.2: Upper limb contouring
Joseph F. Capella, Matthew J. Trovato, and Scott Woehrle

Chapter 28: Post-bariatric reconstruction

28.1: Post-bariatric reconstruction – bodylift procedure
J. Peter Rubin and Jonathan W. Toy
© J. Peter Rubin

Volume Three:

Chapter 6: Aesthetic nasal reconstruction

6.1: The three-stage folded forehead flap for cover and lining
6.2: First-stage transfer and intermediate operation
Frederick J. Menick

Chapter 7: Auricular construction

7.1: Total auricular construction
Akira Yamada

Chapter 8: Acquired cranial and facial bone deformities

8.1: Removal of venous malformation enveloping intraconal optic nerve
Renee M. Burke, Robert J. Morin, and S. Anthony Wolfe

Chapter 13: Facial paralysis

13.1: Facial paralysis
Eyal Gur
13.2: Facial paralysis
13.3: Cross facial nerve graft
13.4: Gracilis harvest
Peter C. Neligan

Chapter 14: Pharyngeal and esophageal reconstruction

14.1: Reconstruction of pharyngoesophageal defects with the anterolateral thigh flap
Peirong Yu

Chapter 15: Tumors of the facial skeleton: Fibrous dysplasia

15.1: Surgical approaches to the facial skeleton
Yu-Ray Chen, You-Wei Cheong, and Alberto Córdova-Aguilar

Chapter 17: Local flaps for facial coverage

17.1: Facial artery perforator flap
17.2: Local flaps for facial coverage
Peter C. Neligan

Chapter 21.2: Rotation advancement cheiloplasty

21.2.1: Repair of unilateral cleft lip
Philip Kuo-Ting Chen, M. Samuel Noordhoff, Frank Chun-Shin, Chang, and Fuan Chiang Chan
21.2.2: Unilateral cleft lip repair – anatomic subunit approximation technique
David M. Fisher

Chapter 24: Alveolar clefts

24.1: Unilateral cleft alveolar bone graft
24.2: Mobilized premaxilla after vomer osteotomy prior to setback and splint application
Richard A. Hopper and Gerhard S. Mundinger

Chapter 26: Velopharyngeal dysfunction

26.1: Velopharyngeal incompetence – 1
26.2: Velopharyngeal incompetence – 2
26.3: Velopharyngeal incompetence – 3
Richard E. Kirschner and Adriane L. Baylis

Chapter 27: Secondary deformities of the cleft lip, nose, and palate

27.1: Abbé flap
27.2: Alveolar bone grafting
27.3: Complete takedown
27.4: Definitive rhinoplasty
Evan M. Feldman, John C. Koshy, Larry H. Hollier Jr., and Samuel Stal
27.5: Thick lip and buccal sulcus deformities
Evan M. Feldman and John C. Koshy

Chapter 36: Pierre Robin Sequence

36.1: Mandibular distraction
Arun K. Gosain and Chad A. Purnell

Chapter 39: Vascular anomalies

39.1: Lip hemangioma
Arin K. Greene

Chapter 43: Reconstruction of urogenital defects: Congenital

43.1: First-stage hypospadias repair with free inner preputial graft
43.2: Second-stage hypospadias repair with tunica vaginalis flap
Mohan S. Gundeti and Michael C. Large

Volume Four:

Chapter 2: Management of lower extremity trauma

2.1: Anterolateral thigh flap harvest
Michel Saint-Cyr

Chapter 3: Lymphatic reconstruction of the extremities

3.1: End-to-side lymphovenous bypass technique
© Cheng M-H, Chang D, Patel K. Principles and Practice of Lymphedema Surgery, Elsevier; 2015.
3.2: Recipient site preparation for vascularized lymph node transfer – axilla
© Cheng M-H, Chang D, Patel K. Principles and Practice of Lymphedema Surgery, Elsevier; 2015.
3.3: Indocyanine green lymphography
David W. Chang
3.4: Charles procedure
Peter C. Neligan

Chapter 6: Diagnosis and treatment of painful neuroma and nerve compression in the lower extremity

6.1: Diagnosis and treatment of painful neuroma and of nerve compression in the lower extremity 1
6.2: Diagnosis and treatment of painful neuroma and of nerve compression in the lower extremity 2

6.3: Diagnosis and treatment of painful neuroma and of nerve compression in the lower extremity 3
A. Lee Dellon

Chapter 7: Skeletal reconstruction

7.1: Medial femoral condyle/medial geniculate artery osteocutaneous free flap dissection for scaphoid nonunion
Stephen J. Kovach III and L. Scott Levin

Chapter 10: Reconstruction of the chest

10.1: Sternal rigid fixation
David H. Song and Michelle C. Roughton

Chapter 12: Abdominal wall reconstruction

12.1: Component separation innovation
Peter C. Neligan

Chapter 13: Reconstruction of male genital defects

13.1: Complete and partial penile reconstruction
Stan Monstrey, Peter Ceulemans, Nathalie Roche, Philippe Houtmeyers, Nicolas Lumen, and Piet Hoebeke

Volume Five:

Chapter 6: Mastopexy options and techniques

6.1: Circumareolar mastopexy
Kenneth C. Shestak

Chapter 7: One- and two-stage considerations for augmentation mastopexy

7.1: Preoperative markings for a single-stage augmentation mastopexy
W. Grant Stevens

Chapter 10: Reduction mammaplasty with short scar techniques

10.1: SPAIR technique
Dennis C. Hammond

Chapter 11: Gynecomastia surgery

11.1: Ultrasound-assisted liposuction
Charles M. Malata

Chapter 15: One- and two-stage prosthetic reconstruction in nipple-sparing mastectomy

15.1: Pectoralis muscle elevation
15.2: Acellular dermal matrix
15.3: Sizer
Amy S. Colwell

Chapter 16: Skin-sparing mastectomy: Planned two-stage and direct-to-implant breast reconstruction

16.1: Mastectomy and expander insertion: First stage
16.2: Mastectomy and expander insertion: Second stage
Maurizio B. Nava, Giuseppe Catanuto, Angela Pennati, Valentina Visintini Cividin, and Andrea Spano

Chapter 19: Latissimus dorsi flap breast reconstruction

19.1: Latissimus dorsi flap technique
Scott L. Spear†
19.2: Markings
19.3: Intraoperative skin paddles
19.4: Tendon division
19.5: Transposition and skin paddles
19.6: Inset and better skin paddle explanation
Neil A. Fine and Michael S. Gart

Chapter 20.2: The deep inferior epigastric artery perforator (DIEAP) flap

20.2.1: The Deep Inferior Epigastric Artery Perforator (DIEAP) flap breast reconstruction
Phillip N. Blondeel and Robert J. Allen, Sr

Chapter 21.2: Gluteal free flaps for breast reconstruction

21.2.1: Superior Gluteal Artery Perforator (SGAP) flap
21.2.2: Inferior Gluteal Artery Perforator (IGAP) flap
Peter C. Neligan

Chapter 21.3: Medial thigh flaps for breast reconstruction

21.3.1: Transverse Upper Gracilis (TUG) flap 1
Peter C. Neligan
21.3.2: Transverse Upper Gracilis (TUG) flap 2
Venkat V. Ramakrishnan

Chapter 23.2: Partial breast reconstruction using reduction and mastopexy techniques

23.2.1: Partial breast reconstruction using reduction mammoplasty
Maurice Y. Nahabedian
23.2.2: Partial breast reconstruction with a latissimus dorsi flap
Neil A. Fine
23.2.3: Partial breast reconstruction with a pedicle TRAM
Maurice Y. Nahabedian

Volume Six:

Chapter 1: Anatomy and biomechanics of the hand

1.1: The extensor tendon compartments
1.2: The contribution of the interosseous and lumbrical muscles to the lateral bands
1.3: Extrinsic flexors and surrounding vasculonervous elements, from superficial to deep
1.4: The lumbrical plus deformity
1.5: The sensory and motor branches of the median nerve in the hand
James Chang, Vincent R. Hentz, Robert A. Chase, and Anais Legrand

Chapter 2: Examination of the upper extremity

2.1: Flexor profundus test in a normal long finger
2.2: Flexor sublimis test in a normal long finger
2.3: Extensor pollicis longus test in a normal person
2.4: Test for the Extensor Digitorum Communis (EDC) muscle in a normal hand
2.5: Test for assessing thenar muscle function
2.6: The “cross fingers” sign
2.7: Static Two-Point Discrimination Test (s-2PD Test)
2.8: Moving 2PD Test (m-2PD Test) performed on the radial or ulnar aspect of the finger

2.9: Semmes–Weinstein monofilament test: The patient should sense the pressure produced by bending the filament
2.10: Allen's test in a normal person
2.11: Digital Allen's test
2.12: Scaphoid shift test
2.13: Dynamic tenodesis effect in a normal hand
2.14: The milking test of the fingers and thumb in a normal hand
2.15: Eichhoff test
2.16: Adson test
2.17: Roos test
Ryosuke Kakinoki

Chapter 3: Diagnostic imaging of the hand and wrist

3.1: Scaphoid lunate dislocation
Alphonsus K. Chong and David M. K. Tan

3.2: Right wrist positive midcarpal catch up clunk
Alphonsus K. Chong

Chapter 4: Anesthesia for upper extremity surgery

4.1: Supraclavicular block
Subhro K. Sen

Chapter 5: Principles of internal fixation as applied to the hand and wrist

5.1: Dynamic compression plating and lag screw technique
Christopher Cox

5.2: Headless compression screw
5.3: Locking vs. non-locking plates
Jeffrey Yao and Jason R. Kang

Chapter 7: Hand fractures and joint injuries

7.1: Bennett reduction
7.2: Hemi-Hamate arthroplasty
Warren C. Hammert

Chapter 9: Flexor tendon injury and reconstruction

9.1: Zone II flexor tendon repair
9.2: Incision and feed tendon forward
9.3: Distal tendon exposure
9.4: Six-strand M-tang repair
9.5: Extension–flexion test – wide awake
Jin Bo Tang

Chapter 10: Extensor tendon injuries

10.1: Sagittal band reconstruction
10.2: Setting the tension in extensor indicis transfer
Kai Megerle

Chapter 11: Replantation and revascularization

11.1: Hand replantation
James Chang

Chapter 12: Reconstructive surgery of the mutilated hand

12.1: Debridement technique
James Chang

Chapter 13: Thumb reconstruction: Non-microsurgical techniques

13.1: Osteoplastic thumb reconstruction
13.2: First Dorsal Metacarpal Artery (FDMA) flap
Jeffrey B. Friedrich

Chapter 14: Thumb reconstruction: Microsurgical techniques

14.1: Trimmed great toe
14.2: Second toe for index finger
14.3: Combined second and third toe for metacarpal hand
Nidal F. Al Deek

Chapter 19: Rheumatologic conditions of the hand and wrist

19.1: Extensor tendon rupture and end–side tendon transfer
James Chang

19.2: Silicone metacarpophalangeal arthroplasty
Kevin C. Chung and Evan Kowalski

Chapter 20: Osteoarthritis in the hand and wrist

20.1: Ligament reconstruction tendon interposition arthroplasty of the thumb carpometacarpal joint
James W. Fletcher

Chapter 21: The stiff hand and the spastic hand

21.1: Flexor pronator slide
David T. Netscher

Chapter 22: Ischemia of the hand

22.1: Radial artery sympathectomy
Hee Chang Ahn and Neil F. Jones

22.2: Interposition arterial graft and sympathectomy
Hee Chang Ahn

Chapter 24: Nerve entrapment syndromes

24.1: The manual muscle testing algorithm
24.2: Scratch collapse test – carpal tunnel
Elisabet Hagert

24.3: Injection technique for carpal tunnel surgery
24.4: Wide awake carpal tunnel surgery
Donald Lalonde

24.5: Clinical exam and surgical technique – lacertus syndrome
Elisabet Hagert

24.6: Injection technique for cubital tunnel surgery
24.7: Wide awake cubital tunnel surgery
Donald Lalonde

24.8: Clinical exam and surgical technique – radial tunnel syndrome
24.9: Clinical exam and surgical technique – lateral intermuscular syndrome
24.10: Clinical exam and surgical technique – axillary nerve entrapment
Elisabet Hagert

24.11: Carpal tunnel and cubital tunnel releases in the same patient in one procedure with field sterility: Part 1 – local anesthetic injection for carpal tunnel
24.12: Carpal tunnel and cubital tunnel releases in the same patient in one procedure with field sterility: Part 2 – local anesthetic injection for cubital tunnel
Donald Lalonde and Michael Bezuhly

Chapter 25: Congenital hand I: Embryology, classification, and principles

25.1: Pediatric trigger thumb release
James Chang

Chapter 27: Congenital hand III: Thumb hypoplasia

27.1: Thumb hypoplasia
Joseph Upton III and Amir Taghinia

Chapter 30: Growth considerations in pediatric upper extremity trauma and reconstruction

30.1: Epiphyseal transplant harvesting technique
Marco Innocenti and Carla Baldrighi

Chapter 31: Vascular anomalies of the upper extremity

31.1: Excision of venous malformation
Joseph Upton III and Amir Taghinia

Chapter 32: Peripheral nerve injuries of the upper extremity

32.1: Suture repair of the cut digital nerve
32.2: Suture repair of the median nerve
Simon Farnebo and Johan Thorfinn

Chapter 35: Free-functioning muscle transfer in the upper extremity

35.1: Gracilis functional muscle harvest
Gregory H. Borschel

Chapter 36: Brachial plexus injuries: Adult and pediatric

36.1: Pediatric: shoulder correct and biceps-to-triceps transfer with preserving intact brachialis
36.2: Adult: results of one-stage surgery for C5 rupture, C6–T1 root avulsion 10 years after
36.3: Nerve transfer results 1
36.4: Nerve transfer results 2
36.5: Nerve transfer results 3
36.6: Nerve transfer results 4
36.7: Nerve transfer results 5
David Chwei-Chin Chuang

Chapter 37: Restoration of upper extremity function in tetraplegia

37.1: The single-stage grip and release procedure
37.2: Postoperative results after single-stage grip release procedure in OCu3–5 patients
Carina Reinholdt and Catherine Curtin

Chapter 38: Upper extremity vascularized composite allotransplantation

38.1: Upper extremity composite tissue allotransplantation
W. P. Andrew Lee and Vijay S. Gorantla

Chapter 39: Hand therapy

39.1: Goniometric measurement
39.2: Threshold testing
Christine B. Novak and Rebecca L. Neiduski

Lecture Video Contents

Volume One:

Chapter 1: Plastic surgery and innovation in medicine

Plastic surgery and innovation in medicine
Peter C. Neligan

Chapter 7: Digital imaging in plastic surgery

Digital imaging in plastic surgery
Daniel Z. Liu

Chapter 15: Skin graft

Skin graft
Peter C. Neligan

Chapter 19: Repair and grafting of peripheral nerve

Nerve injury and repair
Kirsty Usher Boyd, Andrew Yee, and Susan E. Mackinnon

Chapter 20: Reconstructive fat grafting

Reconstructive fat grafting
J. Peter Rubin

Chapter 21: Vascular territories

Vascular territories
Steven F. Morris

Chapter 22: Flap classification and applications

Flap classification and applications
Joon Pio Hong

Chapter 23: Flap pathophysiology and pharmacology

Flap pathophysiology and pharmacology
Cho Y. Pang and Peter C. Neligan

Chapter 24: Principles and techniques of microvascular surgery

Principles and techniques of microvascular surgery
Fu-Chan Wei, Nidal F. Al Deek, and Sherilyn Keng Lin Tay

Chapter 25: Principles and applications of tissue expansion

Principles and applications of tissue expansion
Ivo Alexander Pestana, Louis C. Argenta, and Malcolm W. Marks

Chapter 26: Principles of radiation

Therapeutic radiation: principles, effects, and complications
Gabrielle M. Kane

Chapter 28: Benign and malignant nonmelanocytic tumors of the skin and soft tissue

Benign and malignant nonmelanocytic tumors of the skin and soft tissue
Rei Ogawa

Chapter 31: Facial prosthetics in plastic surgery

Facial prosthetics in plastic surgery
Gordon H. Wilkes

Volume Two:

Chapter 4: Skincare and nonsurgical skin rejuvenation

Skincare and nonsurgical skin rejuvenation
Leslie Baumann and Edmund Weisberg

Chapter 5.2: Injectables and resurfacing techniques: Soft-tissue fillers

Soft-tissue fillers
Trevor M. Born, Lisa E. Airan, and Daniel Suissa

Chapter 5.3: Injectables and resurfacing techniques: Botulinum toxin (BoNT-A)

Botulinum toxin
Michael A. C. Kane

Chapter 5.4: Injectables and resurfacing techniques: Laser resurfacing

Laser resurfacing
Steven R. Cohen, Ahmad N. Saad, Tracy Leong, and E. Victor Ross

Chapter 5.5: Injectables and resurfacing techniques: Chemical peels

Chemical peels
Suzan Obagi

Chapter 6.1: Facelift: Facial anatomy and aging

Anatomy of the aging face
Bryan Mendelson and Chin-Ho Wong

Chapter 6.2: Facelift: Principles of and surgical approaches to facelift

Principles of and surgical approaches to facelift
Richard J. Warren

Chapter 6.3: Facelift: Platysma-SMAS plication

Platysma-SMAS plication
Miles G. Berry

Chapter 6.4: Facelift: Facial rejuvenation with loop sutures – the MACS lift and its derivatives

Facial rejuvenation with loop sutures – the MACS lift and its derivatives
Mark Laurence Jewell

Chapter 6.5: Facelift: Lateral SMASectomy facelift

Lateral SMASectomy facelift
Daniel C. Baker and Steven M. Levine

Chapter 6.6: Facelift: The extended SMAS technique in facial rejuvenation

The extended SMAS technique in facelift
James M. Stuzin

Chapter 6.7: Facelift: SMAS with skin attached – the "high SMAS" technique

SMAS with skin attached – the high SMAS technique
Fritz E. Barton Jr.

Chapter 6.8: Facelift: Subperiosteal midface lift

Subperiosteal midface lift
Alan Yan and Michael J. Yaremchuk

Chapter 6.9: Facelift: Male facelift

Male facelift
Timothy J. Marten and Dino Elyassnia

Chapter 6.10: Facelift: Secondary deformities and the secondary facelift

Secondary deformities and the secondary facelift
Timothy J. Marten and Dino Elyassnia

Chapter 7: Forehead rejuvenation

Forehead rejuvenation
Richard J. Warren

Chapter 8: Endoscopic brow lifting

Endoscopic brow lift
Renato Saltz and Alyssa Lolofie

Chapter 9: Blepharoplasty

Blepharoplasty
Julius Few Jr. and Marco Ellis

Chapter 11: Asian facial cosmetic surgery

Asian facial cosmetic surgery
Clyde H. Ishii

Chapter 12: Neck rejuvenation

Neck rejuvenation
James E. Zins, Joshua T. Waltzman, and Rafael A. Couto

Chapter 13: Structural fat grafting

Structural fat grafting
Sydney R. Coleman and Alesia P. Saboeiro

Chapter 15: Nasal analysis and anatomy

Nasal analysis and anatomy
Rod J. Rohrich

Chapter 19: Secondary rhinoplasty

Secondary rhinoplasty
Ronald P. Gruber, Simeon H. Wall Jr., David L. Kaufman, and David M. Kahn

Chapter 21: Hair restoration

Hair restoration
Jack Fisher

Chapter 22.1: Liposuction: A comprehensive review of techniques and safety

Liposuction
Phillip J. Stephan, Phillip Dauwe, and Jeffrey Kenkel

Chapter 22.2: Correction of liposuction deformities with the SAFE liposuction technique

SAFE liposuction technique
Simeon H. Wall Jr. and Paul N. Afrooz

Chapter 23: Abdominoplasty procedures

Abdominoplasty
Dirk F. Richter and Nina Schwaiger

Chapter 25.2: Circumferential approaches to truncal contouring: Belt lipectomy

Belt lipectomy
Al S. Aly, Khalid Al-Zahrani, and Albert Cram

Chapter 25.3: Circumferential approaches to truncal contouring: The lower lipo-bodylift

Circumferential lower bodylift
Dirk F. Richter and Nina Schwaiger

Chapter 25.4: Circumferential approaches to truncal contouring: Autologous buttocks augmentation with purse string gluteoplasty

Purse string gluteoplasty
Joseph P. Hunstad and Nicholas A. Flugstad

Chapter 25.5: Circumferential approaches to truncal contouring: Lower bodylift with autologous gluteal flaps for augmentation and preservation of gluteal contour

Lower bodylift with gluteal flaps
Robert F. Centeno and Jazmina M. Gonzalez

Chapter 26.3: Buttock augmentation: Buttock shaping with fat grafting and liposuction

Buttock shaping with fat grafting and liposuction
Constantino G. Mendieta, Thomas L. Roberts III, and Terrence W. Bruner

Chapter 27: Upper limb contouring

Upper limb contouring
Joseph F. Capella, Matthew J. Trovato, and Scott Woehrle

Chapter 30: Aesthetic genital surgery

Aesthetic genital surgery
Gary J. Alter

Volume Three:

Chapter 10.3: Midface reconstruction: The M. D. Anderson approach

Midfacial reconstruction: The M. D. Anderson approach
Matthew M. Hanasono and Roman Skoracki

Chapter 12: Lip reconstruction

Lip reconstruction
Peter C. Neligan and Lawrence J. Gottlieb

Chapter 14: Pharyngeal and esophageal reconstruction

Pharyngoesophageal reconstruction
Peirong Yu

Chapter 15: Tumors of the facial skeleton: Fibrous dysplasia

Fibrous dysplasia
Alberto Córdova-Aguilar and Yu-Ray Chen

Chapter 17: Local flaps for facial coverage

Local flaps for facial coverage
David W. Mathes

Chapter 19: Facial transplant

Facial transplant
Michael Sosin and Eduardo D. Rodriguez

Chapter 32: Nonsyndromic craniosynostosis

Nonsyndromic craniosynostosis
Patrick A. Gerety, Jesse A. Taylor, and Scott P. Bartlett

Chapter 36: Pierre Robin Sequence

Pierre Robin sequence
Chad A. Purnell and Arun K. Gosain

Chapter 39: Vascular anomalies

Vascular anomalies
Arin K. Greene and John B. Mulliken

Volume Four:

Chapter 2: Management of lower extremity trauma

Management of lower extremity trauma
Yoo Joon Sur, Shannon M. Colohan, and Michel Saint-Cyr

Chapter 15: Surgery for gender identity disorder

Surgery for gender identity disorder
Loren S. Schechter

Chapter 16: Pressure sores

Pressure sores
Robert Kwon, Juan L. Rendon, and Jeffrey E. Janis

Chapter 17: Perineal reconstruction

Perineal reconstruction
Hakim K. Said and Otway Louie

Volume Five:

Chapter 5: Breast augmentation with autologous fat grafting

Breast augmentation with autologous fat grafting
E. Delay

Chapter 6: Mastopexy options and techniques

Mastopexy
Robert Cohen

Chapter 9: Reduction mammaplasty with inverted-T techniques

Reduction mammaplasty with inverted-T techniques
Maurice Y. Nahabedian

Chapter 15: One- and two-stage prosthetic reconstruction in nipple-sparing mastectomy

Prosthetic reconstruction in nipple-sparing mastectomy
Amy S. Colwell

Chapter 20.1: Abdominally based free flaps: Introduction

Abdominally-based autologous breast reconstruction
Maurice Y. Nahabedian, Phillip N. Blondeel, and David H. Song

Chapter 20.2: The deep inferior epigastric artery perforator (DIEAP) flap

Abdominally-based autologous breast reconstruction
Maurice Y. Nahabedian, Phillip N. Blondeel, and David H. Song

Chapter 20.3: The superficial inferior epigastric artery (SIEA) flap

Abdominally-based autologous breast reconstruction
Maurice Y. Nahabedian, Phillip N. Blondeel, and David H. Song

Chapter 20.4: The free TRAM flap

Abdominally-based autologous breast reconstruction
Maurice Y. Nahabedian, Phillip N. Blondeel, and David H. Song

Chapter 25: Radiation therapy considerations in the setting of breast reconstruction

Radiation therapy in breast reconstruction
Steven Kronowitz

Volume Six:

Chapter 7: Hand fractures and joint injuries

Hand fractures and joint injuries
Joseph S. Khouri and Warren C. Hammert

Chapter 13: Thumb reconstruction: Non-microsurgical techniques

Thumb reconstruction
Nicholas B. Vedder and Jeffrey B. Friedrich

Chapter 21: The stiff hand and the spastic hand

The stiff hand
David T. Netscher, Kenneth W. Donohue, and Dang T. Pham

Chapter 24: Nerve entrapment syndromes

Tips and pearls on common nerve compressions
Elisabet Hagert and Donald Lalonde

Chapter 30: Growth considerations in pediatric upper extremity trauma and reconstruction

Growth considerations in pediatric upper extremity trauma and reconstruction
Marco Innocenti and Carla Baldrighi

Chapter 33: Nerve transfers

Nerve injury and repair
Kirsty Usher Boyd, Andrew Yee, and Susan E. Mackinnon

Chapter 37: Restoration of upper extremity function in tetraplegia

Restoration of upper extremity function in tetraplegia
Carina Reinholdt and Catherine Curtin

Preface to the Fourth Edition

When I wrote the preface to the 3rd edition of this book, I remarked how honored and unexpectedly surprised I was to be the Editor of this great series. This time 'round, I'm equally grateful to carry this series forward. When Elsevier called me and suggested it was time to prepare the 4th edition, my initial reaction was that this was way too soon. What could possibly have changed in Plastic Surgery since the 3rd edition was launched in 2012? As it transpires, there have been many developments and I hope we have captured them in this edition.

We have an extraordinary specialty. A recent article by Chadra, Agarwal and Agarwal entitled "Redefining Plastic Surgery" appeared in *Plastic and Reconstructive Surgery—Global Open*. In it they gave the following definition: "Plastic surgery is a specialized branch of surgery, which deals with deformities, defects and abnormalities of the organs of perception, organs of action and the organs guarding the external passages, besides innovation, implantation, replantation and transplantation of tissues, and aims at restoring and improving their form, function and the esthetic appearances." This is an all-encompassing but very apt definition and captures the enormous scope of the specialty.[1]

In the 3rd edition, I introduced volume editors for each of the areas of the specialty because the truth is that one person can no longer be an expert in all areas of this diverse specialty, and I'm certainly not. I think this worked well because the volume editors not only had the expertise to present their area of subspecialty in the best light, but they were tuned in to what was new and who was doing it. We have continued this model in this new edition. Four of the seven volume editors from the previous edition have again helped to bring the latest and the best to this edition: Drs Gurtner, Song, Rodriguez, Losee, and Chang have revised and updated their respective volumes with some chapters remaining, some extensively revised, some added, and some deleted. Dr. Peter Rubin has replaced Dr. Rick Warren to compile the Aesthetic volume (Vol. 2). Dr. Warren did a wonderful job in corralling this somewhat disparate, yet vitally important, part of our specialty into the Aesthetic volume in the 3rd edition but felt that the task of doing it again, though a labor of love, was more than he wanted to take on. Similarly, Dr. Jim Grotting who did a masterful job in the last edition on the Breast volume, decided that doing a major revision should be undertaken by someone with a fresh perspective and Dr. Maurice Nahabedian stepped into that breach. I hope you will like the changes you see in both of these volumes.

Dr. Allen Van Beek was the video editor for the last edition and he compiled an impressive array of movies to complement the text. This time around, we wanted to go a step further and though we've considerably expanded the list of videos accompanying the text (there are over 170), we also added the idea of lectures accompanying selected chapters. What we've done here is to take selected key chapters and include the images from that chapter, photos and artwork, and create a narrated presentation that is available online; there are annotations in the text to alert the reader that this is available. Dr. Daniel Liu, who has taken over from Dr. Van Beek as multimedia editor (rather than video editor) has done an amazing job in making all of this happen. There are over 70 presentations of various key chapters online, making it as easy as possible for you, the reader, to get as much knowledge as you can, in the easiest way possible from this edition. Many of these presentations have been done by the authors of the chapters; the rest have been compiled by Dr. Liu and myself from the content of the individual chapters. I hope you find them useful.

The reader may wonder how this all works. To plan this edition, the Elsevier team, headed by Belinda Kuhn, and I, convened a face-to-face meeting in San Francisco. The volume editors, as well as the London based editorial team, were present. We went through the 3rd edition, volume by volume, chapter by chapter, over an entire weekend. We decided what needed to stay, what needed to be added, what needed to be revised, and what needed to be changed. We also decided who should write the various chapters, keeping many existing authors, replacing others, and adding some new ones; we did this so as to really reflect the changes occurring within the specialty. We also decided on practical changes that needed to be made. As an example, you will notice that we have omitted the complete index for the 6 Volume set from Volumes 2-6 and highlighted only the table of contents for that particular volume. The complete index is of course available in Volume 1 and fully searchable online. This allowed us to save several hundred pages per volume, reducing production costs and diverting those dollars to the production of the enhanced online content.

In my travels around the world since the 3rd edition was published, I've been struck by what an impact this publication has had on the specialty and, more particularly, on training. Everywhere I go, I'm told how the text is an important part of didactic teaching and a font of knowledge. It is gratifying to see that the 3rd edition has been translated into Portuguese, Spanish, and Chinese. This is enormously encouraging. I hope this 4th edition continues to contribute to the specialty, remains a resource for practicing surgeons, and continues to prepare our trainees for their future careers in Plastic Surgery.

Peter C. Neligan
Seattle, WA
September, 2017

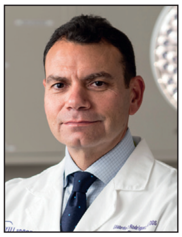
[1] Chandra R, Agarwal R, Agarwal D. Redefining Plastic Surgery. *Plast Reconstr Surg Glob Open*. 2016;4(5):e706.

List of Editors

Editor-in-Chief
Peter C. Neligan, MB, FRCS(I), FRCSC, FACS
Professor of Surgery
Department of Surgery, Division of Plastic Surgery
University of Washington
Seattle, WA, USA

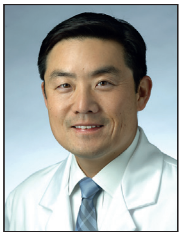
Volume 1: Principles
Geoffrey C. Gurtner, **MD, FACS**
Johnson and Johnson Distinguished Professor of Surgery and Vice Chairman,
Department of Surgery (Plastic Surgery)
Stanford University
Stanford, CA, USA

Volume 2: Aesthetic
J. Peter Rubin, **MD, FACS**
UPMC Professor of Plastic Surgery
Chair, Department of Plastic Surgery
Professor of Bioengineering
University of Pittsburgh
Pittsburgh, PA, USA



Volume 3: Craniofacial, Head and Neck Surgery
Eduardo D. Rodriguez, MD, DDS
Helen L. Kimmel Professor of Reconstructive Plastic Surgery
Chair, Hansjörg Wyss Department of Plastic Surgery
NYU School of Medicine
NYU Langone Medical Center
New York, NY, USA

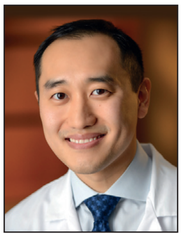
Volume 3: Pediatric Plastic Surgery
Joseph E. Losee, MD
Ross H. Musgrave Professor of Pediatric Plastic Surgery
Department of Plastic Surgery
University of Pittsburgh Medical Center;
Chief Division of Pediatric Plastic Surgery
Children's Hospital of Pittsburgh
Pittsburgh, PA, USA



Volume 4: Lower Extremity, Trunk, and Burns
David H. Song, **MD, MBA, FACS**
Regional Chief, MedStar Health
Plastic and Reconstructive Surgery
Professor and Chairman
Department of Plastic Surgery
Georgetown University School of Medicine
Washington, DC, USA

Volume 5: Breast
Maurice Y. Nahabedian, **MD, FACS**
Professor and Chief
Section of Plastic Surgery
MedStar Washington Hospital Center
Washington, DC, USA;
Vice Chairman
Department of Plastic Surgery
MedStar Georgetown University Hospital
Washington, DC, USA

Volume 6: Hand and Upper Extremity
James Chang, MD
Johnson & Johnson Distinguished
Professor and Chief
Division of Plastic and Reconstructive Surgery
Stanford University Medical Center
Stanford, CA, USA



Multimedia editor
Daniel Z. Liu, MD
Plastic and Reconstructive Surgeon
Cancer Treatment Centers of America at Midwestern Regional Medical Center
Zion, IL, USA

List of Contributors

The editors would like to acknowledge and offer grateful thanks for the input of all previous editions' contributors, without whom this new edition would not have been possible.

VOLUME ONE

Hatem Abou-Sayed, MD, MBA
Vice President
Physician Engagement
Interpreta, Inc.
San Diego, CA, USA

Paul N. Afrooz, MD
Resident
Plastic and Reconstructive Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Claudia R. Albornoz, MD, MSc
Research Fellow
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Nidal F. Al Deek, MD
Doctor of Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
Taipei, Taiwan

Amy K. Alderman, MD, MPH
Private Practice
Atlanta, GA, USA

Louis C. Argenta, MD
Professor of Plastic and Reconstructive Surgery
Department of Plastic Surgery
Wake Forest Medical Center
Winston Salem, NC, USA

Stephan Ariyan, MD, MBA
Emeritus Frank F. Kanthak Professor of Surgery, Plastic Surgery, Surgical Oncology, Otolaryngology
Yale University School of Medicine;
Associate Chief
Department of Surgery;
Founding Director, Melanoma Program
Smilow Cancer Hospital, Yale Cancer Center
New Haven, CT, USA

Tomer Avraham, MD
Attending Plastic Surgeon
Mount Sinai Health System
Tufts University School of Medicine
New York, NY, USA

Aaron Berger, MD, PhD
Clinical Assistant Professor
Division of Plastic Surgery
Florida International University School of Medicine
Miami, FL, USA

Kirsty Usher Boyd, MD, FRCSC
Assistant Professor Surgery (Plastics)
Division of Plastic and Reconstructive Surgery
University of Ottawa
Ottawa, Ontario, Canada

Charles E. Butler, MD, FACS
Professor and Chairman
Department of Plastic Surgery
Charles B. Barker Endowed Chair in Surgery
The University of Texas MD Anderson Cancer Center
Houston, TX, USA

Peter E. M. Butler, MD, FRCSI, FRCS, FRCS(Plast)
Professor
Plastic and Reconstructive Surgery
University College and Royal Free London
London, UK

Yilin Cao, MD, PhD
Professor
Shanghai Ninth People's Hospital
Shanghai Jiao Tong University School of Medicine
Shanghai, China

Franklyn P. Cladis, MD, FAAP
Associate Professor of Anesthesiology
Department of Anesthesiology
The Children's Hospital of Pittsburgh of UPMC
Pittsburgh, PA, USA

Mark B. Constantian, MD
Private Practice
Surgery (Plastic Surgery)
St. Joseph Hospital
Nashua, NH, USA

Daniel A. Cuzzone, MD
Plastic Surgery Fellow
Hanjörg Wyss Department of Plastic Surgery
New York University Medical Center
New York, NY, USA

Gurleen Dhami, MD
Chief Resident
Department of Radiation Oncology
University of Washington
Seattle, WA, USA

Gayle Gordillo, MD
Associate Professor
Plastic Surgery
The Ohio State University
Columbus, OH, USA

Geoffrey C. Gurtner, MD, FACS
Johnson and Johnson Distinguished Professor of Surgery and Vice Chairman,
Department of Surgery (Plastic Surgery)
Stanford University
Stanford, CA, USA

Phillip C. Haeck, MD
Surgeon
Plastic Surgery
The Polyclinic
Seattle, WA, USA

The late Bruce Halperin†, MD
Formerly Adjunct Associate Professor of Anesthesia
Department of Anesthesia
Stanford University
Stanford, CA, USA

Daniel E. Heath
Lecturer
School of Chemical and Biomedical Engineering
University of Melbourne
Parkville, Victoria, Australia

Joon Pio Hong, MD, PhD, MMM
Professor
Plastic Surgery
Asan Medical Center, University of Ulsan
Seoul, South Korea

Michael S. Hu, MD, MPH, MS
Postdoctoral Fellow
Division of Plastic Surgery
Department of Surgery
Stanford University School of Medicine
Stanford, CA, USA

C. Scott Hultman, MD, MBA
Professor and Chief
Division of Plastic and Reconstructive Surgery
University of North Carolina
Chapel Hill, NC, USA

Amir E. Ibrahim
Division of Plastic Surgery
Department of Surgery
American University of Beirut Medical Center
Beirut, Lebanon

Leila Jazayeri, MD
Microsurgery Fellow
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Brian Jeffers
Student
Bioengineering
University of California Berkeley
Berkeley, CA USA

Lynn Jeffers, MD, FACS
Private Practice
Oxnard, CA, USA

Mohammed M. Al Kahtani, MD, FRCSC
Clinical Fellow
Division of Plastic Surgery
Department of Surgery
University of Alberta
Edmonton, Alberta, Canada

Gabrielle M. Kane, MB, BCh, EdD, FRCPC
Associate Professor
Radiation Oncology
University of Washington
Seattle, WA, USA

Raghu P. Kataru, PhD
Senior Research Scientist
Memorial Sloan-Kettering Cancer Center
New York, NY, USA

Carolyn L. Kerrigan, MD, MSc, MHCDS
Professor of Surgery
Surgery
Dartmouth–Hitchcock Medical Center
Lebanon, NH, USA

Timothy W. King, MD, PhD, FAAP, FACS
Associate Professor with Tenure
Departments of Surgery and Biomedical Engineering;
Director of Research, Division of Plastic Surgery
University of Alabama at Birmingham (UAB)
Craniofacial and Pediatric Plastic Surgery
Children's of Alabama – Plastic Surgery;
Chief, Plastic Surgery Section
Birmingham VA Hospital
Birmingham, AL, USA

Brian M. Kinney, MD, FACS, MSME
Clinical Assistant Professor of Plastic Surgery
University of Southern California
School of Medicine
Los Angeles, CA, USA

W. P. Andrew Lee, MD
The Milton T. Edgerton MD, Professor and Chairman
Department of Plastic and Reconstructive Surgery
Johns Hopkins University School of Medicine
Baltimore, MD, USA

Sherilyn Keng Lin Tay, MBChB, MSc, FRCS(Plast)
Consultant Plastic Surgeon
Canniesburn Plastic Surgery Unit
Glasgow Royal Infirmary
Glasgow, UK

Daniel Z. Liu, MD
Plastic and Reconstructive Surgeon
Cancer Treatment Centers of America at Midwestern Regional Medical Center
Zion, IL, USA

Wei Liu, MD, PhD
Professor
Plastic and Reconstructive Surgery
Shanghai Ninth People's Hospital
Shanghai Jiao Tong University School of Medicine
Shanghai, China

Michael T. Longaker, MD, MBA, FACS
Deane P. and Louise Mitchell Professor and Vice Chair
Department of Surgery
Stanford University
Stanford, CA, USA

H. Peter Lorenz, MD
Service Chief and Professor, Plastic Surgery
Lucile Packard Children's Hospital
Stanford University School of Medicine
Stanford, CA, USA

Susan E. Mackinnon, MD
Sydney M. Shoenberg Jr. and Robert H. Shoenberg Professor
Department of Surgery, Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Malcolm W. Marks, MD
Professor and Chairman
Department of Plastic Surgery
Wake Forest University School of Medicine
Winston-Salem, NC, USA

Diego Marre, MD
Fellow
O'Brien Institute
Department of Plastic and Reconstructive Surgery
St. Vincent's Hospital
Melbourne, Australia

David W. Mathes, MD
Professor and Chief of the Division of Plastic and Reconstructive Surgery
University of Colorado
Aurora, CO, USA

Evan Matros MD, MMSc
Plastic Surgeon
Memorial Sloan-Kettering Cancer Center
New York, NY, USA

Isabella C. Mazzola, MD
Attending Plastic Surgeon
Klinik für Plastische und Ästhetische Chirurgie
Klinikum Landkreis Erding
Erding, Germany

Riccardo F. Mazzola, MD
Plastic Surgeon
Department of Specialistic Surgical Sciences
Fondazione Ospedale Maggiore Policlinico, Ca' Granda IRCCS
Milano, Italy

Lindsay D. McHutchion, MS, BSc
Anaplastologist
Institute for Reconstructive Sciences in Medicine
Edmonton, Alberta, Canada

Babak J. Mehrara, MD, FACS
Associate Member, Associate Professor of Surgery (Plastic)
Memorial Sloan Kettering Cancer Center
Weil Cornell University Medical Center
New York, NY, USA

Steven F. Morris, MD, MSc, FRCSC
Professor of Surgery
Department of Surgery
Dalhousie University
Halifax, Nova Scotia, Canada

Wayne A. Morrison, MBBS, MD, FRACS
Professorial Fellow
O'Brien Institute
Department of Surgery, University of Melbourne
Department of Plastic and Reconstructive Surgery, St. Vincent's Hospital
Melbourne, Australia

Peter C. Neligan, MB, FRCS(I), FRCSC, FACS
Professor of Surgery
Department of Surgery, Division of Plastic Surgery
University of Washington
Seattle, WA, USA

Andrea J. O'Connor, BE(Hons), PhD
Associate Professor
Department of Chemical and Biomolecular Engineering
University of Melbourne
Parkville, Victoria, Australia

Rei Ogawa, MD, PhD, FACS
Professor and Chief
Department of Plastic
Reconstructive and Aesthetic Surgery
Nippon Medical School
Tokyo, Japan

Dennis P. Orgill, MD, PhD
Professor of Surgery
Harvard Medical School
Medical Director, Wound Care Center;
Vice Chairman for Quality Improvement
Department of Surgery
Brigham and Women's Hospital
Boston, MA, USA

Cho Y. Pang, PhD
Senior Scientist
Research Institute
The Hospital for Sick Children;
Professor
Departments of Surgery/Physiology
University of Toronto
Toronto, Ontario, Canada

Ivo Alexander Pestana, MD, FACS
Associate Professor
Plastic and Reconstructive Surgery
Wake Forest University
Winston Salem, NC, USA

Giorgio Pietramaggior, MD, PhD
Swiss Nerve Institute
Clinique de La Source
Lausanne, Switzerland

Andrea L. Pusic, MD, MHS, FACS
Associate Professor
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Russell R. Reid, MD, PhD
Associate Professor
Surgery/Section of Plastic and Reconstructive Surgery
University of Chicago Medicine
Chicago, IL, USA

Neal R. Reisman, MD, JD
Chief
Plastic Surgery
Baylor St. Luke's Medical Center
Houston, TX, USA

Joseph M. Rosen, MD
Professor of Surgery
Plastic Surgery
Dartmouth–Hitchcock Medical Center
Lebanon, NH, USA

Sashwati Roy, MS, PhD
Associate Professor
Surgery, Center for Regenerative Medicine and Cell based Therapies
The Ohio State University
Columbus, OH, USA

J. Peter Rubin, MD, FACS
UPMC Professor of Plastic Surgery
Chair, Department of Plastic Surgery
Professor of Bioengineering
University of Pittsburgh
Pittsburgh, PA, USA

Karim A. Sarhane, MD
Department of Surgery
University of Toledo Medical Center
Toledo, OH, USA

David B. Sarwer, PhD
Associate Professor of Psychology
Departments of Psychiatry and Surgery
University of Pennsylvania School of Medicine
Philadelphia, PA, USA

Saja S. Scherer-Pietramaggiori, MD
Plastic and Reconstructive Surgeon
Plastic Surgery
University Hospital Lausanne
Lausanne, Vaud, Switzerland

Iris A. Seitz, MD, PhD
Director of Research and International Collaboration
University Plastic Surgery
Rosalind Franklin University;
Clinical Instructor of Surgery
Chicago Medical School
Chicago, IL, USA

Jesse C. Selber, MD, MPH, FACS
Associate Professor, Director of Clinical Research
Department of Plastic Surgery
MD Anderson Cancer Center
Houston, TX, USA

Chandan K. Sen, PhD
Professor and Director
Center for Regenerative Medicine and Cell-Based Therapies
The Ohio State University Wexner Medical Center
Columbus, OH, USA

Wesley N. Sivak, MD, PhD
Resident in Plastic Surgery
Department of Plastic Surgery
University of Pittsburgh
Pittsburgh, PA, USA

M. Lucy Sudekum
Research Assistant
Thayer School of Engineering at Dartmouth College
Hanover, NH, USA

G. Ian Taylor, AO, MBBS, MD, MD(Hon Bordeaux), FRACS, FRCS(Eng), FRCS(Hon Edinburgh), FRCSI(Hon), FRSC(Hon Canada), FACS(Hon)
Professor
Department of Plastic Surgery
Royal Melbourne Hospital;
Professor
Department of Anatomy
University of Melbourne
Melbourne, Victoria, Australia

Chad M. Teven, MD
Resident
Section of Plastic and Reconstructive Surgery
University of Chicago
Chicago, IL, USA

Ruth Tevlin, MB BAO BCh, MRCSI, MD
Resident in Surgery
Department of Plastic and Reconstructive Surgery
Stanford University School of Medicine
Stanford, CA, USA

E. Dale Collins Vidal, MD, MS
Chief
Section of Plastic Surgery
Dartmouth–Hitchcock Medical Center
Lebanon, NH, USA

Derrick C. Wan, MD
Associate Professor
Division of Plastic Surgery
Department of Surgery
Director of Maxillofacial Surgery
Lucile Packard Children's Hospital
Stanford University School of Medicine
Stanford, CA, USA

Renata V. Weber, MD
Assistant Professor Surgery (Plastics)
Division of Plastic and Reconstructive Surgery
Albert Einstein College of Medicine
Bronx, NY, USA

Fu-Chan Wei, MD
Professor
Department of Plastic Surgery
Chang Gung Memorial Hospital
Taoyuan, Taiwan

Gordon H. Wilkes, BScMed, MD
Clinical Professor of Surgery
Department of Surgery University of Alberta
Institute for Reconstructive Sciences in Medicine
Misericordia Hospital
Edmonton, Alberta, Canada

Johan F. Wolfaardt, BDS, MDent(Prosthodontics), PhD
Professor
Division of Otolaryngology – Head and Neck Surgery
Department of Surgery
Faculty of Medicine and Dentistry;
Director of Clinics and International Relations
Institute for Reconstructive Sciences in Medicine
University of Alberta
Covenant Health Group
Alberta Health Services
Alberta, Canada

Kiryu K. Yap, MBBS, BMedSc
Junior Surgical Trainee & PhD Candidate
O'Brien Institute
Department of Surgery, University of Melbourne
Department of Plastic and Reconstructive Surgery, St. Vincent's Hospital
Melbourne, Australia

Andrew Yee
Research Assistant
Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Elizabeth R. Zielins, MD
Postdoctoral Research Fellow
Surgery
Stanford University School of Medicine
Stanford, CA, USA

VOLUME TWO

Paul N. Afrooz, MD
Resident
Plastic and Reconstructive Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Jamil Ahmad, MD, FRCSC
Director of Research and Education
The Plastic Surgery Clinic
Mississauga;
Assistant Professor
Surgery
University of Toronto
Toronto, Ontario, Canada

Lisa E. Airan, MD
Aesthetic Dermatologist NYC
Private Practice;
Associate Clinical Professor Department of Dermatology
Mount Sinai School of Medicine
New York, NY, USA

Gary J. Alter, MD
Assistant Clinical Professor
Division of Plastic Surgery
University of California
Los Angeles, CA, USA

Al S. Aly, MD
Professor of Plastic Surgery
Aesthetic and Plastic Surgery Institute University of California Irvine
Orange, CA, USA

Khalid Al-Zahrani, MD, SSC-PLAST
Assistant Professor
Consultant Plastic Surgeon
King Khalid University Hospital
King Saud University
Riyadh, Saudi Arabia

Bryan Armijo, MD
Plastic Surgery Chief Resident
Department of Plastic and Reconstructive Surgery
Case Western Reserve/University Hospitals
Cleveland, OH, USA

Daniel C. Baker, MD
Professor of Surgery
Institute of Reconstructive Plastic Surgery
New York University Medical Center
Department of Plastic Surgery
New York, NY, USA

Fritz E. Barton Jr., MD
Clinical Professor
Department of Plastic Surgery
UT Southwestern Medical Center
Dallas, TX, USA

Leslie Baumann, MD
CEO
Baumann Cosmetic and Research Institute
Miami, FL, USA

Miles G. Berry, MS, FRCS(Plast)
Consultant Plastic and Aesthetic Surgeon
Institute of Cosmetic and Reconstructive Surgery
London, UK

Trevor M. Born, MD
Division of Plastic Surgery
Lenox Hill/Manhattan Eye Ear and Throat Hospital North Shore-LIJ Hospital
New York, NY, USA;
Clinical Lecturer
Division of Plastic Surgery
University of Toronto Western Division
Toronto, Ontario, Canada

Terrence W. Bruner, MD, MBA
Private Practice
Greenville, SC, USA

Andrés F. Cánchica, MD
Chief Resident of Plastic Surgery
Plastic Surgery Service Dr. Osvaldo Saldanha
São Paulo, Brazil

Joseph F. Capella, MD
Chief Post-bariatric Body Contouring
Division of Plastic Surgery
Hackensack University Medical Center
Hackensack, NJ, USA

Robert F. Centeno, MD, MBA
Medical Director
St. Croix Plastic Surgery and MediSpa;
Chief Medical Quality Officer
Governor Juan F. Luis Hospital and Medical Center
Christiansted, Saint Croix, United States Virgin Islands

Ernest S. Chiu, MD, FACS
Associate Professor of Plastic Surgery
Department of Plastic Surgery
New York University
New York, NY, USA

Jong Woo Choi, MD, PhD, MMM
Associate Professor
Department of Plastic and Reconstructive Surgery
Seoul Asan Medical Center
Seoul, South Korea

Steven R. Cohen, MD
Senior Clinical Research Fellow, Clinical Professor
Plastic Surgery
University of California
San Diego, CA;
Director
Craniofacial Surgery
Rady Children's Hospital, Private Practice, FACES+ Plastic Surgery, Skin and Laser Center
La Jolla, CA, USA

Sydney R. Coleman, MD
Assistant Clinical Professor
Plastic Surgery
New York University Medical Center
New York;
Assistant Clinical Professor
Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Mark B. Constantian, MD
Private Practice
Surgery (Plastic Surgery)
St. Joseph Hospital
Nashua, NH, USA;
Adjunct Clinical Professor
Surgery (Plastic Surgery)
University of Wisconsin School of Medicine
Madison, WI, USA;
Visiting Professor
Plastic Surgery
University of Virginia Health System
Charlottesville, VA, USA

Rafael A. Couto, MD
Plastic Surgery Resident
Department of Plastic Surgery
Cleveland Clinic
Cleveland, OH, USA

Albert Cram, MD
Professor Emeritus
University of Iowa
Iowa City Plastic Surgery
Coralville, IO, USA

Phillip Dauwe, MD
Department of Plastic Surgery
University of Texas Southwestern Medical School
Dallas, TX, USA

Dai M. Davies, FRCS
Consultant and Institute Director
Institute of Cosmetic and Reconstructive Surgery
London, UK

Jose Abel De la Peña Salcedo, MD, FACS
Plastic Surgeon
Director
Instituto de Cirugia Plastica S.C.
Huixquilucan
Estado de Mexico, Mexico

Barry DiBernardo, MD, FACS
Clinical Associate Professor, Plastic Surgery
Rutgers, New Jersey Medical School
Director New Jersey Plastic Surgery
Montclair, NJ, USA

Felmont F. Eaves III, MD, FACS
Professor of Surgery, Emory University
Medical Director, Emory Aesthetic Center
Medical Director, EAC Ambulatory Surgery Center
Atlanta, GA, USA

Marco Ellis, MD
Director of Craniofacial Surgery
Northwestern Specialists in Plastic Surgery;
Adjunct Assistant Professor
University of Illinois Chicago Medical Center
Chicago, IL, USA

Dino Elyassnia, MD
Associate Plastic Surgeon
Marten Clinic of Plastic Surgery
San Francisco, CA, USA

Julius Few Jr., MD
Director
The Few Institute for Aesthetic Plastic Surgery;
Clinical Professor
Plastic Surgery
University of Chicago Pritzker School of Medicine
Chicago, IL, USA

Osvaldo Ribeiro Saldanha Filho, MD
Professor of Plastic Surgery
Plastic Surgery Service Dr. Osvaldo Saldanha
São Paulo, Brazil

Jack Fisher, MD
Associate Clinical Professor
Plastic Surgery
Vanderbilt University
Nashville, TN, USA

Nicholas A. Flugstad, MD
Flugstad Plastic Surgery
Bellevue, WA, USA

James D. Frame, MBBS, FRCS, FRCSEd, FRCS(Plast)
Professor of Aesthetic Plastic Surgery
Anglia Ruskin University
Chelmsford, UK

Jazmina M. Gonzalez, MD
Bitar Cosmetic Surgery Institute
Fairfax, VA, USA

Richard J. Greco, MD
CEO
The Georgia Institute For Plastic Surgery
Savannah, GA, USA

Ronald P. Gruber, MD
Adjunct Associate Clinical Professor
Division of Plastic and Reconstructive Surgery
Stanford University
Stanford, CA
Clinical Association Professor
Division of Plastic and Reconstructive Surgery
University of California San Francisco
San Francisco, CA, USA

Bahman Guyuron, MD, FCVS
Editor in Chief, Aesthetic Plastic Surgery Journal
Emeritus Professor of Plastic Surgery
Case School of Medicine
Cleveland, OH, USA

Joseph P. Hunstad, MD, FACS
Associate Consulting Professor
Division of Plastic Surgery
The University of North Carolina at Chapel Hill;
Private Practice
Huntersville/Charlotte, NC, USA

Clyde H. Ishii, MD, FACS
Assistant Clinical Professor of Surgery
John A. Burns School of Medicine;
Chief, Department of Plastic Surgery
Shriners Hospital
Honolulu Unit
Honolulu, HI, USA

Nicole J. Jarrett, MD
Department of Plastic Surgery
University of Pittsburgh
Pittsburgh, PA, USA

Elizabeth B. Jelks, MD
Private Practice
Jelks Medical
New York, NY, USA

Glenn W. Jelks, MD
Associate Professor
Department of Ophthalmology
Department of Plastic Surgery
New York University School of Medicine
New York, NY, USA

Mark Laurence Jewell, MD
Assistant Clinical Professor Plastic Surgery
Oregon Health Science University
Portland, OR, USA

David M. Kahn, MD
Clinical Associate Professor of Plastic Surgery
Department of Surgery
Stanford University School of Medicine
Stanford, CA, USA

Michael A. C. Kane, BS, MD
Attending Surgeon
Plastic Surgery
Manhattan Eye, Ear, and Throat Hospital
New York, NY, USA

David L. Kaufman, MD, FACS
Private Practice Plastic Surgery
Aesthetic Artistry Surgical and Medical Center
Folsom, CA, USA

Jeffrey Kenkel, MD
Professor and Chairman
Department of Plastic Surgery
UT Southwestern Medical Center
Dallas, TX, USA

Kyung S. Koh, MD, PhD
Professor of Plastic Surgery
Asan Medical Center, University of Ulsan School of Medicine
Seoul, South Korea

Tracy Leong, MD
Dermatology
Rady Children's Hospital - San Diego;
Sharp Memorial Hospital;
University California San Diego Medical Center
San Diego;
Private Practice, FACES+ Plastic Surgery, Skin and Laser Center
La Jolla, CA, USA

Steven M. Levine, MD
Assistant Professor of Surgery (Plastic)
Hofstra Medical School, Northwell Health,
New York, NY, USA

Michelle B. Locke, MBChB, MD
Senior Lecturer in Surgery
Department of Surgery
University of Auckland Faculty of Medicine and Health Sciences;
South Auckland Clinical Campus
Middlemore Hospital
Auckland, New Zealand

Alyssa Lolofie
University of Utah
Salt Lake City, UT, USA

Timothy J. Marten, MD, FACS
Founder and Director
Marten Clinic of Plastic Surgery
San Francisco, CA, USA

Bryan Mendelson, FRCSE, FRACS, FACS
The Centre for Facial Plastic Surgery
Toorak, Victoria, Australia

Constantino G. Mendieta, MD, FACS
Private Practice
Miami, FL, USA

Drew B. Metcalfe, MD
Division of Plastic and Reconstructive Surgery
Emory University
Atlanta, GA, USA

Gabriele C. Miotto, MD
Emory School of Medicine
Atlanta, GA, USA

Foad Nahai, MD
Professor of Surgery
Division of Plastic and Reconstructive Surgery
Department of Surgery
Emory University School of Medicine
Emory Aesthetic Center at Paces
Atlanta, Georgia, USA

Suzan Obagi, MD
Associate Professor of Dermatology
Dermatology
University of Pittsburgh;
Associate Professor of Plastic Surgery
Plastic Surgery
University of Pittsburgh
Pittsburgh, PA, USA

Sabina Aparecida Alvarez de Paiva, MD
Resident of Plastic Surgery
Plastic Surgery Service Dr. Ewaldo Bolivar de Souza Pinto
São Paulo, Brazil

Galen Perdikis, MD
Assistant Professor of Surgery
Division of Plastic Surgery
Emory University School of Medicine
Atlanta, GA, USA

Jason Posner, MD, FACS
Private Practice
Boca Raton, FL, USA

Dirk F. Richter, MD, PhD
Clinical Professor of Plastic Surgery
University of Bonn
Director and Chief
Dreifaltigkeits-Hospital
Wesseling, Germany

Thomas L. Roberts III, FACS
Plastic Surgery Center of the Carolinas
Spartanburg, SC, USA

Jocelyn Celeste Ledezma Rodriguez, MD
Private Practice
Guadalajara, Jalisco, Mexico

Rod J. Rohrich, MD
Clinical Professor and Founding Chair
Department of Plastic Surgery
Distinguished Teaching Professor
University of Texas Southwestern Medical Center
Founding Partner
Dallas Plastic Surgery Institute
Dallas, TX, USA

E. Victor Ross, MD
Director of Laser and Cosmetic Dermatology
Scripps Clinic
San Diego, CA, USA

J. Peter Rubin, MD, FACS
Chief
Plastic and Reconstructive Surgery
University of Pittsburgh Medical Center;
Associate Professor
Department of Surgery
University of Pittsburgh
Pittsburgh, PA, USA

Ahmad N. Saad, MD
Private Practice
FACES+ Plastic Surgery
Skin and Laser Center
La Jolla, CA, USA

Alesia P. Saboeiro, MD
Attending Physician
Private Practice
New York, NY, USA

Cristianna Bonnetto Saldanha, MD
Plastic Surgery Service Dr. Osvaldo Saldanha
São Paulo, Brazil

Osvaldo Saldanha, MD, PhD
Director of Plastic Surgery Service Dr. Osvaldo Saldanha;
Professor of Plastic Surgery Department
Universidade Metropolitana de Santos
- UNIMES
São Paulo, Brazil

Renato Saltz, MD, FACS
Saltz Plastic Surgery
President
International Society of Aesthetic Plastic Surgery
Adjunct Professor of Surgery
University of Utah
Past-President, American Society for Aesthetic Plastic Surgery
Salt Lake City and Park City, UT, USA

Paulo Rodamilans Sanjuan MD
Chief Resident of Plastic Surgery
Plastic Surgery Service Dr. Ewaldo Boliar de Souza Pinto
São Paulo, Brazil

Nina Schwaiger, MD
Senior Specialist in Plastic and Aesthetic Surgery
Department of Plastic Surgery
Dreifaltigkeits-Hospital Wesseling
Wesseling, Germany

Douglas S. Steinbrech, MD, FACS
Gotham Plastic Surgery
New York, NY, USA

Phillip J. Stephan, MD
Clinical Faculty
Plastic Surgery
UT Southwestern Medical School;
Plastic Surgeon
Texoma Plastic Surgery
Wichita Falls, TX, USA

David Gonzalez Sosa, MD
Plastic and Reconstructive Surgery
Hospital Quirónsalud Torrevieja
Alicante, Spain

James M. Stuzin, MD
Associate Professor of Surgery
(Plastic) Voluntary
University of Miami Leonard M. Miller School of Medicine
Miami, FL, USA

Daniel Suissa, MD, MSc
Clinical Instructor
Section of Plastic and Reconstructive Surgery
Yale University
New Haven, CT, USA

Charles H. Thorne, MD
Associate Professor of Plastic Surgery
Department of Plastic Surgery
NYU School of Medicine
New York, NY, USA

Ali Totonchi, MD
Assistant Professor
Plastic Surgery
Case Western Reserve University;
Medical Director Craniofacial Deformity Clinic
Plastic Surgery
MetroHealth Medical center
Cleveland, OH, USA

Jonathan W. Toy, MD, FRCSC
Program Director, Plastic Surgery Residency
Program Assistant Clinical Professor
University of Alberta
Edmonton, Alberta, Canada

Matthew J. Trovato, MD
Dallas Plastic Surgery Institute
Dallas, TX, USA

Simeon H. Wall Jr., MD, FACS
Director
The Wall Center for Plastic Surgery;
Assistant Clinical Professor
Plastic Surgery
LSU Health Sciences Center at Shreveport
Shreveport, LA, USA

Joshua T. Waltzman, MD, MBA
Private Practice
Waltzman Plastic and Reconstructive Surgery
Long Beach, CA, USA

Richard J. Warren, MD, FRCSC
Clinical Professor
Division of Plastic Surgery
University of British Columbia
Vancouver, British Columbia, Canada

Edmund Weisberg, MS, MBE
University of Pennsylvania
Philadelphia, PA, USA

Scott Woehrle, MS BS
Physician Assistant
Department of Plastic Surgery
Jospeh Capella Plastic Surgery
Ramsey, NJ, USA

Chin-Ho Wong, MBBS, MRCS, MMed(Surg), FAMS(Plast Surg)
W Aesthetic Plastic Surgery
Mt Elizabeth Novena Specialist Center
Singapore

Alan Yan, MD
Former Fellow
Adult Reconstructive and Aesthetic Craniomaxillofacial Surgery
Division of Plastic and Reconstructive Surgery
Massachusetts General Hospital
Boston, MA, USA

Michael J. Yaremchuk, MD
Chief of Craniofacial Surgery
Massachusetts General Hospital;
Clinical Professor of Surgery
Harvard Medical School;
Program Director
Harvard Plastic Surgery Residency Program
Boston, MA, USA

James E. Zins, MD
Chairman
Department of Plastic Surgery
Dermatology and Plastic Surgery Institute
Cleveland Clinic
Cleveland, OH, USA

VOLUME THREE

Neta Adler, MD
Senior Surgeon
Department of Plastic and Reconstructive Surgery
Hadassah University Hospital
Jerusalem, Israel

Ahmed M. Afifi, MD
Assistant Professor of Plastic Surgery
Department of Surgery
University of Wisconsin
Madison, WI, USA;
Associate Professor
Department of Plastic Surgery
Cairo University
Cairo, Egypt

Marta Alvarado, DDS, MS
Department of Orthodontics
Facultad de Odontología
Universidad de San Carlos de Guatemala
Guatemala

Eric Arnaud, MD
Pediatric Neurosurgeon and Co-Director
Unité de Chirurgie Craniofaciale
Hôpital Necker Enfants Malades
Paris, France

Stephen B. Baker, MD, DDS
Associate Professor and Program Director
Co-Director Inova Hospital for Children
Craniofacial Clinic
Department of Plastic Surgery
Georgetown University Hospital
Georgetown, WA, USA

Scott P. Bartlett, MD
Professor of Surgery
Surgery
University of Pennsylvania;
Chief Division of Plastic Surgery
Surgery
Children's Hospital of Philadelphia
Philadelphia, PA, USA

Bruce S. Bauer, MD
Chief
Division of Plastic Surgery
NorthShore University HealthSystem
Highland Park;
Clinical Professor of Surgery
Department of Surgery
University of Chicago Pritzker School of Medicine
Chicago, IL, USA

Adriane L. Baylis, PhD
Speech Scientist
Section of Plastic and Reconstructive Surgery
Nationwide Children's Hospital
Columbus, OH, USA

Mike Bentz, MD, FAAP, FACS
Interim Chairman
Department of Surgery
University of Wisconsin;
Chairman Division of Plastic Surgery
Department of Surgery
University of Wisconsin
Madison, WI, USA

Craig Birgfeld, MD, FACS
Associate Professor, Pediatric Plastic and Craniofacial Surgery
Seattle Children's Hospital
Seattle, WA, USA

William R. Boysen, MD
Resident Physician, Urology
University of Chicago Medicine
Chicago, IL, USA

James P. Bradley, MD
Professor and Chief
Section of Plastic and Reconstructive Surgery
Temple University
Philadelphia, PA, USA

Edward P. Buchanan, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Michael R. Bykowski, MD, MS
Plastic Surgery Resident
Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Edward J. Caterson, MD, PhD
Director of Craniofacial Surgery
Division of Plastic Surgery
Brigham and Women's Hospital
Boston, MA, USA

Rodney K. Chan, MD
Chief Plastic and Reconstructive Surgery
Clinical Division and Burn Center
United States Army Institute of Surgical Research
Joint Base San Antonio, TX, USA

Edward I. Chang, MD
Assistant Professor
Department of Plastic Surgery
The University of Texas M. D. Anderson Cancer Center
Houston, TX, USA

Constance M. Chen, MD, MPH
Director of Microsurgery
Plastic and Reconstructive Surgery
New York Eye and Ear Infirmary of Mt Sinai;
Clinical Assistant Professor
Plastic and Reconstructive Surgery
Weil Medical College of Cornell University;
Clinical Assistant Professor
Plastic and Reconstructive Surgery
Tulane University School of Medicine
New York, NY, USA

Yu-Ray Chen, MD
Professor of Surgery
Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
Taoyuan City, Taiwan

Philip Kuo-Ting Chen, MD
Professor
Craniofacial Center
Chang Gung Memorial Hospital
Taoyuan City, Taiwan

Ming-Huei Cheng, MD, MBA
Professor
Division of Reconstructive Microsurgery
Department of Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
Taoyuan City, Taiwan

Gerson R. Chinchilla, DDS MS
Director
Department of Orthodontics
Facultad de Odontología
Universidad de San Carlos de Guatemala
Guatemala

Peter G. Cordeiro, MD
Chief
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center;
Professor of Surgery
Surgery
Weil Medical College of Cornell University
New York, NY, USA

Alberto Córdova-Aguilar, MD, MPH
Attending Plastic Surgeon
Surgery
Faculty of Medicine Ricardo Palma University
Lima, Peru

Edward H. Davidson, MA(Cantab), MBBS
Resident Plastic Surgeon
Department of Plastic Surgery
University of Pittsburgh
Pittsburgh, PA, USA

Sara R. Dickie, MD
Clinician Educator
Surgery
University of Chicago Hospital Pritzker School of Medicine;
Attending Surgeon
Section of Plastic and Reconstructive Surgery
NorthShore University HealthSystem
Northbrook, IL, USA

Risal S. Djohan, MD
Microsurgery Fellowship Program Director
Plastic Surgery
Cleveland Clinic;
Surgery ASC Quality Improvement Officer
Plastic Surgery
Cleveland Clinic
Cleveland, OH, USA

Amir H. Dorafshar, MBChB, FACS, FAAP
Associate Professor
Plastic and Reconstructive Surgery
Johns Hopkins Medical Institute;
Assistant Professor
Plastic Surgery
R Adams Cowley Shock Trauma Center
Baltimore, MD, USA

Jeffrey A. Fearon, MD
Director
The Craniofacial Center
Dallas, TX, USA

Alexander L. Figueroa, DMD
Craniofacial Orthodontist
Rush Craniofacial Center
Rush University Medical Center
Chicago, IL, USA

Alvaro A. Figueroa, DDS, MS
Co-Director
Rush Craniofacial Center
Rush University Medical Center
Chicago, IL, USA

David M. Fisher, MB, BCh, FRCSC, FACS
Medical Director Cleft Lip and Palate Program
Plastic Surgery
Hospital for Sick Children;
Associate Professor
Surgery
University of Toronto
Toronto, Ontario, Canada

Roberto L. Flores, MD
Associate Professor of Plastic Surgery
Director of Cleft Lip and Palate
Hansjörg Wyss Department of Plastic Surgery
NYU Langone Medical Center
New York, NY, USA

Andrew Foreman, B. Physio, BMBS(Hons), PhD, FRACS
Consultant Surgeon, Department of Otolaryngology - Head and Neck Surgery
University of Adelaide,
Royal Adelaide Hospital,
Adelaide, SA, Australia

Patrick A. Gerety, MD
Assistant Professor of Surgery
Division of Plastic and Reconstructive Surgery
Indiana University and Riley Hospital for Children
Philadelphia, PA, USA

Jesse A. Goldstein, MD
Chief Resident
Department of Plastic Surgery
Georgetown University Hospital
Washington, DC, USA

Arun K. Gosain, MD
Chief
Division of Plastic Surgery
Ann and Robert H. Lurie Children's Hospital of Chicago
Chicago, IL, USA

Lawrence J. Gottlieb, MD
Professor of Surgery
Department of Surgery
Section of Plastic and Reconstructive Surgery
University of Chicago
Chicago, IL, USA

Arin K. Greene, MD, MMSc
Department of Plastic and Oral Surgery
Boston Children's Hospital;
Associate Professor of Surgery
Harvard Medical School
Boston, MA, USA

Patrick J. Gullane, MD, FRCS
Wharton Chair in Head and Neck Surgery
Professor of Surgery, Department of Otolaryngology - Head and Neck Surgery
University of Toronto
Toronto, Ontario, Canada

Mohan S. Gundeti, MB, MCh, FEBU, FRCS(Urol), FEAPU
Associate Professor of Urology in Surgery and Pediatrics, Director Pediatric Urology, Director Centre for Pediatric Robotics and Minimal Invasive Surgery
University of Chicago and Pritzker Medical School Comer Children's Hospital
Chicago, IL, USA

Eyal Gur, MD
Professor of Surgery, Chief
Department of Plastic and Reconstructive Surgery
The Tel Aviv Sourasky Medical Center
Tel Aviv, Israel

Bahman Guyuron, MD, FCVS
Editor in Chief, Aesthetic Plastic Surgery Journal;
Emeritus Professor of Plastic Surgery
Case School of Medicine
Cleveland, OH, USA

Matthew M. Hanasono, MD
Associate Professor
Department of Plastic Surgery
The University of Texas MD Anderson Cancer Center
Houston, TX, USA

Toshinobu Harada, PhD
Professor in Engineering
Department of Systems Engineering
Faculty of Systems Engineering
Wakayama University
Wakayama, Japan

Jill A. Helms, DDS, PhD
Professor
Surgery
Stanford University
Stanford, CA, USA

David L. Hirsch, MD, DDS
Director of Oral Oncology and Reconstruction
Lenox Hill Hospital/Northwell Health
New York, NY, USA

Jung-Ju Huang, MD
Associate Professor
Division of Microsurgery
Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
Taoyuan, Taiwan

William Y. Hoffman, MD
Professor and Chief
Division of Plastic and Reconstructive Surgery
UCSF
San Francisco, CA, USA

Larry H. Hollier Jr., MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Richard A. Hopper, MD, MS
Chief
Division of Craniofacial Plastic Surgery
Seattle Children's Hospital;
Surgical Director
Craniofacial Center
Seattle Children's Hospital;
Associate Professor
Department of Surgery
University of Washington
Seattle, WA, USA

Gazi Hussain, MBBS, FRACS
Clinical Senior Lecturer
Macquarie University
Sydney, Australia

Oksana Jackson, MD
Assistant Professor
Plastic Surgery
Perelman School of Medicine at the University of Pennsylvania;
Assistant Professor
Plastic Surgery
The Children's Hospital of Philadelphia
Philadelphia, PA, USA

Syril James, MD
Clinic Marcel Sembat
Boulogne-Billancourt
Paris, France

Leila Jazayeri, MD
Microsurgery Fellow
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Sahil Kapur, MD
Assistant Professor
Department of Plastic Surgery
University of Texas - MD Anderson Cancer Center
Houston, TX, USA

Henry K. Kawamoto Jr., MD, DDS
Clinical Professor
Surgery Division of Plastic Surgery
UCLA
Los Angeles, CA, USA

David Y. Khechoyan, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Richard E. Kirschner, MD
Section Chief
Plastic and Reconstructive Surgery
Nationwide Children's Hospital;
Senior Vice Chair
Plastic Surgery
The Ohio State University Medical College
Columbus, OH, USA

John C. Koshy, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Michael C. Large, MD
Urologic Oncologist
Urology of Indiana
Greenwood, IN, USA

Edward I. Lee, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Jamie P. Levine, MD
Chief of Microsurgery
Associate Professor
Plastic Surgery
NYU Langone Medical Center
New York, NY, USA

Jingtao Li, DDS, PhD
Consultant Surgeon
Oral and Maxillofacial Surgery
West China Hospital of Stomatology
Chengdu, Sichuan, People's Republic of China

Lawrence Lin, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Joseph E. Losee, MD
Ross H. Musgrave Professor of Pediatric Plastic Surgery
Department of Plastic Surgery
University of Pittsburgh Medical Center;
Chief, Division of Pediatric Plastic Surgery
Children's Hospital of Pittsburgh
Pittsburgh, PA, USA

David W. Low, MD
Professor of Surgery
Division of Plastic Surgery
Perelman School of Medicine at the University of Pennsylvania;
Clinical Associate
Department of Surgery
Children's Hospital of Philadelphia
Philadelphia, PA, USA

Ralph T. Manktelow, MD, FRCSC
Professor of Surgery,
The University of Toronto,
Toronto, Ontario, Canada

Paul N. Manson, MD
Distinguished Service Professor
Plastic Surgery
Johns Hopkins University
Baltimore, MD, USA

David W. Mathes, MD
Professor and Chief of the Division of Plastic and Reconstructive Surgery
Surgery Division of Plastic and Reconstructive Surgery
University of Colorado
Aurora, CO, USA

Frederick J. Menick, MD
Private Practitioner
Tucson, AZ, USA

Fernando Molina, MD
Director
Craniofacial Anomalies Foundation A.C.
Mexico City;
Professor of Plastic Reconstructive and Aesthetic Surgery
Medical School
Universidad La Salle
Mexico City, Distrito Federal, Mexico

Laura A. Monson, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Reid V. Mueller, MD
Associate Professor
Plastic Surgery
Oregon Health and Science University
Portland, OR, USA

John B. Mulliken, MD
Professor
Department of Plastic and Oral Surgery
Boston Children's Hospital
Harvard Medical School
Boston, MA, USA

Gerhard S. Mundinger, MD
Assistant Professor
Craniofacial, Plastic, and Reconstructive Surgery
Louisiana State University Health Sciences Center
Children's Hospital of New Orleans
New Orleans, LA, USA

Blake D. Murphy, BSc, PhD, MD
Craniofacial Fellow
Plastic Surgery
Nicklaus Children's Hospital
Miami, FL, USA

Peter C. Neligan, MB, FRCS(I), FRCSC, FACS
Professor of Surgery
Department of Surgery, Division of Plastic Surgery
University of Washington
Seattle, WA, USA

M. Samuel Noordhoff, MD, FACS
Emeritus Professor in Surgery
Chang Gung University
Taoyuan City, Taiwan

Giovanna Paternoster, MD
Unité de chirurgie crânio-faciale du departement de neurochirurgie
Hôpital Necker Enfants Malades
Paris, France

Jason Pomerantz, MD
Assistant Professor
Surgery
University of California San Francisco;
Surgical Director
Craniofacial Center
University of California San Francisco
San Francisco, CA, USA

Julian J. Pribaz, MD
Professor of Surgery
University of South Florida, Morsani College of Medicine
Tampa General Hospital
Tampa, FL, USA

Chad A. Purnell, MD
Division of Plastic Surgery
Lurie Children's Hospital of Northwestern
Feinberg School of Medicine
Chicago, IL, USA

Russell R. Reid, MD, PhD
Associate Professor
Surgery/Section of Plastic and Reconstructive Surgery
University of Chicago Medicine
Chicago, IL, USA

Eduardo D. Rodriguez, MD, DDS
Helen L. Kimmel Professor of Reconstructive Plastic Surgery
Chair, Hansjörg Wyss Department of Plastic Surgery
NYU School of Medicine
NYU Langone Medical Center
New York, NY, USA

Craig Rowin, MD
Craniofacial Fellow
Plastic Surgery
Nicklaus Children's Hospital
Miami, FL, USA

Ruston J. Sanchez, MD
Plastic and Reconstructive Surgery Resident
University of Wisconsin
Madison, WI, USA

Lindsay A. Schuster, DMD, MS
Director Cleft-Craniofacial Orthodontics
Pediatric Plastic Surgery
Children's Hospital of Pittsburgh of UMPC;
Clinical Assistant Professor of Plastic Surgery
Department of Plastic Surgery
University of Pittsburgh School of Medicine
Pittsburgh, PA, USA

Jeremiah Un Chang See, MD
Plastic Surgeon
Department of Plastic and Reconstructive Surgery
Penang General Hospital
Georgetown, Penang, Malaysia

Pradip R. Shetye, DDS, BDS, MDS
Assistant Professor (Orthodontics)
Hansjörg Wyss Department of Plastic Surgery
NYU Langone Medical Center
New York, NY, USA

Roman Skoracki, MD
Plastic Surgery
The Ohio State University
Columbus, OH, USA

Mark B. Slidell, MD, MPH
Assistant Professor of Surgery
Department of Surgery
Section of Pediatric Surgery
University of Chicago Medicine Biological Sciences
Chicago, IL, USA

Michael Sosin, MD
Research Fellow
Department of Plastic Surgery Institute of Reconstructive Plastic Surgery
NYU Langone Medical Center
New York, NY, USA;
Research Fellow
Division of Plastic Reconstructive and Maxillofacial Surgery
R Adams Cowley Shock Trauma Center
University of Maryland Medical Center
Baltimore, MD, USA;
Resident
Department of Surgery
Medstar Georgetown University Hospital
Washington, DC, USA

Youssef Tahiri, MD, MSc, FRCSC, FAAP, FACS
Associate Professor
Pediatric Plastic & Craniofacial Surgery
Cedars Sinai Medical Center
Los Angeles, CA, USA

Peter J. Taub, MD
Professor
Surgery Pediatrics Dentistry and Medical Education
Surgery Division of Plastic and Reconstructive Surgery
Icahn School of Medicine at Mount Sinai
New York, NY, USA

Jesse A. Taylor, MD
Mary Downs Endowed Chair of Pediatric Craniofacial Treatment and Research;
Director, Penn Craniofacial Fellowship;
Co-Director, CHOP Cleft Team
Plastic, Reconstructive, and Craniofacial Surgery
The University of Pennsylvania and Children's Hospital of Philadelphia
Philadelphia, PA, USA

Kathryn S. Torok, MD
Assistant Professor
Pediatric Rheumatology
University of Pittsburgh
Pittsburgh, PA, USA

Ali Totonchi, MD
Assistant Professor
Plastic Surgery
Case Western Reserve University;
Medical Director Craniofacial Deformity Clinic
Plastic Surgery
MetroHealth Medical Center
Cleveland, OH, USA

Kris Wilson, MD
Division of Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

S. Anthony Wolfe, MD
Plastic Surgery
Miami Children's Hospital
Miami, FL, USA

Akira Yamada, MD, PhD
Professor of Plastic Surgery
World Craniofacial Foundation
Dallas, TX, USA;
Clinical Assistant Professor
Plastic Surgery
Case Western Reserve University
Cleveland, OH, USA

Peirong Yu, MD
Professor
Plastic Surgery
M. D. Anderson Cancer Center;
Adjunct Professor
Plastic Surgery
Baylor College of Medicine
Houston, TX, USA

Ronald M. Zuker, MD, FRCSC, FACS, FRCSEd(Hon)
Professor of Surgery
Department of Surgery
University of Toronto;
Staff Plastic and Reconstructive Surgeon
Department of Surgery
SickKids Hospital
Toronto, Ontario, Canada

VOLUME FOUR

Christopher E. Attinger, MD
Professor, Interim Chairman
Department of Plastic Surgery
Center for Wound Healing
Medstar Georgetown University Hospital
Washington, DC, USA

Lorenzo Borghese, MD
Plastic Surgeon
Chief of International Missions
Ospedale Pediatrico Bambino Gesù
Rome, Italy

Charles E. Butler, MD, FACS
Professor and Chairman
Department of Plastic Surgery
Charles B. Barker Endowed Chair in Surgery
The University of Texas M. D. Anderson Cancer Center
Houston, TX, USA

David W. Chang, MD
Professor of Surgery
University of Chicago
Chicago, IL, USA

Karel Claes, MD
Department of Plastic and Reconstructive Surgery
Ghent University Hospital
Ghent, Belgium

Mark W. Clemens II, MD, FACS
Associate Professor
Plastic Surgery
MD Anderson Cancer Center,
Houston, TX, USA

Shannon M. Colohan, MD, MSc
Assistant Professor of Surgery
University of Washington
Seattle, WA, USA

Peter G. Cordeiro, MD
Chief
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Salvatore D'Arpa, MD, PhD
Department of Plastic and Reconstructive Surgery
Ghent University Hospital
Ghent, Belgium

Michael V. DeFazio, MD
Department Plastic Surgery
MedStar Georgetown University Hospital
Washington, DC, USA

A. Lee Dellon, MD, PhD
Professor of Plastic Surgery
Professor of Neurosurgery
Johns Hopkins University
Baltimore, MD, USA

Sara R. Dickie, MD
Clinical Associate of Surgery
University of Chicago Hospitals
Pritzker School of Medicine
Chicago, IL, USA

Ivica Ducic, MD, PhD
Clinical Professor of Surgery
GWU Washington Nerve Institute
McLean, VA, USA

Gregory A. Dumanian, MD
Stuteville Professor of Surgery
Division of Plastic Surgery
Northwestern Feinberg School of Medicine
Chicago, IL, USA

John M. Felder III, MD
Fellow in Hand Surgery
Plastic Surgery
Washington University in Saint Louis
St. Louis, MO, USA

Goetz A. Giessler, MD, PhD
Professor Director
Plastic-Reconstructive, Aesthetic and Hand Surgery
Gesundheit Nordhessen
Kassel, Germany

Kevin D. Han, MD
Department of Plastic Surgery
MedStar Georgetown University Hospital
Washington, DC, USA

Piet Hoebeke
Department of Urology
Ghent University Hospital
Ghent, Belgium

Joon Pio Hong, MD, PhD, MMM
Professor of Plastic Surgery
Asan Medical Center, University of Ulsan
Seoul, South Korea

Michael A. Howard, MD
Clinical Assistant Professor of Surgery
Plastic Surgery
NorthShore University HealthSystem/University of Chicago
Chicago, IL, USA

Jeffrey E. Janis, MD, FACS
Professor of Plastic Surgery, Neurosurgery, Neurology, and Surgery;
Executive Vice Chairman, Department of Plastic Surgery;
Chief of Plastic Surgery, University Hospitals
Ohio State University Wexner Medical Center
Columbus, OH, USA

Leila Jazayeri, MD
Microsurgery Fellow
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Grant M. Kleiber, MD
Assistant Professor of Surgery
Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Stephen J. Kovach III, MD
Assistant Professor
Division of Plastic Surgery
University of Pennsylvania
Philadelphia, PA, USA

Robert Kwon, MD
Southwest Hand and Microsurgery
3108 Midway Road, Suite 103
Plano, TX, USA

Raphael C. Lee, MS, MD, ScD, FACS, FAIMBE
Paul and Allene Russell Professor
Plastic Surgery, Dermatology, Anatomy and Organismal Biology, Molecular Medicine
University of Chicago
Chicago, IL, USA

L. Scott Levin, MD, FACS
Chairman of Orthopedic Surgery
Department of Orthopaedic Surgery
University of Pennsylvania School of Medicine
Philadelphia, PA, USA

Otway Louie, MD
Associate Professor
Surgery
University of Washington Medical Center
Seattle, WA, USA

Nicolas Lumen, MD, PhD
Head of Clinic
Urology
Ghent University Hospital
Ghent, Belgium

Alessandro Masellis, MD
Plastic Surgeon
Euro-Mediterranean Council for Burns and Fire Disasters
Palermo, Italy

Michele Masellis, MD
Former Chief of Department of Plastic and Reconstructive Surgery and Burn Therapy
Department of Plastic and Reconstructive Surgery and Burn Therapy - ARNAS Ospedale Civico e Benfratelli
Palermo, Italy

Stephen M. Milner, MB BS, BDS
Professor of Plastic Surgery
Surgery
Johns Hopkins School of Medicine
Baltimore, MD, USA

Arash Momeni, MD
Fellow, Reconstructive Microsurgery
Division of Plastic Surgery
University of Pennsylvania Health System
Philadelphia, PA, USA

Stan Monstrey, MD, PhD
Department of Plastic and Reconstructive Surgery
Ghent University Hospital
Ghent, Belgium

Venkateshwaran N, MBBS, MS, DNB, MCh, MRCS(Intercollegiate)
Consultant Plastic Surgeon
Jupiter Hospital
Thane, India

Rajiv P. Parikh, MD, MPHS
Resident Physician
Department of Surgery, Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Mônica Sarto Piccolo, MD, MSc, PhD
Director
Pronto Socorro para Queimaduras
Goiânia, Goiás, Brazil

Nelson Sarto Piccolo, MD
Chief
Division of Plastic Surgery
Pronto Socorro para Queimaduras
Goiânia, Goiás, Brazil

Maria Thereza Sarto Piccolo, MD, PhD
Scientific Director
Pronto Socorro para Queimaduras
Goiânia, Goiás, Brazil

Vinita Puri, MS, MCh
Professor and Head
Department of Plastic, Reconstructive Surgery and Burns
Seth G S Medical College and KEM Hospital
Mumbai, Maharashtra, India

Andrea L. Pusic, MD, MHS, FACS
Associate Professor
Plastic and Reconstructive Surgery
Memorial Sloan Kettering Cancer Center
New York, NY, USA

Vinay Rawlani, MD
Division of Plastic Surgery
Northwestern Feinberg School of Medicine
Chicago, IL, USA

Juan L. Rendon, MD, PhD
Clinical Instructor Housestaff
Department of Plastic Surgery
The Ohio State University Wexner Medical Center
Columbus, OH, USA

Michelle C. Roughton, MD
Assistant Professor
Division of Plastic and Reconstructive Surgery
University of North Carolina at Chapel Hill
Chapel Hill, NC, USA

Hakim K. Said, MD, FACS
Associate Professor
Division of Plastic surgery
University of Washington
Seattle, WA, USA

Michel Saint-Cyr, MD, FRSC(C)
Professor
Plastic Surgery
Mayo Clinic
Rochester, MN, USA

Michael Sauerbier, MD, PhD
Professor, Chair
Department for Plastic, Hand, and Reconstructive Surgery
Academic Hospital Goethe University Frankfurt am Main
Frankfurt am Main, Germany

Loren S. Schechter, MD
Associate Professor and Chief
Division of Plastic Surgery
Chicago Medical School
Morton Grove, IL, USA

David H. Song, MD, MBA, FACS
Regional Chief, MedStar Health
Plastic and Reconstructive Surgery
Professor and Chairman
Department of Plastic Surgery
Georgetown University School of Medicine
Washington, DC, USA

Yoo Joon Sur, MD, PhD
Associate Professor
Department of Orthopedic Surgery
The Catholic University of Korea, College of Medicine
Seoul, Korea

Chad M. Teven, MD
Resident
Section of Plastic and Reconstructive Surgery
University of Chicago
Chicago, IL, USA

VOLUME FIVE

Jamil Ahmad, MD, FRCSC
Director of Research and Education
The Plastic Surgery Clinic
Mississauga, Ontario, Canada;
Assistant Professor of Surgery
University of Toronto
Toronto, Ontario, Canada

Robert J. Allen Sr., MD
Clinical Professor of Plastic Surgery
Department of Plastic Surgery
New York University Medical Center
Charleston, NC, USA

Ryan E. Austin, MD, FRCSC
Plastic Surgeon
The Plastic Surgery Clinic
Mississauga, ON, Canada

Brett Beber, BA, MD, FRCSC
Plastic and Reconstructive Surgeon
Lecturer, Department of Surgery
University of Toronto
Toronto, Ontario, Canada

Philip N. Blondeel, MD
Professor of Plastic Surgery
Department of Plastic Surgery
University Hospital Ghent
Ghent, Belgium

Benjamin J. Brown, MD
Gulf Coast Plastic Surgery
Pensacola, FL, USA

Mitchell H. Brown, MD, MEd, FRCSC
Plastic and Reconstructive Surgeon
Associate Professor, Department of Surgery
University of Toronto
Toronto, Ontario, Canada

M. Bradley Calobrace, MD, FACS
Plastic Surgeon
Calobrace and Mizuguchi Plastic Surgery Center
Departments of Surgery, Divisions of Plastic Surgery
Clinical Faculty, University of Louisville and University of Kentucky
Louisville, KY, USA

Grant W. Carlson, MD
Wadley R. Glenn Professor of Surgery
Emory University
Atlanta, GA, USA

Bernard W. Chang, MD
Chief of Plastic and Reconstructive Surgery
Mercy Medical Center
Baltimore, MD, USA

Mark W. Clemens II, MD, FACS
Assistant Professor Plastic Surgery
M. D. Anderson Cancer Center
Houston, TX, USA

Robert Cohen MD, FACS
Medical Director
Plastic Surgery
Scottsdale Center for Plastic Surgery
Paradise Valley, AZ and;
Santa Monica, CA, USA

Amy S. Colwell, MD
Associate Professor
Harvard Medical School
Massachusetts General Hospital
Boston, MA, USA

Edward H. Davidson, MA(Cantab), MB, BS
Resident Plastic Surgeon
Department of Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Emmanuel Delay, MD, PhD
Unité de Chirurgie Plastique et Reconstructrice
Centre Léon Bérard
Lyon, France

Francesco M. Egro, MB ChB, MSc, MRCS
Department of Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Neil A. Fine, MD
President
Northwestern Specialists in Plastic Surgery;
Associate Professor (Clinical) Surgery/Plastics
Northwestern University Fienberg School of Medicine
Chicago, IL, USA

Jaime Flores, MD
Plastic and Reconstructive Microvascular Surgeon
Miami, FL, USA

Joshua Fosnot, MD
Assistant Professor of Surgery
Division of Plastic Surgery
The Perelman School of Medicine
University of Pennsylvania Health System
Philadelphia, PA, USA

Allen Gabriel, MD
Clinical Associate Professor
Department of Plastic Surgery
Loma Linda University Medical Center
Loma Linda, CA, USA

Michael S. Gart, MD
Resident Physician
Division of Plastic Surgery
Northwestern University Feinberg School of Medicine
Chicago, IL, USA

Matthew D. Goodwin, MD
Plastic Surgeon
Plastic Reconstructive and Cosmetic Surgery
Boca Raton Regional Hospital
Boca Raton, FL, USA

Samia Guerid, MD
Cabinet
50 rue de la République
Lyon, France

Moustapha Hamdi, MD, PhD
Professor of Plastic and Reconstructive Surgery
Brussels University Hospital
Vrij Universitaire Brussels
Brussels, Belgium

Alexandra M. Hart, MD
Emory Division of Plastic and Reconstructive Surgery
Emory University School of Medicine
Atlanta, GA, USA

Emily C. Hartmann, MD, MS
Aesthetic Surgery Fellow
Plastic and Reconstructive Surgery
University of Southern California
Los Angeles, CA, USA

Nima Khavanin, MD
Resident Physician
Department of Plastic and Reconstructive Surgery
Johns Hopkins Hospital
Baltimore, MD, USA

John Y. S. Kim, MD
Professor and Clinical Director
Department of Surgery
Division of Plastic Surgery
Northwestern University Feinberg School of Medicine
Chicago, IL, USA

Steven Kronowitz, MD
Owner, Kronowitz Plastics
PLLC;
University of Texas, M. D. Anderson Medical Center
Houston, TX, USA

John V. Larson, MD
Resident Physician
Division of Plastic and Reconstructive Surgery
Keck School of Medicine of USC
University of Southern California
Los Angeles, CA, USA

Z-Hye Lee, MD
Resident
Department of Plastic Surgery
New York University Medical Center
New York, NY, USA

Frank Lista, MD, FRCSC
Medical Director
The Plastic Surgery Clinic
Mississauga, Ontario, Canada;
Assistant Professor Surgery
University of Toronto
Toronto, Ontario, Canada

Albert Losken, MD, FACS
Professor of plastic surgery and Program Director
Emory Division of Plastic and Reconstructive Surgery
Emory University School of Medicine
Atlanta, GA, USA

Charles M. Malata, BSc(HB), MB ChB, LRCP, MRCS, FRCS(Glasg), FRCS(Plast)
Professor of Academic Plastic Surgery
Postgraduate Medical Institute
Faculty of Health Sciences
Anglia Ruskin University
Cambridge and Chelmsford, UK;
Consultant Plastic and Reconstructive Surgeon
Department of Plastic and Reconstructive Surgery
Cambridge Breast Unit at Addenbrooke's Hospital
Cambridge University Hospitals NHS Foundation Trust
Cambridge, UK

Jaume Masià, MD, PhD
Chief and Professor of Plastic Surgery
Sant Pau University Hospital
Barcelona, Spain

G. Patrick Maxwell, MD, FACS
Clinical Professor of Surgery
Department of Plastic Surgery
Loma Linda University Medical Center
Loma Linda, CA, USA

James L. Mayo, MD
Microsurgery Fellow
Plastic Surgery
New York University
New York, NY, USA

Roberto N. Miranda, MD
Professor
Department of Hematopathology
Division of Pathology and Laboratory Medicine
MD Anderson Cancer Center
Houston, TX, USA

Colin M. Morrison, MSc (Hons) FRCSI (Plast)
Consultant Plastic Surgeon
St. Vincent's University Hospital
Dublin, Ireland

Maurice Y. Nahabedian, MD, FACS
Professor and Chief
Section of Plastic Surgery
MedStar Washington Hospital Center
Washington DC, USA;
Vice Chairman
Department of Plastic Surgery
MedStar Georgetown University Hospital
Washington DC, USA

James D. Namnoum, MD
Clinical Professor of Plastic Surgery
Atlanta Plastic Surgery
Emory University School of Medicine
Atlanta, GA, USA

Maria E. Nelson, MD
Assistant Professor of Clinical Surgery
Department of Surgery, Division of Upper GI/General Surgery, Section of Surgical Oncology
Keck School of Medicine
University of Southern California
Los Angeles, CA, USA

Julie Park, MD
Associate Professor of Surgery
Section of Plastic Surgery
University of Chicago
Chicago, IL, USA

Ketan M. Patel, MD
Assistant Professor of Surgery
Division of Plastic and Reconstructive Surgery
Keck Medical Center of USC
University of Southern California
Los Angeles, CA, USA

Nakul Gamanlal Patel, BSc(Hons), MBBS(Lond), FRCS(Plast)
Senior Microsurgery Fellow
St. Andrew's Centre for Plastic Surgery
Broomfield Hospital
Chelmsford, UK

Gemma Pons, MD, PhD
Head
Microsurgery Unit
Plastic Surgery
Hospital de Sant Pau
Barcelona, Spain

Julian J. Pribaz, MD
Professor of Surgery
Brigham and Women's Hospital
Harvard Medical School
Boston, MA, USA

Venkat V. Ramakrishnan, MS, FRCS, FRACS(Plast Surg)
Consultant Plastic Surgeon
St. Andrew's Centre for Plastic Surgery
Broomfield Hospital
Chelmsford, UK

Elena Rodríguez-Bauzà, MD
Plastic Surgery Department
Hospital Santa Creu i Sant Pau
Barcelona, Spain

Michael R. Schwartz, MD
Board Certified Plastic Surgeon
Private Practice
Westlake Village, CA, USA

Stephen F. Sener, MD
Professor of Surgery, Clinical Scholar
Chief of Breast, Endocrine, and Soft Tissue Surgery
Department of Surgery, Keck School of Medicine of USC
Chief of Surgery and Associate Medical Director Perioperative Services
LAC+USC (LA County) Hospital
Los Angeles, CA, USA

Joseph M. Serletti, MD, FACS
The Henry Royster–William Maul Measey Professor of Surgery and Chief
Division of Plastic Surgery
University of Pennsylvania Health System
Philadelphia, PA, USA

Deana S. Shenaq, MD
Chief Resident
Department of Surgery - Plastic Surgery
The University of Chicago Hospitals
Chicago, IL, USA

Kenneth C. Shestak, MD
Professor, Department of Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, PA, USA

Ron B. Somogyi, MD MSc FRCSC
Plastic and Reconstructive Surgeon
Assistant Professor, Department of Surgery
University of Toronto
Toronto, ON, Canada

David H. Song, MD, MBA, FACS
Regional Chief, MedStar Health
Plastic and Reconstructive Surgery
Professor and Chairman
Department of Plastic Surgery
Georgetown University School of Medicine
Washington, DC, USA

The late Scott L. Spear†, MD
Formerly Professor of Plastic Surgery
Division of Plastic Surgery
Georgetown University
Washington, MD, USA

Michelle A. Spring, MD, FACS
Program Director
Glacier View Plastic Surgery
Kalispell Regional Medical Center
Kalispell, MT, USA

W. Grant Stevens, MD, FACS
Clinical Professor of Surgery
Marina Plastic Surgery Associates;
Keck School of Medicine of USC
Los Angeles, CA, USA

Elizabeth Stirling Craig, MD
Plastic Surgeon and Assistant Professor
Department of Plastic Surgery
University of Texas
MD Anderson Cancer Center
Houston, TX, USA

Simon G. Talbot, MD
Assistant Professor of Surgery
Brigham and Women's Hospital
Harvard Medical School
Boston, MA, USA

Jana Van Thielen, MD
Plastic Surgery Department
Brussels University Hospital
Vrij Universitaire Brussel (VUB)
Brussels, Belgium

Henry Wilson, MD, FACS
Attending Plastic Surgeon
Private Practice
Plastic Surgery Associates
Lynchburg, VA, USA

Kai Yuen Wong, MA, MB BChir, MRCS, FHEA, FRSPH
Specialist Registrar in Plastic Surgery
Department of Plastic and Reconstructive Surgery
Cambridge University Hospitals NHS Foundation Trust
Cambridge, UK

VOLUME SIX

Hee Chang Ahn, MD, PhD
Professor
Department of Plastic and Reconstructive Surgery
Hanyang University Hospital School of Medicine
Seoul, South Korea

Nidal F. Al Deek, MD
Surgeon
Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
Taipei, Taiwan

Kodi K. Azari, MD, FACS
Reconstructive Transplantation Section Chief
Professor
Department of Orthopedic Surgery
UCLA Medical Center
Santa Monica, CA, USA

Carla Baldrighi, MD
Staff Surgeon
Pediatric Surgery Meyer Children's Hospital
Pediatric Hand and Reconstructive Microsurgery Unit
Azienda Ospedaliera Universitaria Careggi
Florence, Italy

Gregory H. Borschel, MD, FAAP, FACS
Assistant Professor
University of Toronto Division of Plastic and Reconstructive Surgery;
Assistant Professor
Institute of Biomaterials and Biomedical Engineering;
Associate Scientist
The SickKids Research Institute
The Hospital for Sick Children
Toronto, Ontario, Canada

Kirsty Usher Boyd, MD, FRCSC
Assistant Professor
Division of Plastic Surgery, University of Ottawa
Ottawa, Ontario, Canada

Gerald Brandacher, MD
Scientific Director
Department of Plastic and Reconstructive Surgery
Johns Hopkins University School of Medicine
Baltimore, MD, USA

Lesley Butler, MPH
Clinical Research Coordinator
Charles E. Seay, Jr. Hand Center
Texas Scottish Rite Hospital for Children
Dallas, TX, USA

Ryan P. Calfee, MD
Associate Professor
Department of Orthopedic Surgery
Washington University School of Medicine
St. Louis, MO, USA

Brian T. Carlsen, MD
Associate Professor
Departments of Plastic Surgery and Orthopedic Surgery
Mayo Clinic
Rochester, MN, USA

David W. Chang, MD
Professor
Division of Plastic and Reconstructive Surgery
The University of Chicago Medicine
Chicago, IL, USA

James Chang, MD
Johnson & Johnson Distinguished Professor and Chief
Division of Plastic and Reconstructive Surgery
Stanford University Medical Center
Stanford, CA, USA

Robert A. Chase, MD
Holman Professor of Surgery – Emeritus
Stanford University Medical Center
Stanford, CA, USA

Alphonsus K. S. Chong, MBBS, MRCS, MMed(Orth), FAMS (Hand Surg)
Senior Consultant
Department of Hand and Reconstructive Microsurgery
National University Health System
Singapore;
Assistant Professor
Department of Orthopedic Surgery
Yong Loo Lin School of Medicine
National University of Singapore
Singapore

David Chwei-Chin Chuang, MD
Senior Consultant, Ex-President, Professor
Department of Plastic Surgery
Chang Gung University Hospital
Tao-Yuan, Taiwan

Kevin C. Chung, MD, MS
Chief of Hand Surgery
Michigan Medicine
Charles B G De Nancrede Professor, Assistant Dean for Faculty Affairs
University of Michigan Medical School
Ann Arbor, Michigan, USA

Christopher Cox, MD
Attending Surgeon
Kaiser Permanente
Walnut Creek, CA, USA

Catherine Curtin, MD
Associate Professor
Department of Surgery Division of Plastic Surgery
Stanford University
Stanford, CA, USA

Lars B. Dahlin, MD, PhD
Professor and Consultant
Department of Clinical Sciences, Malmö – Hand Surgery
University of Lund
Malmö, Sweden

Kenneth W. Donohue, MD
Hand Surgery Fellow
Division of Plastic Surgery
Department of Orthopedic Surgery
Baylor College of Medicine
Houston, TX, USA

Gregory A. Dumanian, MD, FACS
Stuteville Professor of Surgery
Division of Plastic Surgery
Northwestern Feinberg School of Medicine
Chicago, IL, USA

William W. Dzwierzynski, MD
Professor and Program Director
Department of Plastic Surgery
Medical College of Wisconsin
Milwaukee, WI, USA

Simon Farnebo, MD, PhD
Associate Professor and Consultant Hand Surgeon
Department of Plastic Surgery, Hand Surgery and Burns
Institution of Clinical and Experimental Medicine, University of Linköping
Linköping, Sweden

Ida K. Fox, MD
Assistant Professor of Plastic Surgery
Department of Surgery
Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Paige M. Fox, MD, PhD
Assistant Professor
Department of Surgery, Division of Plastic and Reconstructive Surgery
Stanford University Medical Center
Stanford, CA, USA

Jeffrey B. Friedrich, MD
Professor of Surgery and Orthopedics
Department of Surgery, Division of Plastic Surgery
University of Washington
Seattle, WA, USA

Steven C. Haase, MD, FACS
Associate Professor
Department of Surgery, Section of Plastic Surgery
University of Michigan Health
Ann Arbor, MI, USA

Elisabet Hagert, MD, PhD
Associate Professor
Department of Clinical Science and Education
Karolinska Institute;
Chief Hand Surgeon
Hand Foot Surgery Center
Stockholm, Sweden

Warren C. Hammert, MD
Professor of Orthopedic and Plastic Surgery
Chief, Division of Hand Surgery
Department of Orthopedics and Rehabilitation
University of Rochester
Rochester, NY, USA

Isaac Harvey, MD
Clinical Fellow
Department of Pediatric Plastic and Reconstructive Surgery
Hospital for SickKids
Toronto, Ontario, Canada

Vincent R. Hentz, MD
Emeritus Professor of Surgery and Orthopedic Surgery (by courtesy)
Stanford University
Stanford, CA, USA

Jonay Hill, MD
Clinical Assistant Professor
Anesthesiology, Perioperative and Pain Medicine
Stanford University School of Medicine
Stanford, CA, USA

Steven E. R. Hovius, MD, PhD
Former Head, Department of Plastic, Reconstructive and Hand Surgery
Erasmus MC
University Medical Center
Rotterdam, the Netherlands;
Xpert Clinic, Hand and Wrist Center
The Netherlands

Jerry I. Huang, MD
Associate Professor
Department of Orthopedics and Sports Medicine
University of Washington;
Program Director
University of Washington Hand Fellowship
University of Washington
Seattle, WA, USA

Marco Innocenti, MD
Associate Professor of Plastic Surgery, University of Florence;
Director, Reconstructive Microsurgery
Department of Oncology
Careggi University Hospital
Florence, Italy

Neil F. Jones, MD, FRCS
Professor and Chief of Hand Surgery
University of California Medical Center;
Professor of Orthopedic Surgery;
Professor of Plastic and Reconstructive Surgery
University of California Irvine
Irvine, CA, USA

Ryosuke Kakinoki, MD, PhD
Professor of Hand Surgery and Microsurgery, Reconstructive, and Orthopedic Surgery
Department of Orthopedic Surgery
Faculty of Medicine
Kindai University
Osakasayama, Osaka, Japan

Jason R. Kang, MD
Chief Resident
Department of Orthopedic Surgery
Stanford Hospital & Clinics
Redwood City, CA, USA

Joseph S. Khouri, MD
Resident
Division of Plastic Surgery, Department of Surgery
University of Rochester
Rochester, NY, USA

Todd Kuiken, MD, PhD
Professor
Departments of PM&R, BME, and Surgery
Northwestern University;
Director, Neural Engineering Center for Artificial Limbs
Rehabilitation Institute of Chicago
Chicago, IL, USA

Donald Lalonde, BSC, MD, MSc, FRCSC
Professor of Surgery
Division of Plastic and Reconstructive Surgery
Saint John Campus of Dalhousie University
Saint John, New Brunswick, Canada

W. P. Andrew Lee, MD
The Milton T. Edgerton MD, Professor and Chairman
Department of Plastic and Reconstructive Surgery
Johns Hopkins University School of Medicine
Baltimore, MD, USA

Anais Legrand, MD
Postdoctoral Research Fellow
Plastic and Reconstructive Surgery
Stanford University Medical Center
Stanford, CA, USA

Terry Light, MD
Professor
Department of Orthopedic Surgery
Loyola University Medical Center
Maywood, IL, USA

Jin Xi Lim, MBBS, MRCS
Senior Resident
Department of Hand and Reconstructive Microsurgery
National University Health System
Singapore

Joseph Lopez, MD, MBA
Resident, Plastic and Reconstructive Surgery
Department of Plastic and Reconstructive Surgery
Johns Hopkins University School of Medicine
Baltimore, MD, USA

Susan E. Mackinnon, MD
Sydney M. Shoenberg, Jr. and Robert H. Shoenberg Professor
Department of Surgery, Division of Plastic and Reconstructive Surgery
Washington University School of Medicine
St. Louis, MO, USA

Brian Mailey, MD
Assistant Professor of Surgery
Institute for Plastic Surgery
Southern Illinois University
Springfield, IL, USA

Steven J. McCabe, MD, MSc, FRCS(C)
Director of Hand and Upper Extremity Program
University of Toronto
Toronto Western Hospital
Toronto, Ontario, Canada

Kai Megerle, MD, PhD
Assistant Professor
Clinic for Plastic Surgery and Hand Surgery
Technical University of Munich
Munich, Germany

Amy M. Moore, MD
Assistant Professor of Surgery
Division of Plastic and Reconstructive Surgery
Department of Surgery
Washington University School of Medicine
St. Louis, MO, USA

Steven L. Moran, MD
Professor and Chair of Plastic Surgery
Division of Plastic Surgery, Division of Hand and Microsurgery;
Professor of Orthopedics
Rochester, MN, USA

Rebecca L. Neiduski, PhD, OTR/L, CHT
Dean of the School of Health Sciences
Professor of Health Sciences
Elon University
Elon, NC, USA

David T. Netscher, MD
Program Director, Hand Surgery Fellowship;
Clinical Professor, Division of Plastic Surgery and Department of Orthopedic Surgery
Baylor College of Medicine;
Adjunct Professor of Clinical Surgery (Plastic Surgery)
Weill Medical College
Cornell University
Houston, TX, USA

Michael W. Neumeister, MD
Professor and Chairman
Division of Plastic Surgery
Springfield Illinois University School of Medicine
Springfield, IL, USA

Shelley Noland, MD
Assistant Professor
Division of Plastic Surgery
Mayo Clinic Arizona
Phoenix, AZ, USA

Christine B. Novak, PT, PhD
Associate Professor
Department of Surgery, Division of Plastic and Reconstructive Surgery
University of Toronto
Toronto, Ontario, Canada

Scott Oates, MD
Deputy Department Chair;
Professor
Department of Plastic Surgery, Division of Surgery
The University of Texas MD Anderson Cancer Center
Houston, TX, USA

Kerby Oberg, MD, PhD
Associate Professor
Department of Pathology and Human Anatomy
Loma Linda University School of Medicine
Loma Linda, CA, USA

Scott Oishi, MD
Director, Charles E. Seay, Jr. Hand Center
Texas Scottish Rite Hospital for Children;
Professor, Department of Plastic Surgery and Department of Orthopedic Surgery
University of Texas Southwestern Medical Center
Dallas, TX, USA

William C. Pederson, MD, FACS
President and Fellowship Director
The Hand Center of San Antonio;
Adjunct Professor of Surgery
The University of Texas Health Science Center at San Antonio
San Antonio, TX, USA

Dang T. Pham, MD
General Surgery Resident
Department of Surgery
Houston Methodist Hospital
Houston, TX, USA

Karl-Josef Prommersberger, MD, PhD
Chair, Professor of Orthopedic Surgery
Clinic for Hand Surgery
Bad Neustadt/Saale, Germany

Carina Reinholdt, MD, PhD
Senior Consultant in Hand Surgery
Center for Advanced Reconstruction of Extremities
Sahlgrenska University Hospital/ Mölndal
Mölndal, Sweden;
Assistant Professor
Department of Orthopedics
Institute for Clinical Sciences
Sahlgrenska Academy
Goteborg, Sweden

Justin M. Sacks, MD, MBA, FACS
Director, Oncological Reconstruction;
Assistant Professor
Department of Plastic and Reconstructive Surgery
Johns Hopkins School of Medicine
Baltimore, MD, USA

Douglas M. Sammer, MD
Associate Professor of Plastic and Orthopedic Surgery
Chief of Plastic Surgery at Parkland Memorial Hospital
Program Director Hand Surgery Fellowship
University of Texas Southwestern Medical Center
Dallas, TX, USA

Subhro K. Sen, MD
Clinical Associate Professor
Plastic and Reconstructive Surgery
Robert A. Chase Hand and Upper Limb Center
Stanford University School of Medicine
Stanford, CA, USA

Pundrique R. Sharma, MBBS, PhD and FRCS (Plast)
Consultant Plastic Surgeon
Department for Plastic and Reconstructive Surgery
Alder Hey Children's Hospital
Liverpool, UK

Randolph Sherman, MD, FACS
Vice Chair
Department of Surgery
Cedars-Sinai Medical Center
Los Angeles, CA, USA

Jaimie T. Shores, MD
Clinical Director, Hand/Arm Transplant Program
Department of Plastic and Reconstructive Surgery
Johns Hopkins University School of Medicine
Baltimore, MD, USA

Vanila M. Singh, MD, MACM
Clinical Associate Professor
Anesthesiology, Perioperative and Pain Medicine
Stanford University School of Medicine
Stanford, CA, USA

Jason M. Souza, MD, LCDR, MC, USN
Staff Plastic Surgeon, United States Navy
Walter Reed National Military Medical Center
Bethesda, MD, USA

Amir Taghinia, MD, MPH
Attending Surgeon
Department of Plastic and Oral Surgery
Boston Children's Hospital;
Assistant Professor of Surgery
Harvard Medical School
Boston, MA, USA

David M. K. Tan, MBBS
Senior Consultant
Department of Hand and Reconstructive Microsurgery
National University Health System
Singapore;
Assistant Professor
Department of Orthopedic Surgery
Yong Loo Lin School of Medicine
National University Singapore
Singapore

Jin Bo Tang, MD
Professor and Chair
Department of Hand Surgery;
Chair, The Hand Surgery Research Center
Affiliated Hospital of Nantong University
Nantong, The People's Republic of China

Johan Thorfinn, MD, PhD
Senior Consultant of Plastic Surgery, Burn Unit;
Co-Director
Department of Plastic Surgery, Hand Surgery and Burns
Linköping University Hospital
Linköping, Sweden

Michael Tonkin, MBBS, MD, FRACS(Orth), FRCS(Ed Orth)
Professor of Hand Surgery
Department of Hand Surgery and Peripheral Nerve Surgery
Royal North Shore Hospital
The Children's Hospital at Westmead
University of Sydney Medical School
Sydney, New South Wales, Australia

Joseph Upton III, MD
Staff Surgeon
Department of Plastic and Oral Surgery
Boston Children's Hospital;
Professor of Surgery
Harvard Medical School
Boston, MA, USA

Francisco Valero-Cuevas, PhD
Director
Brain-Body Dynamics Laboratory;
Professor of Biomedical Engineering;
Professor of Biokinesiology and Physical Therapy;
(By courtesy) Professor of Computer Science and Aerospace and Mechanical Engineering
The University of Southern California
Los Angeles, CA, USA

Christianne A. van Nieuwenhoven, MD, PhD
Plastic Surgeon/Hand Surgeon
Plastic and Reconstructive Surgery
Erasmus Medical Centre
Rotterdam, the Netherlands

Nicholas B. Vedder, MD
Professor of Surgery and Orthopedics
Chief of Plastic Surgery Vice Chair
Department of Surgery
University of Washington
Seattle, WA, USA

Andrew J. Watt, MD
Attending Hand and Microvascular Surgeon;
Associate Program Director, Buncke Clinic Hand and Microsurgery Fellowship;
Adjunct Clinical Faculty, Stanford University
Division of Plastic and Reconstructive Surgery
The Buncke Clinic
San Francisco, CA, USA

Fu-Chan Wei, MD
Professor
Department of Plastic Surgery
Chang Gung Memorial Hospital
Taoyuan, Taiwan

Julie Colantoni Woodside, MD
Orthopedic Surgeon
OrthoCarolina
Gastonia, NC, USA

Jeffrey Yao, MD
Associate Professor
Department of Orthopedic Surgery
Stanford Hospital & Clinics
Redwood City, CA, USA

Acknowledgments

My wife, Gabrielle Kane, has always been my rock. She not only encourages me in my work but gives constructive criticism bolstered by her medical expertise as well as by her knowledge and training in education. I can never repay her. The editorial team at Elsevier have made this series possible. Belinda Kuhn leads the group of Alexandra Mortimer, Louise Cook, and the newest addition to the team, Sam Crowe. The Elsevier production team has also been vital in moving this project along. The volume editors, Geoff Gurtner, Peter Rubin, Ed Rodriguez, Joe Losee, David Song, Mo Nahabedian, Jim Chang, and Dan Liu have shaped and refined this edition, making vital changes to keep the series relevant and up-to-date. My colleagues in the University of Washington, headed by Nick Vedder, have provided continued encouragement and support. Finally, and most importantly, the residents and fellows who pass through our program keep us on our toes and ensure that we give them the best possible solutions to their questions.

Peter C. Neligan, MB, FRCS(I), FRCSC, FACS

Driven by constant innovation, the field of head, neck, and craniofacial surgery has truly evolved and made noteworthy advances over the last several decades. The diverse expertise of the renowned contributors has provided the latest clinical evidence and surgical techniques to facilitate the decision-making process, which ultimately impacts the outcomes of patients with conditions involving congenital, oncologic, traumatic, and acquired deformities. This volume is a comprehensive resource for specialists of all levels. It has been a true privilege to work with such a distinguished faculty willing to share their vast experience and insights in their respective fields. It is with great admiration that I sincerely thank the contributors for their generous donation of time, commitment to excellence, dedication to education, and advancement of the field.

Eduardo D. Rodriguez, MD, DDS

This volume represents the expertise of the current leaders within pediatric plastic surgery; and I am grateful for their dedication and efforts in making this “labor of love” a reality and the standard within the field. This work is dedicated to my families – at work and at home – and serves as a living example of work–life integration for me. “Thank you” to my work family – my colleagues, staff, patients and their families; and, to my home family – Franklyn P. Cladis, MD and our son Hudson. You all have and continue to provide significant meaning to my life.

Joseph E. Losee, MD, FACS, FAAP

Dedicated to future plastic surgeons. Take up the torch and lead us forward!

1

Anatomy of the head and neck

Ahmed M. Afifi, Ruston J. Sanchez and Risal S. Djohan

SYNOPSIS

- The superficial fascial layer of the face and neck is formed by the superficial cervical fascia (enclosing the platysma), the superficial facial fascia (synonymous with the superficial musculo-aponeurotic system (SMAS)), the superficial temporal fascia (often called the temporoparietal fascia), and the galea.
- The deep fascial layer of the face and neck is formed by the deep cervical fascia (or the general investing fascia of the neck), the deep facial fascia (also known as the parotideomasseteric fascia), and the deep temporal fascia. The deep temporal fascia is continuous with the periosteum of the skull.
- The deep temporal fascia splits into two layers at the level of the superior orbital rim. The two layers insert into the superficial and deep surfaces of the zygomatic arch.
- The facial nerve is initially deep to the deep fascia, eventually penetrating it towards the superficial fascia. The fat and connective tissue filling the space between the superficial temporal fascia and the superficial layer of the deep temporal fascia is a subject of significant debate. Its importance stems from the temporal branch of the facial nerve crossing from deep to superficial in this layer.
- Most surgeons believe that it is the superficial temporal fat pad that fills this space. Others believe there is a distinct fascial layer in this region, named the parotideomasseteric fascia.
- The facial nerve is at significant risk of injury in the area right above the zygomatic arch.
- Pitanguy's line describes the course of the largest branch of the temporal division of the facial nerve.
- The marginal mandibular nerve can be located above or below the level of the mandible. It is usually located between the platysma and the deep cervical fascia and is always superficial to the facial vessels.
- There are multiple fat pads in the face. They can be superficial to the SMAS, between the SMAS and the deep fascia, or deep to the deep fascia.
- Knowledge of the sensory nerves is important, especially within the context of evaluating and treating migraine headaches.

Aesthetic and reconstructive surgery of the head and neck depends on appreciating the three-dimensional anatomy and the functional and cosmetic methods of rearranging the different structures. This chapter is not intended to be a detailed description of the head and neck anatomy, which is beyond such a limited space. It rather offers a different perspective on the anatomy that is more relevant to the plastic surgeon and highlights certain anatomical regions that have fundamental importance or are more controversial.

The fascial planes of the head and neck and the facial nerve

A peculiar feature of the anatomy of the head and neck is the concentric arrangement of the facial soft tissues in layers. These layers have different names and characteristics from one area of the head and neck to the other, but they maintain their continuity across boundaries (Fig. 1.1). Unfortunately, inconsistent nomenclature has been used to describe these layers leading to significant confusion among readers. The facial nerve usually passes in defined planes in between these layers, crossing from one layer to the other only in specific well-described zones. Knowledge of these planes and their relation to the facial nerve is vital if plastic surgeons are to safely access the soft tissues and bony structures of the head and neck.[1,2] In the following discussion, we will not only describe the anatomy and nomenclature of these layers as mostly agreed upon, but also try to elucidate the sources of deliberation and confusion in describing this crucial anatomy.[3]

The bordering regions of neck, cheek (lower face), temple, and the scalp are arbitrarily divided by the lower border of the mandible, the zygomatic arch, and the temporal line, respectively. Topographically, there are two layers of fascia covering the face, a superficial and deep, which cover these regions and extend over other structures, such as the eyelid and the nose (see Fig. 1.1).

The superficial layer of fascia is formed by the superficial cervical fascia (platysma), the superficial facial fascia (SMAS), the superficial temporal fascia (temporoparietal fascia), and

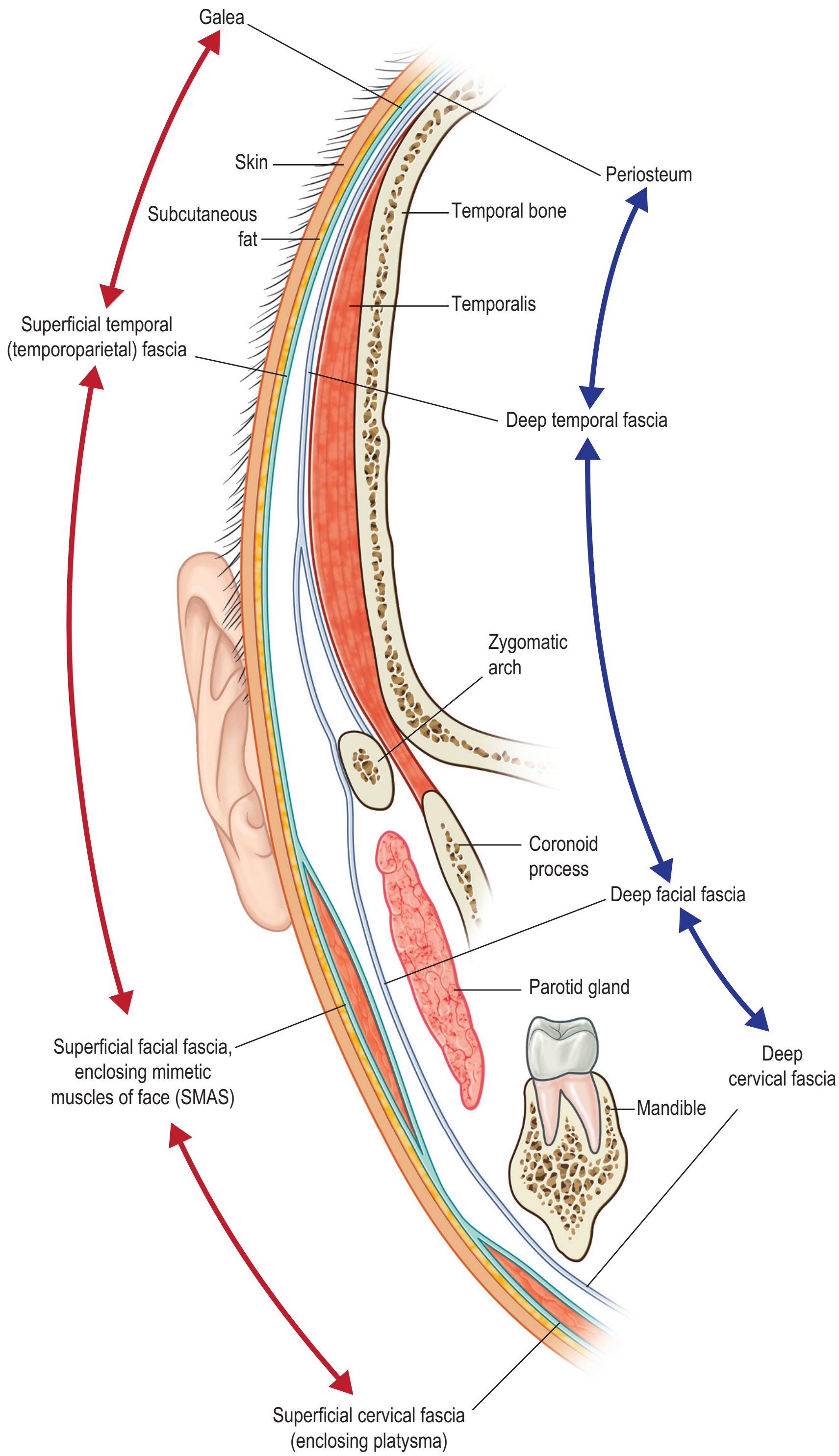
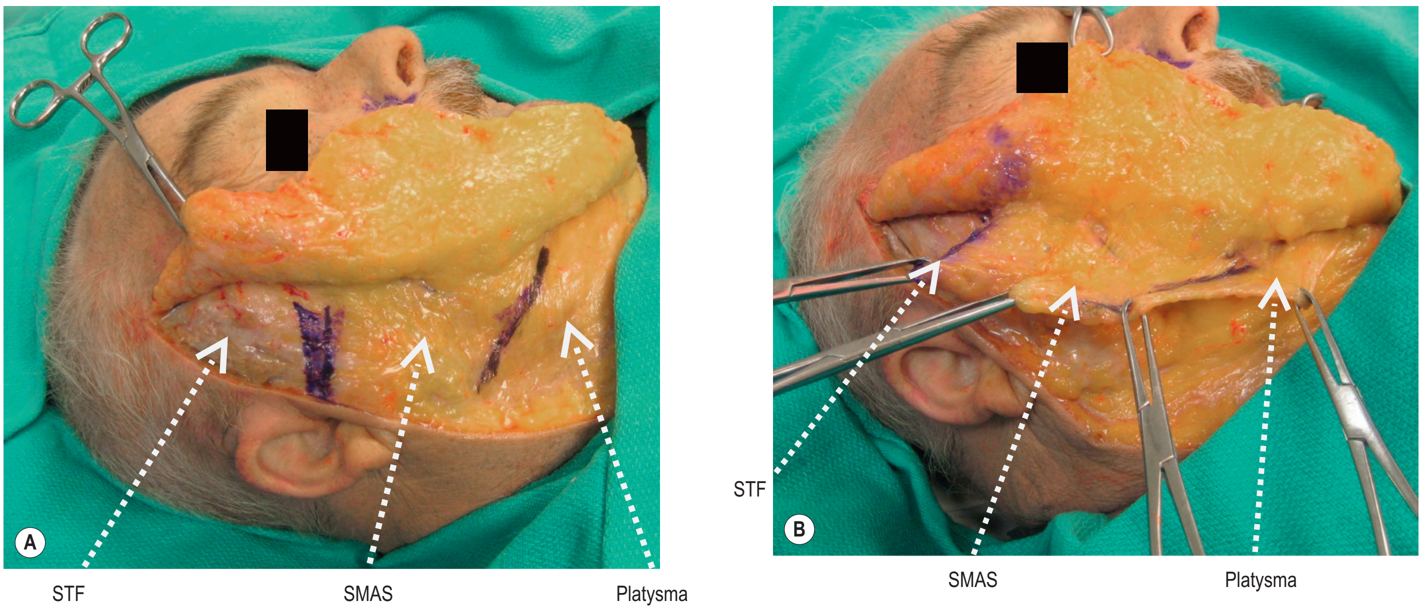


Fig. 1.1 The facial layers of the scalp, face, and neck.

the galea aponeurotica (Figs. 1.1 & 1.2). To be more precise, this superficial fascia splits to enclose many of the facial muscles. This is a consistent pattern seen all over the head and neck region; e.g., the superficial cervical fascia splits into a deep and superficial layer to enclose the platysma, the superficial facial fascia splits to enclose the midfacial muscles, and the galea splits to enclose the frontalis. The two layers of the superficial fascia then rejoin at the other end of the muscle, before splitting again to enclose the next muscle and so on.

The deep layer of fascia is formed by the deep cervical fascia, the deep facial fascia (parotideomasseteric fascia), the deep temporal fascia, and the periosteum. This layer is superficial to the muscles of mastication, the salivary glands and the main neurovascular structures (see Figs. 1.1 & 1.2). Over bony areas, such as the skull and the zygomatic arch, this deep fascia is inseparable from the periosteum.

The facial fat pads are localized collections of fat present deep to the superficial layer of fascia. These are anatomically



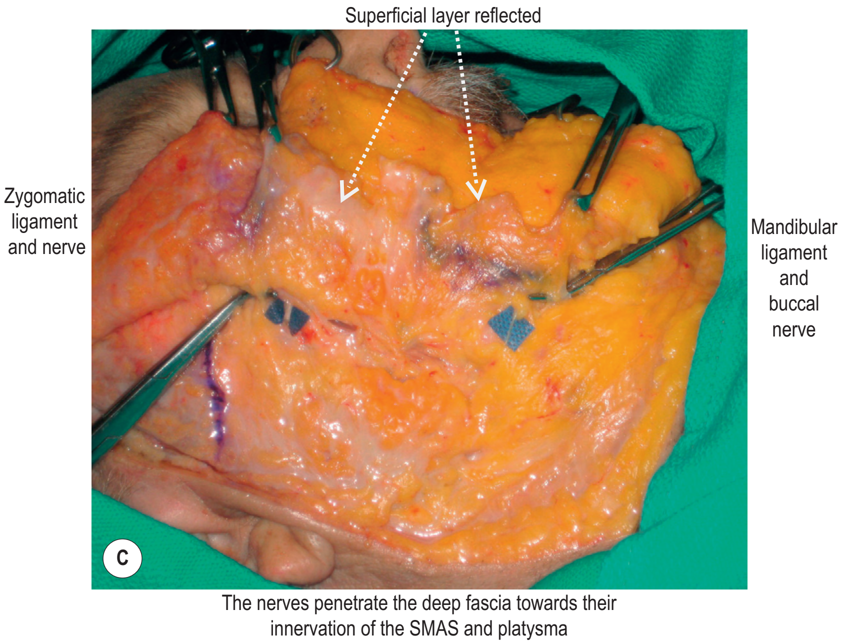


Fig. 1.2 The different fascial layers of the face and neck. **(A)** Dissection in the superficial plane, between the skin and the superficial fascia. **(B)** Elevation of the superficial fascial layer, formed of the superficial cervical fascia (platysma), the superficial facial fascia (SMAS), and the superficial temporal fascia (temporoparietal fascia). **(C)** Note the proximity of the nerve (on the blue background) to the zygomatic and mandibular ligaments (at the tips of the left and right surgical instruments, respectively).

and histologically distinct structures from the subcutaneous fat present between the skin and the superficial fascia (which will be discussed later). These fat pads include the superficial temporal fat pad, the galeal fat pad, suborbicularis oculi fat pad (SOOF), the retro-orbicularis oculi fat pad (ROOF), and the preseptal fat of the eyelids. Deep to the deep fascia are several other fat pads: the deep temporal fat pads, the buccal fat pads, and the postseptal fat pads of the eyelids.[4]

The fascia in the face

The first layer the surgeon encounters in the face deep to the skin and its associated subcutaneous fat is the SMAS (superficial musculo-aponeurotic system) (see Figs. 1.1 & 1.2).[5] The SMAS varies in thickness and composition between individuals and from one area to another, and it can be fatty, fibrous, or muscular.[6] The muscles of facial expression, e.g., orbicularis oculi, oris, zygomaticus major and minor, frontalis, and platysma, are enclosed by (or form part of) the SMAS. The SMAS is often referred to as the superficial facial fascia. In reality, the superficial facial fascia covers the superficial and deep surfaces of the muscles. However, these layers are hard to separate intraoperatively (except in certain areas such as the neck). Dissection superficial to the superficial facial fascia (just under the skin) will generally avoid injury to the underlying facial nerve. However, such dissection can compromise the blood supply of the overlying skin flaps. Often, the surgeon can safely maintain this superficial fascia in the lower face and neck (whether it is the platysma or the SMAS) with the skin, allowing a secure double layer closure and maintaining skin vascularity (e.g. during a neck dissection). In the anterior (medial) face, the facial nerve branches become more superficial just under or within the SMAS layer.

The next layer in the face is the deep facial fascia, which is also known as the parotideomasseteric fascia (see Figs. 1.1 & 1.2). Over the parotid gland, this layer is adherent to the capsule of the gland. The facial nerve is initially (i.e., right after it exits the parotid gland) deep to the deep facial fascia. Most of the muscles of facial expression are superficial to the planes of the nerve. The nerve branches pierce the deep fascia to innervate the muscles from their deep surface, with the exception of the mentalis, levator anguli oris, and the buccinators (see Fig. 1.2). These three muscles are deep to the facial nerve and are thus innervated on their superficial surface.

The fascia in the temporal region

The cheek and lower face are separated from the temporal region by the zygomatic arch. There are two layers of fascia in the temporal region (below the skull temporal lines): the superficial temporal fascia (also known as the temporoparietal fascia (TPF)) and the deep temporal fascia (Figs. 1.3 & 1.4A).[7–9] The deep temporal fascia lies on the superficial surface of the temporalis muscle. Between the superficial and deep temporal fascia is a loose areolar plane that is relatively avascular and easily dissected. However, the frontal branch of the facial nerve is within or directly beneath the superficial temporal fascia (see Fig. 1.4A).[5] Therefore, dissection in this plane should be strictly on the deep temporal fascia, which can be identified by its bright white color and sturdy texture. To ensure that the surgeon is in the right plane, he or she can attempt to grasp the areolar tissues over the deep temporal fascia using an Adson forceps; if in the right plane, one will not catch any tissue. Once deep enough and right on the deep temporal fascia, dissection can proceed quickly using a periosteal elevator hugging the tough deep temporal fascia (Fig. 1.5).

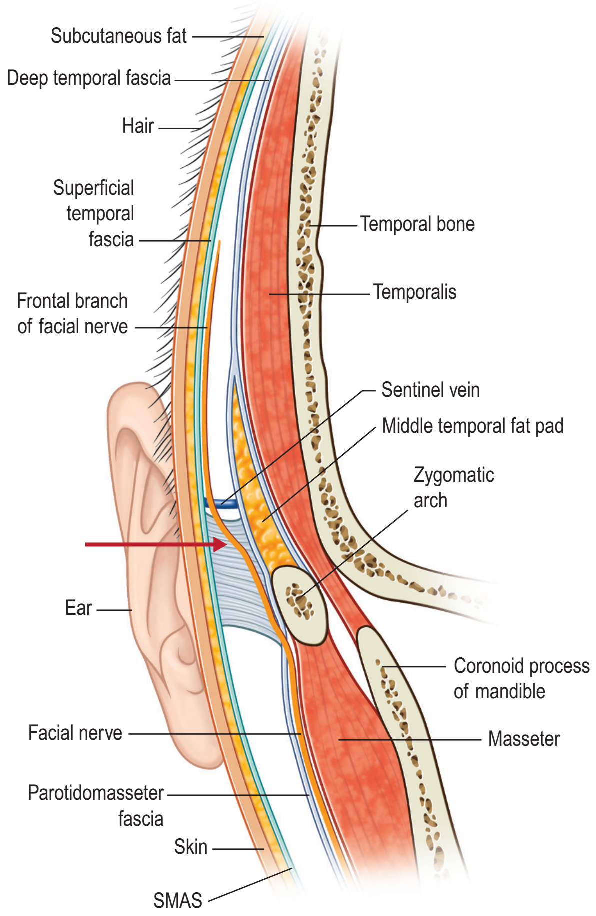
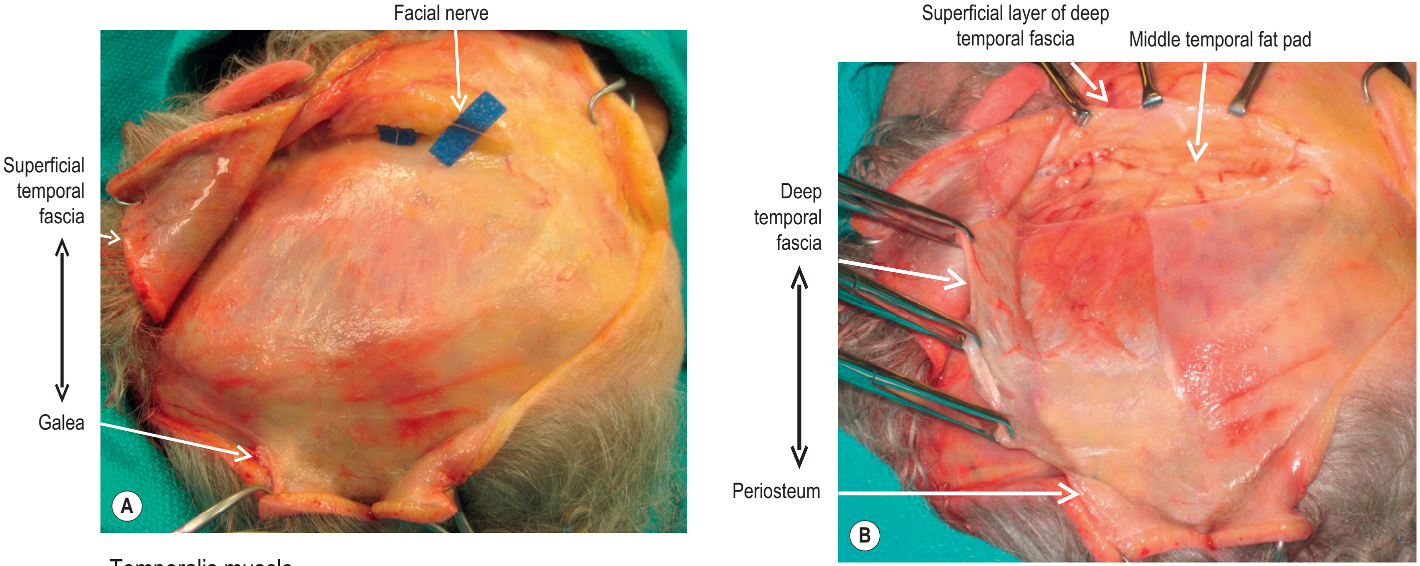


Fig. 1.3 The facial layers of the temporal region. The fat/fascia in the subaponeurotic plane (arrow; between the temporal fascia and deep temporal fascia) is intimately related to the facial nerve. Some authors believe that there is a separate fascial layer in this space, referred to as the parotideomasseteric fascia.

In the region right above the zygomatic arch the space between the superficial TPF and the deep temporal fascia (sometimes referred to as the subaponeurotic space) and the fat/fascia it contains is both a debatable and an important subject (see Fig. 1.4). Its importance stems from the facial nerve crossing this space from deep to superficial right above the zygomatic arch. A third layer of fascia has been described in this space (between the superficial and deep temporal fascia) and is referred to as the parotidotemporal fascia, the subgaleal fascia, or the innominate fascia.[10,11] The term "fascial layer" is used loosely, as there is no general consensus as to how thick connective tissue must be before it can be considered a "fascial layer". What some authors refer to as "loose connective tissue" may be called a "fascial layer" or a "fat pad" by others. Our own cadaver dissection showed that this third fascial layer could often be identified. It extends for a short distance above and below the arch. Directly superficial to the arch, the facial nerve is deep to this layer, piercing it to become more superficial 1–2 cm cephalad to the arch (see below).

Above the zygomatic arch and at the same horizontal level as the superior orbital rim, the deep temporal fascia splits into two layers: the superficial layer of the deep temporal fascia (sometimes referred to as the middle temporal fascia, intermediate fascia, or the innominate fascia) and the deep layer of the deep temporal fascia (see Fig. 1.3).[7] The deep and superficial layers of the deep temporal fascia attach to the superficial and deep surfaces of the zygomatic arch. There are three fat pads in this region.[7,12] The superficial fat pad is located between the superficial temporal fascia and superficial layer of the deep temporal fascia and, as described above, is analogous with the parotidotemporal fascia, subgaleal fascia, and/or the loose connective tissue between the superficial and deep temporal fascia. The middle fat pad is located directly above the zygomatic arch between the superficial and deep layers of the deep temporal fascia. Finally, the deep fat pad (also known as the buccal fat pad) is deep to the deep layer of the deep temporal fascia, superficial to the temporalis muscles and extends deep to the zygomatic arch. It is considered an extension of the buccal fat pad.

Most of the controversy in describing the fascial layers in the temporal region arises from confusing the *superficial temporal fascia* with the *superficial layer of the deep temporal fascia*. This is very significant since the facial nerve is deep to or within the former and superficial to the latter. The second point is the location of the *deep* temporal fascia *superficial* to the temporalis muscle. There is another fascial layer on the deep surface of the muscle; this is not the deep temporal fascia and is of little significance from a surgical standpoint. The final controversy is what exactly is the *innominate* fascia? This term is often used to describe the superficial layer of the deep temporal fascia above the arch. Other surgeons reserve the



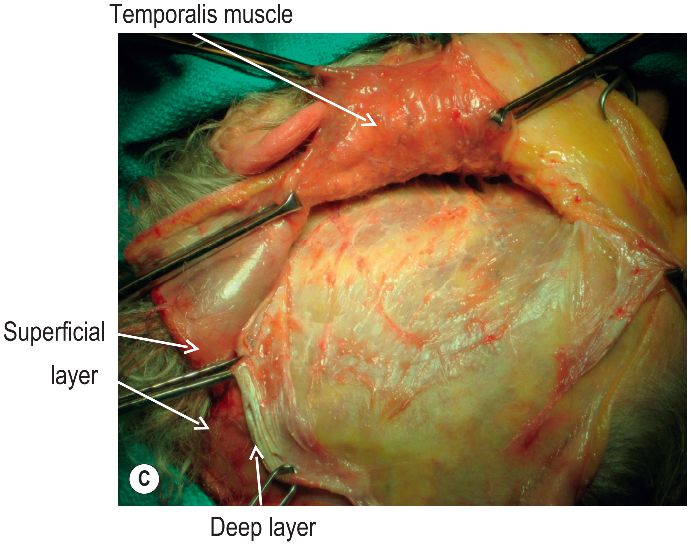


Fig. 1.4 The different planes of dissection in the temporal region. **(A)** Dissection between the superficial temporal fascia (temporoparietal fascia) and the deep temporal fascia. In this plane, the surgeon should try to stay right on the deep temporal fascia. **(B)** Dissection deep to the deep temporal fascia. This is a safe plan that will lead to the zygomatic arch. The facial nerve will be protected by the superficial layer of the deep temporal fascia. **(C)** Dissection deep to the temporalis muscle. The muscle can be left as part of the skin flap. This is a safe and easy plan if no exposure of the arch is needed.

term to the areolar tissue between the superficial layer of the deep temporal fascia and the superficial temporal fascia (i.e., the innominate fascia can be synonymous with the parotidotemporal fascia or subgaleal fascia or the superficial temporal fat pad).[13]

The plane of dissection in the temporal region depends on the goal of the surgery (see Fig. 1.4). In general, the surgeon should avoid the superficial temporal fascia as it harbors the frontal branch of the facial nerve. During surgery to expose the orbital rims and the forehead musculature, the dissection plane is between the superficial temporal fascia and deep temporal fascia (see Fig. 1.4A). To expose the arch, the superficial layer of the deep temporal fascia is divided and dissection proceeds between it and the middle fat pad (the superficial layer of the deep temporal fascia will act as an extra layer protecting the nerve) (see Fig. 1.4B). Finally, when a coronal approach is used, but the arch does not need to be exposed, dissection can proceed deep to the temporalis muscles, elevating them with the coronal flap (see Fig. 1.4B). Using this avascular plane avoids potential traction or injury to the frontal nerve and ensures good aesthetic results as it prevents possible fat atrophy or retraction of the temporalis muscle.

While the fascial layers in the temporal region are well described, there is more debate and variability of the anatomy of the fascial layers and the facial nerve directly superficial to the arch.[12,14,15] The superficial facial fascia (SMAS) is continuous with the TPF, but it is not clear if the deep facial and deep temporal fasciae are continuous to each other or attach and arise from the periosteum of the arch separately. In addition, the thickness of the soft tissues from the periosteum to skin is minimal and the tissues are tightly adherent, making identification of the fascial planes and the facial nerve hazardous in this region.[16] The frontal branch of the facial nerve pierces the deep temporal fascia to become more superficial near the vicinity of the upper border of the arch, and this area constitutes one of the danger zones of the face (see below).

The fascia in the neck

The nomenclature used to describe the different fascial layers in the neck also creates significant confusion. There are two different fascias in the neck: the superficial and the deep (Figs. 1.3 & 1.6). The latter is composed of three different layers: (1) the superficial layer of the deep cervical fascia, also known as

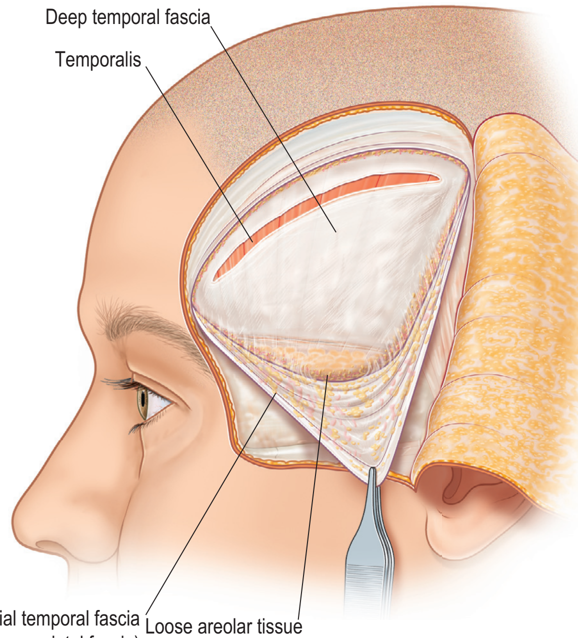


Fig. 1.5 Dissection in the temporal layer.

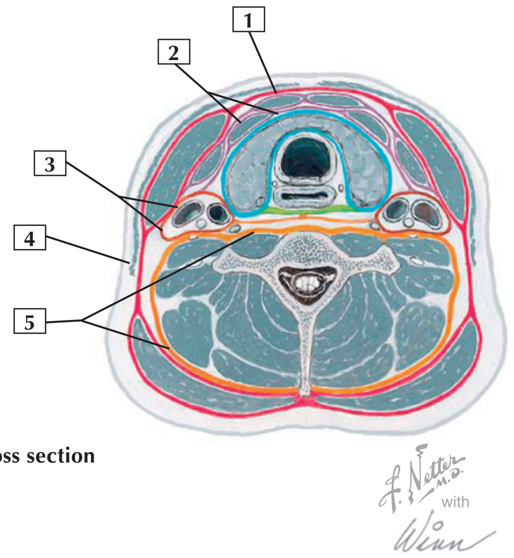


Fig. 1.6 Fascial layers of the neck. 1, Investing layer of deep cervical fascia; 2, pretracheal fascia; 3, carotid sheath; 4, superficial fascia; 5, prevertebral fascia. *(Reprinted with permission from www.netterimages.com © Elsevier Inc. All rights reserved.)*

the general investing layer of deep cervical fascia; (2) the middle layer, commonly named the pretracheal fascia; and (3) the deep layer, or the prevertebral fascia (see Figs. 1.3 & 1.6). The pretracheal fascia encircles the trachea, thyroid, and the esophagus, while the prevertebral fascia encloses the prevertebral muscles and forms the floor of the posterior triangle of the neck. For practical purposes, it is the superficial cervical fascia and the superficial layer of the deep cervical fascia that the plastic surgeon encounters.[17,18]

The superficial cervical fascia encloses the platysma muscle and is closely associated with the subcutaneous adipose tissue. The platysma muscle and its surrounding superficial cervical fascia represent the continuation of the SMAS into the neck. In general, when skin flaps are raised in the neck, the platysma muscle is maintained with the skin to enhance its blood supply (e.g. during neck dissections). However, in necklifts the skin is raised off the platysma to allow platysmal shaping and skin redraping. Tissue expanders placed in the neck could be placed either deep or superficial to the platysma. Placing them superficially will create thinner flaps that are more suitable for facial resurfacing, while placing them deeper allows a more secure coverage of the expander.[19,20]

The superficial layer of deep cervical fascia, or the general investing layer of deep cervical fascia, is what plastic surgeons commonly refer to simply as the "deep cervical fascia". It encircles the whole neck and has attachments to the spinous processes of the vertebrae and the ligamentum nuchae posteriorly. It splits to enclose the sternocleidomastoid and the trapezius muscles. It also splits to enclose the parotid and the submandibular glands. The deep facial fascia, or parotideomasseteric fascia, is therefore considered the continuation of the deep cervical fascia into the face.

Retaining ligaments and adhesions of the face

The ligaments of the face maintain the skin and soft tissues of the face in their normal positions, resisting gravitational changes. Knowledge of their anatomy is important for both the craniofacial and the aesthetic surgeon for several reasons. For the aesthetic surgeon, these ligaments play an important role in maintaining facial fat in its proper positions. For ideal aesthetic repositioning of the skin and soft tissues of the face, numerous surgeons recommend releasing the ligaments. For the craniofacial surgeon, the zones of adherence represent coalescence between different fascial layers, possibly luring the surgeon into an erroneous plane of dissection. In facial reconstruction or face transplants, reconstructing or maintaining these ligaments is important to prevent sagging of the soft tissues with its functional and aesthetic consequences.

Various terms have been used to describe these ligamentous attachments. Moss *et al*. classified them into ligaments (connecting deep fascia/periosteum to the dermis), adhesions (fibrous attachments between the deep and the superficial fascia), and septi (fibrous wall between layers).[21]

In the periorbital and temporal region, various ligaments and adhesions have been described with numerous names given to each (Fig. 1.7). Along the skull temporal line lies the temporal line of fusion, also known as the superior temporal septum, which represents the coalition of the temporal fascia with the skull periosteum. These adhesions end as the temporal ligamentous adhesions (TLA) at the lateral third of the eyebrow.[21] The TLA measure approximately 20 mm in height and 15 mm in width and begin 10 mm cephalad to the superior orbital rim. Both the temporal line of fusion and the TLA are sometimes referred to collectively as temporal adhesions. The inferior temporal septum extends posteriorly and inferiorly from the TLA on the surface of the deep temporal fascia towards the upper border of the zygoma. It separates the upper temporal region superiorly from the lower temporal region inferiorly and represents the upper boundary of the parotideomasseteric fascia (the fascial layer between the superficial and the deep temporal fascia in the region just

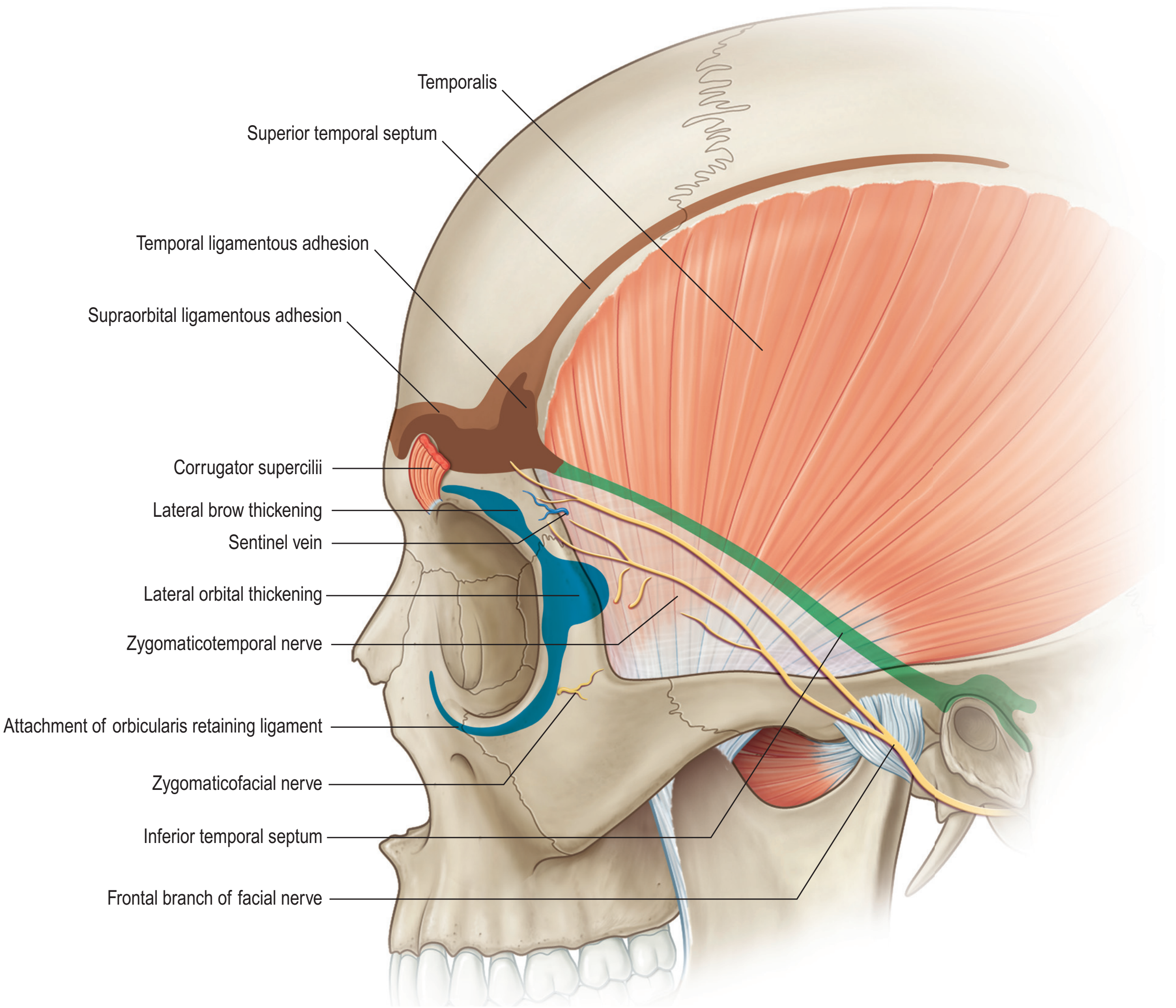


Fig. 1.7 The ligaments of the periorbital region.

above the zygomatic arch).[22] The supraorbital ligamentous adhesions extend from the TLA medially along the eyebrow.

The orbicularis retaining ligament (ORL) lies along the superior, lateral, and inferior rims of the orbit, extending from the periosteum just outside the orbital rim to the deep surface of the orbicularis oculi muscle (Fig. 1.8).[23,24] This ligament serves to anchor the orbicularis oculi muscle to the orbital rims. The orbicularis oculi muscle attaches directly to the bone from the anterior lacrimal crest to the level of the medial limbus. At this level the ORL replaces the bony origin of the muscle, continuing laterally around the orbit. Initially short, it reaches its maximum length centrally near the lateral limbus.[25] It then begins to diminish in length laterally, until it finally blends with the lateral orbital thickening (LOT). The LOT is a condensation of the superficial and deep fascia on the frontal process of the zygoma and the adjacent deep temporal fascia. The ORL and the orbital septum both attach to the arcus marginalis, a thickening of the periosteum of the orbital rims.[24] The ORL is also referred to as the periorbital septum and, in its inferior portion, as the orbitomalar ligament. The ORL attaches to the undersurface of the orbicularis oculi muscle at the junction of its pretarsal and orbital components.

In the midface, the retaining ligaments have been divided into direct, or osteocutaneous, ligaments and indirect ligaments. Direct ligaments run directly from the periosteum to the dermis, and include the zygomatic and mandibular ligaments. Indirect ligaments represent a coalescence between the superficial and deep fascia and include the parotid and the masseteric cutaneous ligaments (Fig. 1.9; see Fig. 1.2C). The retaining ligaments indirectly fix the mobile skin and its intimately related superficial fascia (SMAS) to the relatively immobile deep fascia and underlying structures (masseter and parotid).

The zygomatic and the masseteric ligaments together form an inverted L, with the angle of the L formed by the major zygomatic ligaments (Fig. 1.9; see Fig. 1.2C). These ligaments are typically around 5–15 mm wide and are located 4.5 cm in front of the tragus and 5–9 mm behind the zygomaticus minor muscle.[26–30] Anterior to this main ligament are multiple other bundles that form the horizontal limb of the inverted L. There have been different descriptions of the anatomy of these

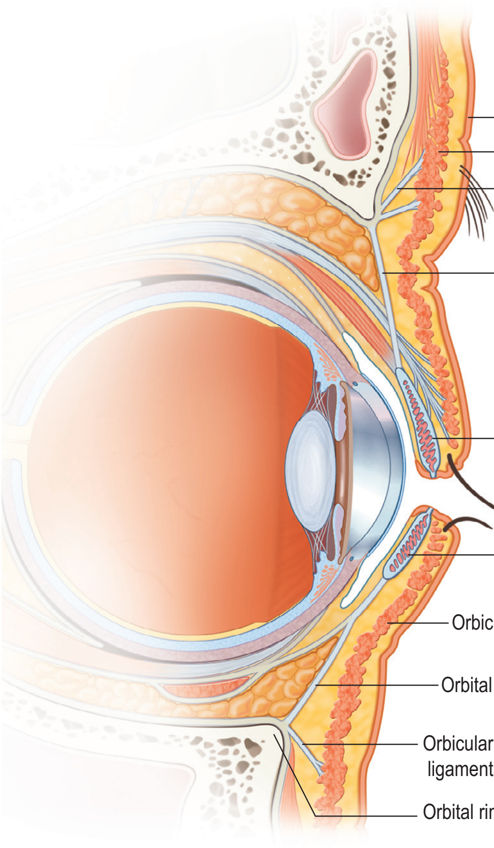


Fig. 1.8 The orbicularis retaining ligaments.

zygomatic ligaments, likely related to the variability in their thickness and location, as well as the different criteria used by different authors to define what is truly a "ligament". Often the surgeon will encounter these ligaments along the whole length of the zygomatic arch.[30] The vertical limb of the L is formed by the masseteric ligaments, which are stronger near their upper end (at the zygomatic ligaments), and extend along the entire anterior border of the masseter as far as the mandibular border.[5,31] The parotid ligaments, also referred to as preauricular ligaments, represent another area of firm adherence between the superficial and deep fascia.[26,28,29] The mandibular ligaments originate from the parasymphyseal region of the mandible around 1 cm above the lower mandibular border.[28,29] There are several descriptions of other retaining ligaments in the face, most notably the mandibular septum and the orbital retaining septum.[32,24]

The prezygomatic space

The prezygomatic space is a glide plane space overlying the body of the zygoma, deep to the orbicularis oculi and the suborbicularis fat (see Fig. 1.8).[33] Its floor is formed by a fascial layer covering the body of the zygoma and the lip elevator muscle (namely the zygomaticus major, zygomaticus minor, and the levator labii superioris). This fascial layer extends caudally over the muscles, gradually becoming thinner and allowing the muscle to be more discernible. The superior boundary of the prezygomatic space is the orbicularis retaining ligament, which separates it from the preseptal space. The more rigid inferior boundary is formed by the reflection of the fascia covering the floor as it curves superficially to blend with the fascia on the undersurface of the orbicularis oculi. This inferior boundary is further reinforced by the zygomatic retaining ligaments. Medially, the space is closed by the origins of the levator labii and the orbicularis oculi muscle from the medial orbital rim. Finally, the lateral boundary is formed superiorly by the LOT over the frontal process of the zygoma and more inferiorly by the zygomatic ligaments.[34] The facial nerve branches cross in the roof of (i.e., superficial to) this space. The only structure traversing the prezygomatic space is the zygomatic branch of the facial nerve, emerging from its foramen located just caudal to the ORL.

The malar fat pad and the subcutaneous fat compartments of the face

Rohrich and Pessa, in an extensive study of the facial subcutaneous fat, found the cheek to be partitioned into multiple, independent anatomical compartments superficial to the superficial fascia.[35] These subcutaneous fat compartments (also referred to as fat pads) are separated by distinct facial condensations that arise from the superficial fascia and insert into the dermis of the skin.[36–38] These superficial fat pads include the nasolabial, jowl, malar, or cheek (subdivided into medial, middle, and lateral-temporal compartments); periorbital (subdivided into inferior, superior, and lateral compartments); and forehead (subdivided into central and medial compartments).[36] This anatomy is important because elements of facial aging may be characterized by how these compartments change relatively in both position and volume with time.[38] Elevation of the malar fat pad, which is triangular in shape with its base at the nasolabial crease and its apex more laterally towards the body of the zygoma, is important for facial rejuvenation and in facial palsy.[39] During facelift dissection, septal transition zones between these superficial fat compartments are regions of potential injury to deeper structures, including branches of the facial nerve as well as the greater auricular nerve.[38]

The buccal fat pad

The buccal fat pad is an underappreciated factor in post-traumatic facial deformities and senile aging and is frequently overlooked as a flap or graft donor site.[40,41] Senile laxity of the fascia allows the fat to prolapse laterally, contributing to the square appearance of the face.[42] With many traumatic injuries the fat herniates, either superficially, towards the oral mucosa, or even into the maxillary sinus.[25,43–45] This fat is anatomically and histologically distinct from the subcutaneous fat. It is voluminous in infants to prevent indrawing of the cheek during suckling, and gradually decreases in size with age.[46] It functions to fill the glide planes between the muscles of mastication.

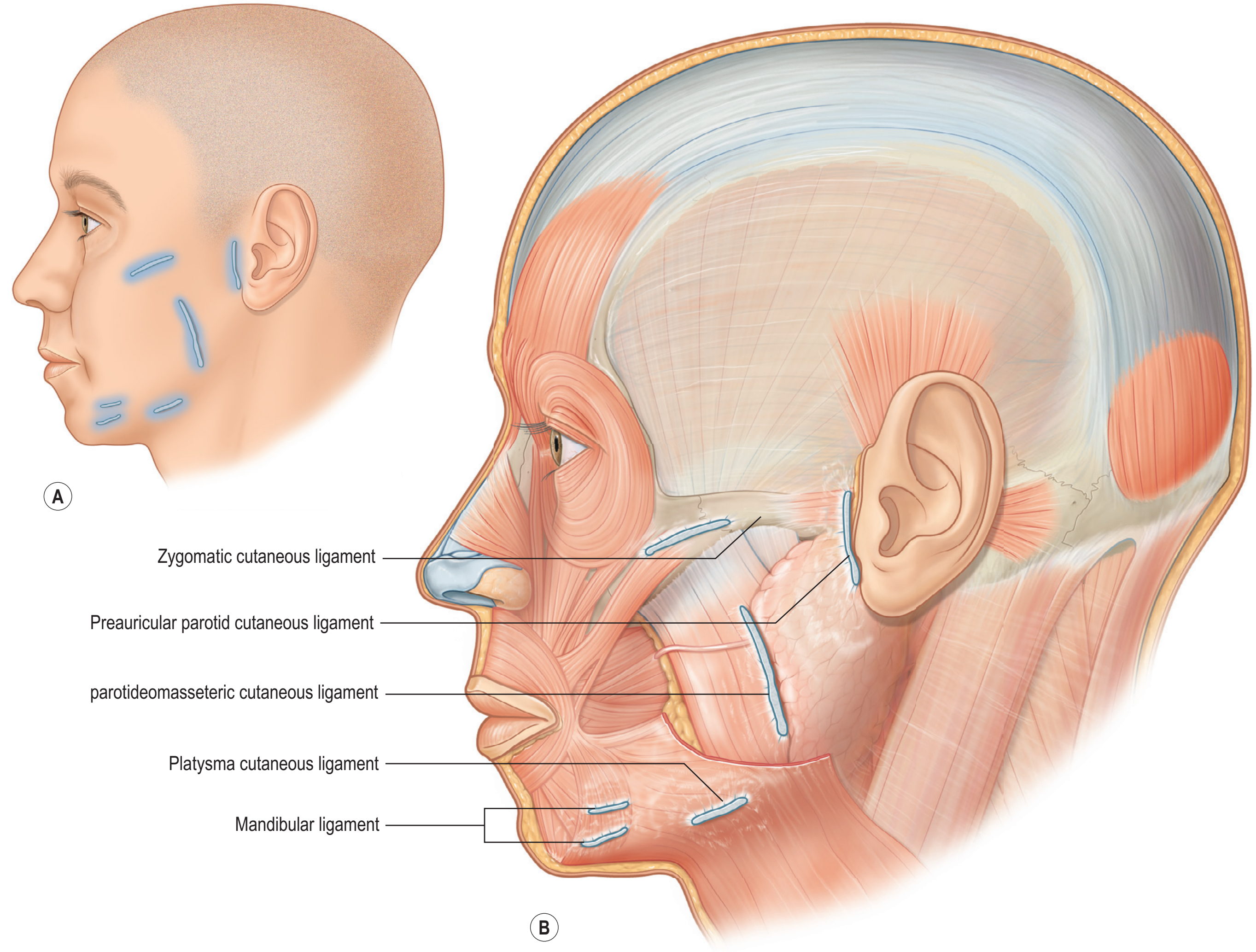


Fig. 1.9 The retaining ligaments of the face. *(Reproduced with permission from Gray's Anatomy 40e, Standring S (ed), Churchill Livingstone, London, 2008.)*

It is usually described as being formed of a central body and four extensions, the buccal, pterygoid, and superficial and deep temporal. The body is located on the periosteum of the posterior maxilla (surrounding the branches of the internal maxillary artery) overlying the buccinator muscle and extends forwards in the vestibule of the mouth to the level of the maxillary second molar. The buccal extension is the most superficial, extending along the anterior border of the masseter around the parotid duct. Both the body and the buccal extension are superficial to the buccinator and deep to the deep facial fascia (parotideomasseteric fascia) and are intimately related to the facial nerve branches and the parotid duct. The buccal extension is in the same plane as the facial artery, which marks its anterior boundary. The pterygoid extension passes backwards and downwards deep to the mandibular ramus to surround the pterygoid muscles. The deep temporal extension passes superiorly between the temporalis and the zygomatic arch. The superficial temporal extension is actually totally separate from the main body and lies between the two layers of the temporal fascia above the zygomatic arch.[47]

The facial nerve

During most facial plastic surgeries, whether congenital, reconstructive, or aesthetic, there are one or more branches of the facial nerve that are at risk for injury. Although there is abundant literature on the anatomy of the facial nerve branches, the majority of publications describe two-dimensional anatomy, depicting the trajectory of the nerve and its surface anatomy in relation to anatomic landpoints (see Fig. 1.3).[9,16,48–55] However, it is the third dimension, the depth of the facial nerve in relation to the layers of the face, that is most relevant to the practicing surgeon. In spite of the significant variability in the branching patterns, the facial nerve consistently passes in defined planes, crossing from one plane to another in certain zones.[1] It is in these "danger zones" that dissection should be avoided or done carefully. In the rest of the face, the dissection can proceed relatively quickly by adhering to a certain plane, either superficial or deep to the plane of the nerve.

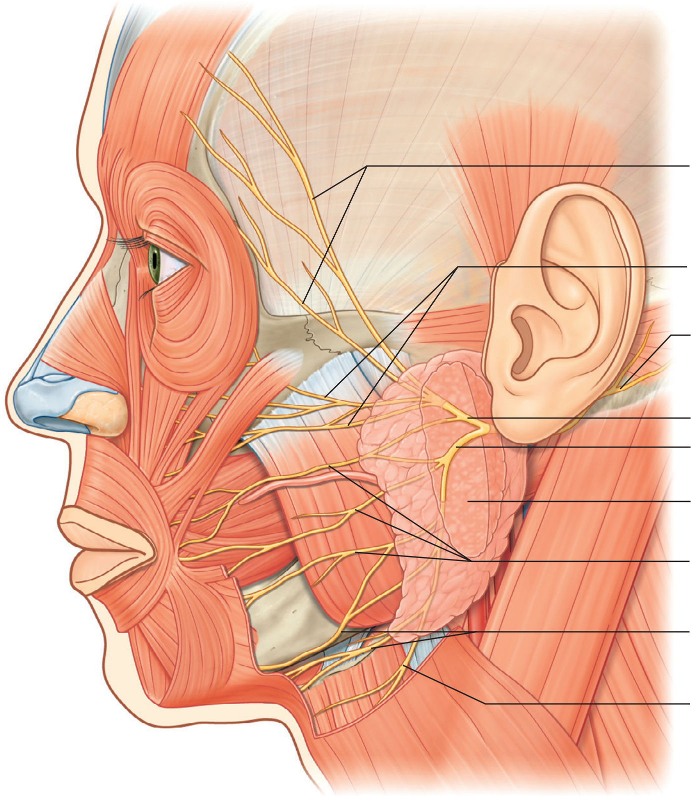


Fig. 1.10 The facial nerve.

The facial nerve nucleus lies in the lower pons and is responsible for motor innervation to all the muscles derived from the second branchial arch. A few sensory fibers originating in the tractus solitarius join the facial nerve to supply the skin of the external acoustic meatus. The nerve emerges from the lower border of the pons, passes laterally in the cerebellopontine angle, and enters the internal acoustic meatus. The facial nerve then traverses the temporal bone (being liable to injury in temporal bone fractures) to exit the skull through the stylomastoid foramen. Just after its exit it is enveloped by a thick layer of fascia that is continuous with the skull periosteum and is surrounded by a small aggregation of fat and usually crossed by a small blood vessel. This makes its identification in this area a challenging task. Several methods for identification of the facial nerve trunk have been described:

1. If the tragal cartilage is followed to its deep end, it terminates in a point. The nerve is 1 cm deep and inferior to this "tragal pointer". There is an avascular plane anterior to the surface of the tragus that allows a safe and quick dissection to this tragal pointer.
2. By following the posterior belly of the digastric posteriorly, the nerve is found passing laterally immediately deep to the upper border of the posterior end of the muscle.
3. If the anterior border of the mastoid process is traced superiorly, it forms an angle with the tympanic bone. The nerve bisects the angle formed between these two bones (at the tympanomastoid suture).
4. By feeling the styloid process in between the mastoid bone and the posterior border of the mandible. The nerve is just lateral to this process.
5. By following the terminal branches of the nerve proximally.

The nerve passes forwards and downwards to pierce the parotid gland. In the parotid gland the nerve divides into the zygomaticotemporal and the cervicofacial divisions, which in turn divide into the five terminal branches of the facial nerve: frontal, zygomatic, buccal, marginal mandibular, and cervical (Fig. 1.10). However, the zygomatic and buccal branches show significant variability in their location and branching patterns, as well as a significant overlap in the muscles they innervate – they are sometimes grouped together and referred to as "zygomaticobuccal". The temporal and the mandibular branches are perhaps at the highest risk for iatrogenic injury, especially as the muscles they innervate show little if any cross-innervation, making injury to these branches much more noticeable.

Frontal (temporal) branch

This consists of 3–4 branches that innervate the orbicularis oculi muscle, the corrugators and the frontalis muscle. Several anatomic landmarks are used to describe their surface anatomy. The most common description is Pitanguy's line, extending from 0.5 cm below the tragus to a point 1 cm above the lateral edge of the eyebrow (or 1 cm lateral to the lateral canthus).[9,56] Ramirez described the nerve as crossing the zygomatic arch 4 cm behind the lateral canthus.[57] However, other surgeons describe the area spanning the middle two-thirds of the arch as the territory of the nerve. Gosain *et al.* found frontal nerve branches are found at the lower border of the zygomatic arch between 10 mm anterior to the external auditory meatus and 19 mm posterior to the lateral orbital rim.[16] Finally, Zani *et al*. in 300 cadaver dissections reported that the nerve is in a region limited by two straight diverging lines; the first line from the upper tragus border to the most cephalic wrinkle of the frontal region, and the second line from the lower tragus border to the most caudal wrinkle of the frontal region.[51] Although there is no connection between the frontal nerve and other branches of the facial nerve, there are connections within the frontal branches themselves.[16] In addition, the more posterior divisions of the frontal nerve may be less clinically significant than the anterior branches, the injury of which will lead to noticeable brow deformities.[16] A line from the tragus to 1 cm above the lateral eyebrow or 1.5 cm lateral to the lateral canthus seems to be a fairly accurate marking of the largest branch of the frontal nerve.

With this great variation in surface anatomy, it is the plane of the nerve (the depth) that is most important (see Fig. 1.4). After emerging from the parotid gland, the nerve is protected by the deep facial fascia (parotideomasseteric fascia) lying on the masseter muscle. In midfacial procedures (e.g. facelift), dissection is usually *superficial* to the deep facial fascia (which protects the nerve deep to it). In the temporal area, the nerve is on the undersurface of the superficial temporal fascia (see Fig. 1.5). Here dissection is usually *deep* to the nerve, either directly superficial or deep to the deep temporal fascia (or the superficial layer of the deep temporal fascia). However, the crossing of the nerve from deep to superficial in the vicinity of the zygomatic arch is a matter of debate. This is largely because of the confusion regarding the anatomy of the fascia in relation to the arch. Directly over the arch, the facial layers are tightly adherent (with little thickness of tissues from the bone to the skin). While the SMAS is continuous with the temporoparietal fascia across the arch, it is not clear if the deep facial fascia is continuous with the deep temporal fascia or they are separate layers that adhere to the periosteum of the zygomatic arch.[7,8,58,59] At the lower border of the arch, the nerve is very close to the periosteum.[60–63] The nerve is still deep to the SMAS/TPF and deep to the areolar tissue between the TPF and the deep temporal fascia (which, as described above, is sometimes considered as a separate layer of fascia called the parotidotemporal fascia). This deep location of the nerve allows safe transection of the SMAS at the level of the zygomatic arch in facelift surgeries.[13,63,64] The nerve passes from its deep location to the superficial temporal fascia in the region right above the zygomatic arch.[13] In this area, the fascia layers are more tightly adherent, which is a warning sign that the facial nerve is in close proximity. Dissection in this transition zone, extending over the arch and the 2–3 cm above it, should be done carefully (see Fig. 1.3).

Zygomatic and buccal branches

These branches emerge from the parotid and diverge forwards lying over the masseter muscle under the parotideomasseteric (deep facial) fascia. The exact point where they pierce the deep fascia is variable but is in the vicinity of the anterior border of the masseter. The upper branches to the midfacial muscle (zygomatic branches) pierce the deep fascia approximately 4 cm in front of the tragus in close proximity (around 1 cm inferior) to the zygomatic ligaments (see Fig. 1.2C). These branches soon innervate the zygomaticus major muscle through its deep surface. The zygomatic and masseteric retaining ligaments can aid in identification of these nerve branches. As mentioned previously, the major zygomatic ligament is located around 45 mm in front of the tragus (it might be helpful to mark this location on the skin prior to facelift surgery). Medial to this ligament is the zygomaticus major muscle and the overlying prezygomatic space, and just inferior to this ligament are the upper zygomatic branches of the facial nerve. These branches are deep to the deep facial fascia at this level. The lower zygomatic branches of the facial nerve pass inferior to the upper masseteric ligaments and are closer to the SMAS. Therefore, both the zygomatic and upper masseteric ligaments should be divided close to the SMAS to protect the facial nerve branches.[30] The buccal branches emerge from the parotid in the same plane as the parotid duct (deep to the parotideomasseteric fascia). They pierce the deep fascia at the anterior edge of the masseter, close to the masseteric cutaneous ligaments (see Fig. 1.2C). Together, the zygomatic and buccal branches supply the orbicularis oculi, midfacial muscle, orbicularis oris, and the buccinator. Unlike the marginal mandibular and the frontal divisions, there are a number of communicating branches between the buccal and zygomatic divisions, and injury to a single branch of these nerves is usually unnoticeable. Facial lacerations medial to the level of the lateral canthus are usually not amenable to exploration or repair of the facial nerve.

Marginal mandibular

The marginal mandibular nerve is one of the most commonly encountered branches of the facial nerve and is in jeopardy in multiple operations, including neck dissections, submandibular sialadenectomy, and exposure of the mandible.[65] There are numerous descriptions and variations of both the trajectory of the nerve and its plane (i.e. depth), necessitating care in a wide area of dissection in the lower face and the submandibular triangle.[2,50,66–70] In addition, the nerve can vary between a single branch and up to 3 or 4 branches.[2,67,71,72]

After exiting the parotid gland near its lower border, the nerve loops downward, often below the mandibular border. Whether the nerve crosses the mandibular border into the submandibular triangle in all individuals is a matter of debate.[2,66,73] Although several cadaver studies found the nerve to be more commonly above the mandibular border, clinical experience has shown that it is frequently located in the submandibular triangle, up to 3 or even 4 cm below the mandible.[2,50,66,74–76] This might also vary with the position of the neck, and the surgeon must consider the wide variability of the nerve location in his dissection.[2] The nerve then passes upwards back into the face midway between the angle and mental protuberance. Once the nerve crosses the facial vessels, its major trunk is usually above the border of the mandible, although smaller branches may continue in the neck to supply the platysma.[2]

After exiting the parotid gland, the nerve is initially deep to the parotideomasseteric fascia. In the submandibular triangle, the nerve is usually described as lying between the platysma and the deep cervical fascia. However, it might occasionally be found deep to the deep fascia near the superficial surface of the submandibular gland. The nerve is deep to the platysma and superficial to the facial vessels throughout its course. As the nerve crosses into the lower face, the platysma thins and the nerve can be injured during a subcutaneous dissection.

The marginal mandibular nerve supplies the lower lip muscles, depressor anguli oris, mentalis, and the upper part of the platysma.[67,71] Injury to the marginal mandibular branch usually causes a recognizable deformity,[77–79] and several surgical maneuvers have been advocated to protect the nerve.[80,81] When exposing the mandible, the surgeon can identify the nerve in the usual subplatysmal location. However, it might be safer and faster to go to a deeper plane, elevating the deep fascia and/or the facial vessels and using them to protect the nerve. Dissection above the platysma laterally will also avoid nerve injury.

Cervical branch

The cervical branch of the facial nerve primarily supplies the platysma. It has received little attention in the literature, as injury of this nerve may pass unnoticed. However, such injury may cause weakness of the lower lip depressors, which is often confused with injury to the mandibular nerve (marginal mandibular nerve pseudoparalysis).[82,83] However, mentalis function differentiates the two conditions, as it is preserved in cases of cervical branch injury.

The cervical nerve exits the parotid gland and passes 1–15 mm behind the angle of the mandible. It then passes forwards, in the subplatysmal plane 1–4.5 cm below the border of the mandible.[84] The cervical nerve is often composed of more than one branch. It may communicate with the marginal mandibular nerve (which might explain the lower lip asymmetry after its injury), and consistently communicates with the transverse cervical nerve, although this latter communication is currently of little significance.[66,85]

Connection with sensory nerves

Several authors have noticed connections between the branches of the facial nerve with sensory nerves, including the infraorbital, mental nerves, and transverse cervical nerves.[72,84,86–88] The exact clinical importance of this finding is yet to be seen.

The scalp

The five layers of the scalp are well known by the mnemonic SCALP:

- *S*kin
- *C*onnective tissue
- Galea *A*poneurotica
- *L*oose areolar tissue
- *P*ericranium.

The galea aponeurotica is also known as the epicranial aponeurosis and corresponds to the SMAS in the face. Peculiar to the scalp is the tight connection of the skin to the galea by a dense network of connective tissue fibers. This makes separation of the skin from the galea difficult (similar to the palm) and bloody. In addition, this lattice of connective tissue stents the vessels open which, combined with the scalp's rich vascularity, leads to profuse bleeding.

The galea is a dynamic structure, being controlled by the frontalis muscle anteriorly and the occipitalis posteriorly. The skin moves together with the galea due to their tight attachment. This is important in brow rejuvenation where weakening of the brow depressor muscles allows the epicranial aponeurosis to move backwards leading to elevation of the brow.

The loose areolar tissue between the galea and the periosteum is also referred to as the subgaleal fascia. This fascia is loose especially over the vertex of the scalp, allowing a quick dissection with minimal bleeding. It becomes more dense closer to the supra orbital rims. Most surgeons consider this layer as a potential dissection "plane" rather than a discrete "layer".[8,89] However, it has been shown to be a distinct layer that can be elevated independently as a vascularized flap.[90] This is especially possible closer to the zygomatic arch and the supraorbital rims where this layer is more substantial. It is formed histologically of multiple lamina, with most of the vasculature along the superficial and the deep lamina.[33,91,92]

The pericranium is simply the periosteum of the skull bones and is tightly adherent to normal sutures but easily dissected over the flat skull bones. It can be elevated as a separate flap for various uses, although once separated from the skull bones it significantly retracts.[93,94]

Five arteries supply the scalp. From the front, there is the supraorbital artery and the supratrochlear artery (branches of the ophthalmic artery from the internal carotid artery), the superficial temporal artery from the side, and the posterior auricular and the occipital arteries form the back (the latter three arteries arise from the external carotid artery). In general, these vessels run along the galea as they enter the periphery of the scalp. At this level, they give multiple perforating branches to the deeper subgaleal fascia. Closer to the vertex, most of the vessels become more superficial, anastomosing with the contralateral vessels. This explains why scalp flaps (formed of skin and galea with an intact subdermal plexus) can be safely extended across the midline, while pure galeal flaps cannot.[95]

The nerve supply of the anterior part of the scalp is by four branches of the trigeminal nerve: supratrochlear nerve (STN), supraorbital nerve (SON), zygomaticotemporal nerve (ZTN), and the auriculotemporal nerve. The posterior part of the scalp (roughly behind the level of the auricle) is supplied by four branches of the cervical nerves (C2 and C3): the great auricular nerve, the lesser occipital nerve, the greater occipital nerve, and the third occipital nerve.

The musculature

In general, the muscles of the forehead and eyebrow are arranged in three planes: the superficial plane right under the skin formed by the frontalis, procerus, and the orbicularis oculi; the deep plane formed by the corrugators; and an intermediate plane formed by the depressor supercilii (Fig. 1.11).

Frontalis, galeal fat pad, and the glide plane

The frontalis muscle originates from the galea aponeurosis and inserts distally (inferiorly) into the eyebrow skin interdigitating with the procerus, corrugator, and the orbicularis oculi. Just above the nasion, both frontalis muscles are contiguous with each other. At a variable point (1.5–6 cm) above the level of the superior orbital rim, the muscles diverge, with the medial borders becoming connected by an extension of

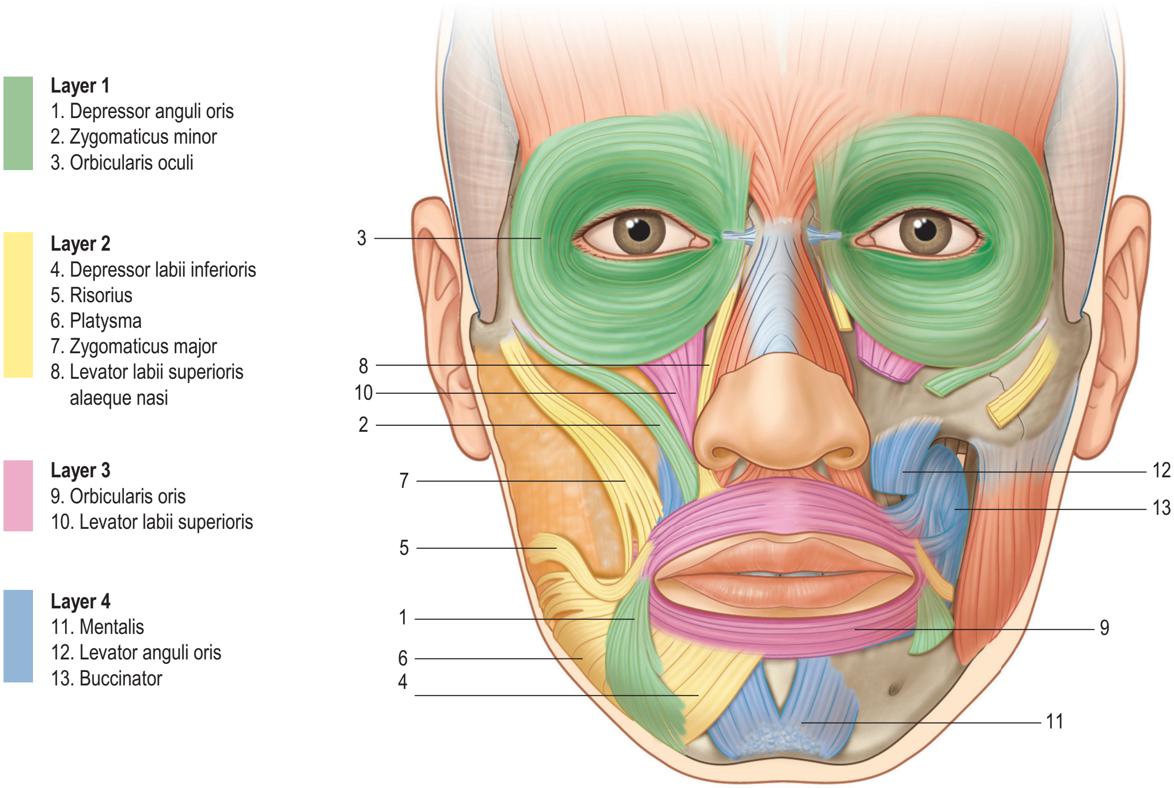


Fig. 1.11 Muscles of facial expression.

the galea aponeurotica.[96] This divergence point is higher in females. This is important when injecting botulinum toxin for treatment of forehead rhytides.

Deep to the frontalis at the level of the eyebrows is the galeal fat pad, a band of fibroadipose tissue that is frequently encountered in brow lift procedures.[97] This fat pad extends for 2–2.5 cm above the supraorbital rims being intimately related to the corrugator muscles. Between the galeal fat pad and the periosteum is the glide plane space, which allows mobility of the brow over the underlying bone. Similar to the SMAS in the face, the galea aponeurotica in the scalp seems to split to cover both deep and the superficial surfaces of the frontalis. At the level of the supraorbital rim, the fascia covering the deep surface of the frontalis becomes more adherent to the periosteum, sealing the galeal fat pad and the glide plane space above it from the eyelids. It is possible that the weakness of these attachments may be predisposed to brow ptosis, especially laterally.[98,99]

Corrugators

The anatomy of the corrugators has gained significance recently, with the realization of its role in browlift, migraine surgery and treatment of forehead rhytides. This renewed interest has led to multiple anatomical studies reporting that the muscle is larger than originally described.[100,101] The muscle originates from the supraorbital ridge and passes obliquely upwards and laterally to insert into the skin of the eyebrow. Usually described as being comprised of a transverse and an oblique head, Park *et al*. found that this distinction is not clear and described the muscle as being formed of three or four parallel muscle groups with loose areolar tissue in between.[100] Janis *et al*. similarly found that both heads are indistinguishable shortly after their origin.[102] In all cases, the muscle fibers blend together laterally and become more superficial. Medial to the SON, the corrugator is clearly separated from the overlying frontalis/orbicularis oculi muscle. However, it becomes more superficial laterally near its insertion blending with the frontalis. This close interdigitation with the orbicularis explains the difference in description of the anatomy in this region between the different authors. Intraoperatively, the corrugator can be recognized by its parallel oblique fibers, darker color, and deeper location, as opposed to the orbicularis oculi which is more superficial and inferior, is lighter in color, and has a circular orientation of the fibers.

The muscle origin is approximately 2.5 cm in width and 1 cm in height, starting a few millimeters lateral to the midline and reaching almost to the level of the SON.[100] The muscle then passes laterally to insert in the skin of the eyebrow, reaching as far as the lateral third of the eyebrow. Janis *et al*. found that the most lateral extension of the muscle is 43 mm from the midline and 7 mm medial to the lateral orbital rim, while the most superior extension is 33 mm cephalad to the level of the nasion.

The nerve supply of the corrugator is probably from both the frontal (temporal) and the zygomatic divisions of the facial nerve.[72,76,102,103] The branch(es) from the frontal nerve enter the muscle from its lateral end, and hence the importance of complete muscle excision lateral to the SON so as not to leave intact innervated muscle. The zygomatic (or upper buccal) division sends a nerve that travels cranially along the side of the nose to innervate the nasalis followed by the procerus and the corrugator.[72,103]

Procerus

This small muscle arises from the nasal bone and the upper lateral cartilages and ascends superiorly to insert into the glabellar skin between the eyebrows, blending with frontalis along the medial ends of the eyebrow.[104] Contraction of the procerus produces transverse glabellar rhytides.

Depressor supercilii

This small muscle lies between the orbicularis oculi and the corrugators, although some authors consider it part of either muscle.[99,105–107] It arises from the frontal process of the maxilla 2–5 mm below the frontomaxillary suture, slightly posterior and superior to the posterior lacrimal crest.[105] Daniel and Landon described it as running vertically between the pale circular orbicularis oculi more superficially and the brownish transverse corrugator lying in a deeper plane.[106] It finally inserts into the dermis of the medial eyebrow.

Midfacial muscles

From lateral to medial, the zygomaticus major, zygomaticus minor, and the levator labii superioris originate from the anterior surface of the maxilla (see Fig. 1.11). Their line of origin is a curved line, convex downwards, with the medial limit higher than the lateral end. These muscles form the floor of the prezygomatic space and are covered by a fascial membrane that is more stout superiorly, being around 2–3 mm thick. This fascial membrane is identified by its pale color and coarse lobulation. The levator labii superioris origin reaches the inferior orbital rim while the zygomaticus major origin is separated from the inferior orbital rim by the front of the body of the zygoma. The three muscles insert into the substance of the upper lip.

The levator labii superioris alaeque nasi originates from the frontal process of the maxilla. Its fibers pass downwards and laterally to insert into the lower lateral cartilage of the nose and the upper lip.

The levator anguli oris arises from the maxilla below the orbital foramen lying deep to the lip elevators. It is one of the few facial muscles innervated on their superficial surface.

The depressor labii inferioris and the depressor anguli oris are continuous with the platysma and draw the lip downwards and laterally.

The mentalis is a thick small muscle that is important in exposure of the mandible and in chin surgery. It arises from the buccal surface of the mandible over the roots of the incisors and inserts into the chin. Repair of the mentalis is vital after buccal incisions to prevent chin ptosis.

Muscles of mastication

The four muscles of mastication, the temporalis, masseter, and lateral and medial pterygoids, are mostly present in the temporal and infratemporal fossae and control mandibular movement during speech and mastication. Being derivatives of the first pharyngeal arch, they are all supplied by the mandibular division of the trigeminal nerve.

The temporalis muscle

The temporalis arises from the bony floor of the temporal fossa, with attachments to the deep surface of the deep temporal fascia. It passes deep to the zygomatic arch to insert into the coronoid process of the mandible and the anterior border of the ramus of the mandible almost down to the third molar tooth. It receives its blood supply from the anterior and posterior deep temporal arteries, arising from the maxillary artery and supplying the muscle through its deep surface.[108] It receives secondary blood supply from the middle temporal artery, which arises from the superficial temporal artery near the zygomatic arch and travels along the deep temporal fascia. Based on its dominant deep pedicle, the muscle's arc of rotation is at the zygomatic arch, and can be rotated as a flap for coverage of the orbit, upper cheek, and ear.[109,110] The muscle is also frequently used for facial reanimation.

The masseter muscle

This strong muscle arises from the lower border and inner surface of the zygomatic arch by two heads: a superficial head from the anterior two-thirds of the arch and a deep head forms the posterior third. The superficial head descends downwards and backwards, while the deep head descends vertically downwards. Both heads then insert together at the lateral and inferior surfaces of the mandible.

The medial pterygoid muscle

The medial pterygoid muscle arises by two heads: a small superficial head from the maxillary tubercle behind the last molar and a deep large head from the medial surface of the medial pterygoid. Both heads run downwards and backwards to insert on the inner surface of the angle of the mandible. In mandibular fractures the action of this muscle is responsible for the upwards and forwards movement of the posterior segment.

The lateral pterygoid muscle

This muscle also has two heads, a smaller upper head from the infratemporal surface and ridge of the greater wing of the sphenoid, and a lower larger head from the lateral surface of the lateral pterygoid plate. The fibers pass backwards to insert into the anterior surface of the neck of the mandible and the capsule of the temporomandibular joint. Some of the fibers pierce the capsule to attach to the intra-articular disc. In condylar fractures, this muscle is responsible for the displacement of the mandibular condyle, while in Le Fort fractures, the muscle pulls the maxillary segment downwards and backwards resulting in premature contact of the molar and resulting in an anterior open bite.

Actions of muscle of mastication

Together, these muscles control most of the movements of the mandible. Elevation of the mandible is achieved by the temporalis and the masseter, while the pterygoids protract the mandible and move it to the contralateral side.

The pterygomasseteric sling

The masseter and the medial pterygoid insert respectively into the lateral and medial surfaces of the lower edge of the mandible near the mandibular angle. These insertions are connected to each other by the pterygomasseteric sling, a fibrous raphe extending around the mandibular border and connecting both insertions.[111] Disruption of this raphe will lead to an unaesthetic upward retraction of the masseter, most visible on clinching the jaws.[112]

The aesthetic importance of the masseter and the temporalis muscle

Atrophy, hypertrophy, or displacement of either the masseter or the temporalis can be aesthetically bothersome. Masseter hypertrophy leads to an increased bigonial angle, although most cases of benign masseteric hypertrophy (BMH) are actually caused by a laterally positioned mandibular ramus and not by a true hypertrophy of the muscle. Deformities of the temporalis muscle are more common, and are usually iatrogenic due to improper resuspension of the origin of the muscle during a coronal incision leading to retraction of the muscle inferiorly. This leads to a visible bulge above the zygoma and a depression near the origin of the muscle. Repair of the atrophy or displacement of the masseter and the temporalis often involves the use of alloplastic implants, as the muscles cannot usually be stretched to their original lengths.

The sensory innervation

The anatomy of the sensory nerves and their relation to the surrounding muscles has gained significant importance with the recognition of their role in the aetiology of migraine headaches.[113,114] Knowledge of the anatomy of these nerves is also important both to avoid iatrogenic injury and for local anesthetic blocks.[115,116] In general, the face is supplied by the three divisions of the trigeminal nerve (through three branches from each division), with the scalp receiving additional supply from the cervical superficial spinal nerves (Fig. 1.12; see Fig. 1.9).

The frontal division of the trigeminal nerve supplies the upper eyelid, forehead, and a large portion of the scalp through three branches: the supraorbital, supratrochlear, and the infratrochlear nerves (Fig. 1.13A; see Fig. 1.12). The first two are particularly important due to their role in triggering frontal migraine and the possibility of their injury during forehead and eyebrow rejuvenation.[114] In addition, successful anesthetic blocks of the SON can effectively anesthetize large areas of the scalp.

The SON exits the orbit through either a notch or foramen located at the level of the medial limbus.[117] There is significant variation in its exit point,[114,117–123] which can be a notch, a foramen, or a canal. This point of emergence is approximately 25–30 mm from the midline. It is usually a few millimeters above the orbital rim but can be up to 19 mm above it.[118–121] The nerve then divides into a superficial (medial) and a deep (lateral) branch. The superficial division passes superficial to the frontalis to supply the forehead skin.[114] The larger deep division, which is more prone to iatrogenic injury, passes cephalad in a more lateral location. As its name suggests, it is in a deeper plane lying between the galea and the periosteum.[122,123] It passes upwards 1 cm medial to the temporal fusion line, and supplies sensation to the frontoparietal scalp. Forehead dissection is safer in the subperiosteal plane as opposed to a subgaleal (subfrontalis) plane which places the deep branch of the SON in risk.[124]

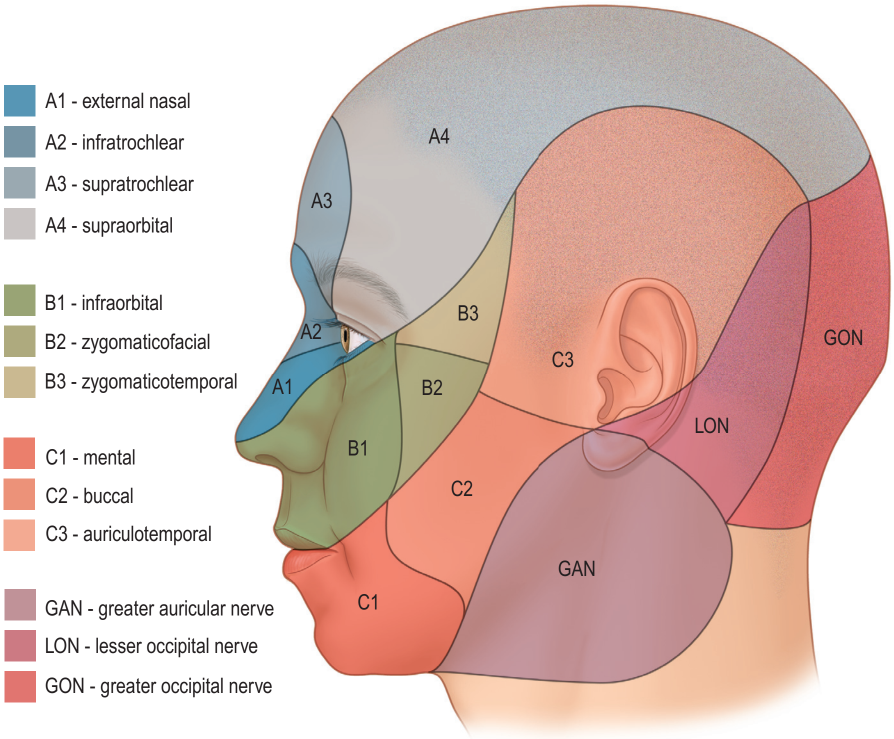


Fig. 1.12 The sensory supply of the face.