DERMATOLOGIC SURGERY

JONATHAN KANTOR

Section Editors
John G. Albertini • Jeremy S. Bordeaux
Leonard M. Dzubow • Naomi Lawrence
Stanley J. Miller

Mc Graw Hill Education

Video
Online Videos
www.mhprofessional.com/mediacenter/

DERMATOLOGIC SURGERY

EDITOR
Jonathan Kantor, MD, MSCE, MA
Adjunct Assistant Professor of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Medical Director
Florida Center for Dermatology, P.A.
St. Augustine, Florida

Mc Graw Hill Education

New York Chicago San Francisco Athens London Madrid Mexico City
Milan New Delhi Singapore Sydney Toronto

ISBN: 978-1-25-983459-2
MHID: 1-25-983459-X

The material in this eBook also appears in the print version of this title: ISBN: 978-1-25-964392-7, MHID: 1-25-964392-1.

eBook conversion by codeMantra
Version 1.0

For Bella—passionate partner and problem-solver par excellence.

Credis ergo sum.

Contents

List of Videos

Videos can be accessed via the following link: https://www.mhprofessional.com/mediacenter/

Chapter Number: Title	Video Number: Title
12. Local Anesthesia, Regional Nerve Blocks, and Postoperative Pain Management	Video 12-1: Traditional Microbotox
	Video 12-2: Aquagold Microbotox
	Video 12-3: Cryoanesthesia Utilization
	Video 12-4: Ring Block
	Video 12-5: Tetracaine Administration
	Video 12-6: Local Anesthesia of the Lower Eyelid
	Video 12-7: Local Anesthesia of the Upper Eyelid
	Video 12-8: Tumescent Anesthesia
	Video 12-9: Supraorbital/Supratrochlear Nerve Block
	Video 12-10: Infraorbital Nerve Block
	Video 12-11: External Nasal Nerve Block
	Video 12-12: Mental Nerve Block
	Video 12-13: Digital Nerve Block
13. Suturing Techniques	Video 13-1: Buried Vertical Mattress Suture
	Video 13-2: Set-Back Dermal Suture
	Video 13-3: Buried Horizontal Mattress Suture
	Video 13-4: Buried Purse-String Suture
	Video 13-5: Simple Interrupted Suture
	Video 13-6: Vertical Mattress Suture
	Video 13-7: Horizontal Mattress
	Video 13-8: Tip Stitch
	Video 13-9: Purse-String Suture
	Video 13-10: Fascial Plication Suture
16. Electrosurgery and Hemostasis	Video 16-1: Electrocautery
	Video 16-2: Bipolar Electrocautery
	Video 16-3: Electrodessication and Curettage
17. Incision and Drainage	Video 17-1: Incision and Drainage
18. Layered Excision and Surgical Repairs	Video 18-1: Excision and Layered Closure
	Video 18-2: Excision and Layered Closure
	Video 18-3: Excision and Layered Closure
	Video 18-4: Excision and Layered Closure
	Video 18-5: Excision and Layered Closure
	Video 18-6: Excision and Layered Closure
	Video 18-7: Excision and Layered Closure
	Video 18-8: Excision and Layered Closure
	Video 18-9: Excision and Layered Closure
	Video 18-10: Excision and Layered Closure
21. Advancement Flaps	Video 21-1: Helical Rim/Chondrocutaneous Advancement Flap
	Video 21-2: Advancement Flap (O to L) on the Upper Cutaneous Lip
	Video 21-3: Advancement Flap (O to U) on the Upper Eyelid
24. Bilobed Flaps	Video 24-1: The Bilobed Flap
	Video 24-2: Dermabrasion After Bilobed Flap Repair
26. Interpolation Flaps	Video 26-1: Paramedian Forehead Flap (Nasal Tip Subunit)
	Video 26-2: Paramedian Forehead Flap (Ala)
28. Skin, Cartilage, and Composite Grafts	Video 28-1: Full-Thickness Skin Graft (FTSG)
	Video 28-2: Split-Thickness Skin Graft (STSG)
	Video 28-3: Cartilage Graft and FTSG
	Video 28-4: Weck Blade Harvest of STSG
29. Mohs Micrographic Surgery	Video 29-1: Mohs Surgery Technique: Tissue Excision
31. Mohs and Staged Geometric Excision for Lentigo Maligna	Video 31-1: Inking Template
	Video 31-2: Transfer Template
	Video 31-3: Inscribe 2 mm Margin
	Video 31-4: Sampling Negative Control
	Video 31-5: Suturing Negative Control
	Video 31-6: Removing Lentigo Maligna
	Video 31-7: Undermining
	Video 31-8: Plication and Intradermal Suture
	Video 31-9: Defatting and Thinning
	Video 31-10: Quadrisecting
	Video 31-11: Inking Quadrants
	Video 31-12: Mounting Pie Wedges
	Video 31-13: Mounting Radial Sections
	Video 31-14: Grossing-In
	Video 31-15: Mounting Specimens on Chuck
	Video 31-16: Quadrisecting
	Video 31-17: Radial Sections
	Video 31-18: Defatting
	Video 31-19: Quadrisecting
	Video 31-20: Cutting Pie Wedges
33. Laboratory Techniques for Mohs Micrographic Surgery	Video 33-1: Mohs Surgery: Tissue Processing
34. Nail Surgery	Video 34-1: Distal Digital Block
	Video 34-2: Application of Tourniquet
	Video 34-3: Tangential Shave Removal of Matrix Pigmented Lesion
	Video 34-4: Matrix Cauterization 1
	Video 34-5: Matrix Cauterization 2
	Video 34-6: Matrix Cauterization 3
	Video 34-7: Matrix Cauterization 4
	Video 34-8: Matrix Cauterization 5
38. Reconstruction of the Eyelids	Video 38-1: Diagonal Superior Suture Placement
	Video 38-2: Inverse Tenzel flap
	Video 38-3: Island Pedicle Flap with Canthal Suspension
	Video 38-4: Lateral Canthopexy

46. Melanoma	Video 46-1: Interrupted Deep Dermal Suture Placement for Wide Excision and Closure Video 46-2: Running Subcuticular Suture Placement for Wide Excision and Closure Video 46-3: Gamma Probe Detection of Radioactive Sentinel Lymph Node Video 46-4: Dissection and Excision of Sentinel Node Using Bipolar Electrocautery Video 46-5: Incision with Scalpel for Complete Groin Dissection
48. Nonmelanoma Skin Cancer	Video 48-1: Excision of Nonmelanoma Skin Cancer
50. Cysts	Video 50-1: Cyst Surgery Slit Excision Video 50-2: Using Punch Biopsy Tool to Remove Epidermoid Cyst Video 50-3: Milia Extraction Video 50-4: Pilar Cyst Excision Video 50-5: Marking Surgical Area and Applying Tegaderm Prior to Local Anesthesia
52. Vitiligo	Video 52-1: Donor Site Preparation Video 52-2: Donor Site Anesthesia Video 52-3: Harvesting the Graft Video 52-4: Bandaging the Donor Site Video 52-5: Recipient Site Preparation, Part 1 Video 52-6: Recipient Site Preparation, Part 2 Video 52-7: Applying Cell Suspension and Bandaging the Recipient Site Video 52-8: Cell Separation: 1: Rinsing the Graft Video 52-9: Cell Separation: 2: Flattening the Graft Video 52-10: Cell Separation: 3: Incubating the Graft Video 52-11: Cell Separation: 4: Removal of Trypsin Video 52-12: Cell Separation: 5: Rinsing the Trypsin from the Graft Video 52-13: Cell Separation: 6: Removal of the Dermis Video 52-14: Cell Separation: 7: Scraping the Graft Video 52-15: Cell Separation: 8: Transferring the Graft Fragments Video 52-16: Cell Separation: 9: Centrifugation of the Graft Fragments Video 52-17: Cell Separation: 10: Formation of the Cell Pellet Video 52-18: Cell Separation: 11: Removal of Tissue Fragments Video 52-19: Cell Separation: 12: Isolation of the Cell Pellet Video 52-20: Cell Separation: 13: Resuspending the Cell Pellet Video 52-21: Cell Separation: 14: Drawing up the Cell Suspension
53. Chronic Wounds	Video 53-1: Apligraf Placement Video 53-2: Debridement Video 53-3: Porcine Small Intestine Submucosa Video 53-4: Unna Boot Placement

54. Hidradenitis Suppurativa	Video 54-1: Intralesional Triamcinolone Video 54-2: Incision and Drainage Video 54-3: Deroofing Video 54-4: Limited Excision: Axilla Video 54-5: Limited Excision: Groin Video 54-6: CO_2 Laser Video 54-7: Probing the Floor Video 54-8: Wide Excision
57. Neuromodulators	Video 57-1: Reconstitution of Botox Video 57-2: Demonstration of Glabellar Injection Video 57-3: Demonstration of Lateral Canthal Line Injection Video 57-4: Demonstration of Bunny Line Injection Video 57-5: Demonstration of Masseter Injection Video 57-6: Demonstration of Depressor Anguli Oris Injection
58. Fillers and Injectable Implants	Video 58-1: Facial Vascular Anatomy Video 58-2: Temple Marking Video 58-3: Temple Treatment Video 58-4: Midface Marking Video 58-5: Midface Treatment Video 58-6: Lower Face Treatment Video 58-7: Piriform Fossae Perioral Treatment Video 58-8: Lip Treatment
59. Ethnic and Gender Considerations in the Use of Facial Fillers	Video 59-1: Ethnic and Gender-Specific Approaches to Fillers
60. Liposuction	Video 60-1: Water-Assisted Tumescent Spray Video 60-2: VASER Ultrasound Technology Demonstrated Through a Scar Revision Video 60-3: Superficial Etching of the Abdominal Lines Video 60-4: Internal Radiofrequency (ThermiRF) Demonstrated After Liposuction of the Arms Video 60-5: Superficial Etching of the Abdominal Lines Using Hand Extraction Video 60-6: Purified Fat Injections to the Buttock Using a Single Port in the Buttock Fold
62. Hair Transplantation	Video 62-1: Hair Transplant
65. Lasers for Pigmented Lesions and Tattoos	Video 65-1: Tattoo Removal 755-nm Laser Video 65-2: Hand Lentigines Treatment
66. Laser- and Light-Based Approaches to Hair Removal	Video 66-1: Laser Hair Removal with a Diode Laser Video 66-2: Laser Hair Removal with an Nd:YAG Laser
67. Laser Resurfacing	Video 67-1: Fractional Carbon Dioxide Laser Resurfacing of Photodamaged Skin Video 67-2: Fractional Er: YAG Laser Resurfacing of Photodamaged Skin Video 67-3: Fractional RF Resurfacing of Acne Scars
72. Sclerotherapy and Management of Varicose Veins	Video 72-1: Liquid Sclerotherapy of Small Varicosities Video 72-2: Foam Sclerotherapy

73. Blepharoplasty	Video 73-1: Upper and Lower Lid Blepharoplasty
74. Facelift	Video 74-1: Weekend Facelift, Part 1 Video 74-2: Weekend Facelift, Part 2 Video 74-3: Weekend Facelift, Part 3
75. Approaches to Facial Wrinkles and Contouring	Video 75-1: Forehead and Eyebrow Tissue Augmentation and BTX-A to Forehead Video 75-2: Infrabrow Hollow Tissue Augmentation Video 75-3: Upper Face Botulinum Toxin Video 75-4: Temple Tissue Augmentation Video 75-5: Zygoma Augmentation Video 75-6: Tear Trough Tissue Augmentation Video 75-7: Masseters/Facial Slimming with Botulinum Toxin Video 75-8: Upper Medial Cheek Tissue Augmentation Video 75-9: Submalar Cheek Tissue Augmentation Video 75-10: Nasal Tissue Augmentation and Bunny Line BTX-A Video 75-11: Chin Augmentation Along with BTX-A to Mentalis Muscle
80. Approaches to Hand Rejuvenation	Video 80-1: Calcium Hydroxyapatite Injection: Dorsal Hand Video 80-2: Compression Sclerotherapy: Dorsal Hand
81. Approaches to Female Genital Rejuvenation	Video 81-1: Marking the Wedge Video 81-2: Labiaplasty Wedge Video 81-3: Fat Grafting

Section Editors

John G. Albertini, MD
The Skin Surgery Center
Winston-Salem, North Carolina
Greensboro, North Carolina
Volunteer Associate Professor
Department of Plastic and Reconstructive Surgery
Wake Forest University
Winston-Salem, North Carolina

Jeremy S. Bordeaux, MD, MPH
Professor of Dermatology
Director, Dermatologic Surgery
Director, Multidisciplinary Melanoma Program
Fellowship Director, Micrographic Surgery and Dermatologic Oncology
University Hospitals Cleveland Medical Center
Case Western Reserve University
Cleveland, Ohio

Leonard M. Dzubow, MD
Dermatology, Ltd.
Media, Pennsylvania

Naomi Lawrence, MD
Director, Micrographic Surgery and Cutaneous Oncology
Cooper University/Rowan Medical School
Marlton, New Jersey

Stanley J. Miller, MD
Private Practice
Towson, Maryland

Contributors

Sumaira Z. Aasi, MD
Professor
Stanford University
Director, Mohs and Dermatologic Surgery
Stanford HealthCare
Palo Alto, California

Shino Bay Aguilera, DO
Shino Bay Cosmetic Dermatology, Plastic Surgery & Laser Institute
Fort Lauderdale, Florida

Pallavi Ailawadi, MD, DNB
Senior Resident
Department of Dermatology
Maulana Azad Medical College and Lok Nayak Hospital
New Delhi, India

John G. Albertini, MD
The Skin Surgery Center
Winston-Salem, North Carolina
Greensboro, North Carolina
Volunteer Associate Professor
Department of Plastic and Reconstructive Surgery
Wake Forest University
Winston-Salem, North Carolina

Adam S. Aldahan, BS
Department of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Mohammad Almohideb, MD, MSc, FRCPC
Assistant Professor
Division of Dermatology
King Saud University for Health Sciences and King Abdulaziz Medical City
Riyadh, Saudi Arabia

Maryam M. Asgari, MD, MPH
Associate Professor
Department of Dermatology
Massachusetts General Hospital
Associate Professor
Department of Population Medicine
Harvard Medical School
Director
High Risk Skin Cancer Clinic
Boston, Massachusetts

Amanda Auerbach, MD
Dermcare and University of Massachusetts Medical School
Arlington, Massachusetts

Eileen Axibal, MD
Resident Physician
Department of Dermatology

University of Colorado Denver
Aurora, Colorado

Anna A. Bar, MD
Assistant Professor, Dermatology
Oregon Health and Science University
Portland, Oregon

Thomas M. Beachkofsky, MD
Assistant Professor
Uniformed Services University of the Health Sciences
Chief, Dermatology
MacDill Air Force Base
Tampa, Florida

Ramona Behshad, MD
Assistant Professor
Department of Dermatology
Saint Louis University
St. Louis, Missouri

Anthony V. Benedetto, DO
Dermatologic SurgiCenter
Philadelphia, Pennsylvania

Brian Berman, MD, PhD
Emeritus Professor
Departments of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida
Co-Director
The Center for Clinical and Cosmetic Research
Aventura, Florida

Vince Bertucci, MD, FRCPC
Instructor
Division of Dermatology
University of Toronto
Toronto, Canada

Ashish C. Bhatia, MD
Department of Dermatology
Northwestern University Feinberg School of Medicine
Chicago, Illinois

Samuel Book, MD
Center for Skin Surgery
Yale University Medical School
New Windsor, Connecticut

Jeremy S. Bordeaux, MD, MPH
Professor of Dermatology
Director, Dermatologic Surgery
Director, Multidisciplinary Melanoma Program
Fellowship Director, Micrographic Surgery and Dermatologic Oncology
University Hospitals Cleveland Medical Center
Case Western Reserve University
Cleveland, Ohio

James Bota, MD
Pariser Dermatology
Suffolk, Virginia

Glen M. Bowen, MD

Professor, Dermatology
Department of Dermatology
Huntsman Cancer Institute
University of Utah School of Medicine
Salt Lake City, Utah

Sean Branch, DO
Henghold Skin Health & Surgery Group
Pensacola, Florida

David G. Brodland, MD
Zitelli & Brodland, PC
Pittsburgh, Pennsylvania

Mariah Ruth Brown, MD
Assistant Professor
Department of Dermatology
University of Colorado School of Medicine
Aurora, Colorado

Richard Caesar, MA, MB BChir, FRCOphth
Consultant Surgeon
Ophthalmology Department
Gloucestershire Hospitals NHS Foundation Trust
Cheltenham, Gloucestershire, United Kingdom

David R. Carr, MD
Department of Dermatology
Ohio State University
Gahanna, Ohio

John A. Carucci, MD, PhD
Professor of Dermatology
Chief
Mohs Micrographic and Dermatologic Surgery
Program Director, Micrographic Surgery and Cutaneous Oncology Fellowship
Section of Dermatologic Surgery
NYU Langone Medical Center
New York, New York

Henry Hin Lee Chan, MD, PhD, FRCP
Division of Dermatology
Department of Medicine
University of Hong Kong
Pokfulam, Hong Kong
Wellman Center for Photomedicine
Massachusetts General Hospital
Harvard Medical School
Boston, Massachusetts

Jonathan Chan, DO
Skin and Cancer Associates
Center for Clinical and Cosmetic Research
Aventura, Florida

Kevin N. Christensen, MD
Department of Dermatology
Division of Mohs Micrographic Surgery
Winona Health
Winona, Minnesota
Department of Dermatology
Allina Health Bandana Square Clinic
Saint Paul, Minnesota

Melanie A. Clark, MD
Department of Dermatology
Medical College of Wisconsin
Milwaukee, Wisconsin

Brandon Coakley, MD
Dermatology and Laser Center of Charleston
Charleston, South Carolina

Terrence A. Cronin, Jr., MD
Assistant Voluntary Professor
Departments of Dermatology and Cutaneous Surgery
University of Miami
Miami, Florida
Cronin Skin Cancer Center
Melbourne, Florida

Min Deng, MD
Assistant Professor
Department of Medicine
Section of Dermatology
WVU Medicine
Morgantown, West Virginia

Seemal R. Desai, MD
Founder and Medical Director
Innovative Dermatology
Plano, Texas
Clinical Assistant Professor
The University of Texas Southwestern Medical Center
Dallas, Texas

Marie DiLauro, MD
Private Practice
Columbus, Ohio

Matthias B. Donelan, MD
Chief
Shriners Burn Hospital for Children
Plastic Surgery
Massachusetts General Hospital
Boston, Massachusetts

Jessica M. Donigan, MD
Department of Dermatology
University of Utah
Salt Lake City, Utah

Keith L. Duffy, MD
Department of Dermatology
University of Utah
Salt Lake City, Utah

Leonard M. Dzubow, MD
Dermatology, Ltd.
Media, Pennsylvania

Daniel B. Eisen, MD
Director of Dermatologic Surgery
Professor of Clinical Dermatology
Department of Dermatology
University of California, Davis
Davis, California

Dirk M. Elston, MD
Professor and Chairman
Department of Dermatology
Medical University of South Carolina
Charleston, South Carolina

Jason Emer, MD
Private Practice
Beverly Hills, California

Derek J. Erstad, MD
Department of Surgery
Massachusetts General Hospital
Boston, Massachusetts

Jeremy R. Etzkorn, MD
Assistant Professor
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Sabrina G. Fabi, MD, FAACS
Volunteer Assistant Clinical Professor
University of California
Cosmetic Laser Dermatology
San Diego, California

Aaron S. Farberg, MD
Department of Dermatology
Icahn School of Medicine at Mount Sinai
New York, New York

Bessam Farjo, MBChB, ABHRS
Farjo Hair Institute
Manchester, United Kingdom

Nilofer Farjo, MBChB, ABHRS
Farjo Hair Institute
Manchester, United Kingdom

Ramin Fathi, MD
Resident Physician
Department of Dermatology
University of Colorado Denver
Aurora, Colorado

Jennifer A. Fehlman, MD
Department of Dermatology
Saint Louis University
St. Louis, Missouri

Jessica Lori Feig, MD
Department of Dermatology
Johns Hopkins University
Baltimore, Maryland

Michael Frank, MD
Dermatology Associates
Portland, Maine

Alice Frigerio, MD, PhD
Department of Dermatology
University of Utah

Salt Lake City, Utah

Katherine Garrity, MD
Staff Dermatologist
Aurora Health Care
Summit, Wisconsin

Luis Garza, MD, PhD
Associate Professor
Department of Dermatology
Johns Hopkins School of Medicine
Attending Physician
Department of Dermatology
Johns Hopkins Hospital
Baltimore, Maryland

Hayes B. Gladstone, MD
Gladstone Clinic
San Ramone, California

Alexandria B. Glass, DO
Dermatology Fellow
Center for Clinical and Cosmetic Research
Aventura, Florida

Alex M. Glazer, MD
Resident
Division of Dermatology
University of Arizona
Tucson, Arizona

Michael H. Gold, MD
Medical Director
Gold Skin Care Center
Nashville, Tennessee

David J. Goldberg, MD, JD
Director
Skin Laser & Surgery Specialists of New York and New Jersey
Clinical Professor of Dermatology
Department of Dermatology
Icahn School of Medicine at Mt. Sinai
New York, New York

Dori Goldberg, MD
Department of Dermatology
University of Massachusetts
Worcester, Massachusetts

Glenn D. Goldman, MD
Professor and Chief of Dermatology
University of Vermont College of Medicine
Burlington, Vermont

Ann F. Haas, MD
Senior Dermatologist
Sutter Medical Group
Associate Clinical Professor
Department of Dermatology
University of California, Davis
Sacramento, California

Adele Haimovic, MD
SkinCare Physicians

Chestnut Hill, Massachusetts

Christine A. Hamori, MD, FACS
Board Certified Plastic Surgeon
Director and Founder
Cosmetic Surgery and Skin Spa
Duxbury, Massachusetts

Iltefat H. Hamzavi, MD
Senior Staff Physician
Department of Dermatology
Henry Ford Hospital
Detroit, Michigan

Marc Z. Handler, MD
Procedural Dermatology Fellow
Skin Laser & Surgery Specialists of New York and New Jersey
Hackensack, New Jersey

David T. Harvey, MD
Instructor
Department of Dermatology
Emory University School of Medicine
Atlanta, Georgia
Medical Director
Dermatology Institute for Skin Cancer + Cosmetic Surgery
Newnan, Georgia

Emma Elizabeth Harvey
Dermatology Institute for Skin Cancer + Cosmetic Surgery
Newnan, Georgia

Amelia K. Hausauer, MD
Director of Dermatology
Aesthetx
Campbell, California

Ingrid Herskovitz, MD
Department of Dermatology and Cutaneous Surgery
University of Miami Miller School of Medicine
Miami, Florida

H. William Higgins, MD
Department of Dermatology
Brown University
Providence, Rhode Island

Molly Hinshaw, MD
Associate Professor of Dermatology
Department of Dermatology
University of Wisconsin School of Medicine and Public Health
Madison, Wisconsin

Chad M. Hivnor, MD
Assistant Professor
Uniformed Services University of the Health Sciences
Department of Dermatology
San Antonio Military Health System
San Antonio, Texas
Dermatologist
Dermatology Associates of San Antonio
San Antonio, Texas

Baran Ho, MD

Department of Dermatology
University of California-Davis
Sacramento, California

S. Tyler Hollmig, MD
Clinical Associate Professor
Department of Dermatology
Director of Laser and Aesthetic Dermatology
Stanford University Medical Center
Redwood City, California

George Hruza, MD, MBA
Laser & Dermatologic Surgery Center
St. Louis, Missouri

Olivia Hughes, BS
Department of Dermatology and Cutaneous Surgery
University of Miami Miller School of Medicine
Miami, Florida

Shannon Humphrey, MD
Clinical Assistant Professor
Director of Continuing Medical Education
Department of Dermatology and Skin Science
University of British Columbia
Medical Director
Carruthers & Humphrey Cosmetic Dermatology
Vancouver, British Columbia, Canada

Jared Jagdeo, MD, MS
Department of Dermatology
University of California-Davis
Sacramento, California

Benjamin Jones, MD
Department of Dermatology
University of Utah
Salt Lake City, Utah

Derek H. Jones, MD
Founder and Director
Skin Care and Laser Physicians of Beverly Hills
Clinical Associate Professor
Department of Dermatology
University of California
Los Angeles, California

Isabela T. Jones, MD
McLean Dermatology
McLean, Virginia

Stephanie E. Kaiser, MD, PA-C
Dermatology and Laser Center of San Antonio
San Antonio, Texas

Penelope Kallis, BS, BA
Department of Dermatology and Cutaneous Surgery
University of Miami Miller School of Medicine
Miami, Florida

Jonathan Kantor, MD, MSCE, MA
Adjunct Assistant Professor of Dermatology
Perelman School of Medicine
University of Pennsylvania

Philadelphia, Pennsylvania
Medical Director
Florida Center for Dermatology, P.A.
St. Augustine, Florida

Caroline C. Kim, MD
Assistant Professor
Department of Dermatology
Harvard Medical School
Boston, Massachusetts
Director
Pigmented Lesion Clinic
Associate Director
Cutaneous Oncology Program
Department of Dermatology
Beth Israel Deaconess Medical Center
Boston, Massachusetts

Robert S. Kirsner, MD, PhD
Chairman and Harvey Blank Professor
Departments of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Lucija Kroepfl, MBChB
Private Practice
Skinthetics Dermatology Clinic
Düsseldorf, Germany

Ka Yee Kung, MBBS (HK), MRCP (UK), FHKAM (Med)
Division of Dermatology
Department of Medicine
University of Hong Kong
Pokfulam, Hong Kong

Joy Kunishige, MD
Department of Plastic Surgery
University of Pittsburgh Medical Center
Zitelli & Brodland Skin Cancer Center
Zitelli & Brodland, PC
Pittsburgh, Pennsylvania

Nirusha Lachman, PhD
Professor of Anatomy
Departments of Anatomy and Surgery
Division of Plastic Surgery
Mayo Clinic College of Medicine and Science
Mayo Clinic
Rochester, Minnesota

Rebecca J. Larson, MD
Assistant Professor of Dermatology and Dermatologic Surgery
Division of Dermatology
Southern Illinois University School of Medicine
Springfield, Illinois

Gary Lask, MD
Clinical Professor
Director, Dermatology Laser Center
Director, Mohs' Micrographic Skin Cancer Surgery Unit
Director, Procedural Dermatology Fellowship
Division of Dermatology/Dermatologic Surgery
University of California, Los Angeles (UCLA)

Los Angeles, California

Naomi Lawrence, MD
Director, Micrographic Surgery and Cutaneous Oncology
Cooper University/Rowan Medical School
Marlton, New Jersey

Brian C. Leach, MD
The Skin Surgery Center and Department of Dermatology
Medical University of South Carolina
Charleston, South Carolina

Patrick K. Lee, MD
Professor
Director, Dermatologic Surgery
Co-Director, Micrographic Surgery and Dermatologic Oncology Fellowship
Associate Residency Program Director
Department of Dermatology
University of California
Irvine, California

Sandra Lee, MD
Private Practice
Skin Physicians & Surgeons
Upland, California

Michael S. Lehrer, MD
Clinical Associate Professor
Department of Dermatology
Hospital of the University of Pennsylvania
Philadelphia, Pennsylvania

Justin J. Leitenberger, MD
Department of Dermatology
Oregon Health & Science University
Portland, Oregon

Ilya Lim, MD
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Flor MacQuhae, MD
Department of Dermatology and Cutaneous Surgery
University of Miami Miller School of Medicine
Miami, Florida

Andrea D. Maderal, MD
Department of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Ian A. Maher, MD
Associate Professor
Department of Dermatology
Saint Louis University
St. Louis, Missouri

Anne M. Mahoney, MD
Advanced Dermatology
Lincolnshire, Illinois

Mary E. Maloney, MD

Professor and Chair
Department of Dermatology
University of Massachusetts Medical School
UMass Memorial Medical Center
Worcester, Massachusetts

Stephanie J. Martin, MD
Division of Dermatology/Dermatologic Surgery
University of California, Los Angeles (UCLA)
Los Angeles, California
Department of Dermatology
VA Greater Los Angeles Healthcare System
Los Angeles, California

Peter L. Mattei, MD
Pinehurst Surgical
Pinehurst, North Carolina

Michael R. Migden, MD
Associate Professor, Departments of Dermatology and Head and Neck Surgery
Mohs Surgery Center
Fellowship Director, Micrographic Surgery and Dermatologic Oncology
The University of Texas
MD Anderson Cancer Center
Houston, Texas

Philip Milam, MD
Department of Dermatology
Ohio State University
Gahanna, Ohio

Nathanial R. Miletta, MD
Assistant Professor
Uniformed Services University of the Health Sciences
Chief
Laser Surgery and Scar Center
San Antonio Military Health System
San Antonio, Texas

Alexander Miller, MD
Private Practice
University of California-Irvine
Yorba Linda, California

Christopher J. Miller, MD
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Stanley J. Miller, MD
Private Practice
Towson, Maryland

Stephanie Mlacker, BS
Department of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Tasneem F. Mohammad, MD
Dermatology Resident
Department of Dermatology
Henry Ford Hospital

Detroit, Michigan

Eduardo K. Moioli, MD, PhD
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Amanda F. Nahhas, DO
Clinical Research Fellow in Dermatology
Department of Dermatology
Henry Ford Hospital
Detroit, Michigan

Omar Nazir, MD
Assistant Professor
Department of Orthopedic Surgery
Oregon Health & Science University
Portland, Oregon

Mark S. Nestor, MD, PhD
Director, Center for Clinical and Cosmetic Research
Director, Center for Cosmetic Enhancement
Aventura, Florida
Voluntary Associate Professor
Department of Dermatology and Cutaneous Surgery
Department of Surgery
Division of Plastic Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Joe Niamtu, III, DMD
Private Practice
Cosmetic Facial Surgery
Richmond, Virginia

Luke Nicholas, MD
Department of Dermatology
University of Massachusetts
Worcester, Massachusetts

Keyvan Nouri, MD
Tenure Professor
Departments of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Sylvester Comprehensive Cancer Center
Miami, Florida

Wojciech Pawlina, MD
Professor and Chair
Department of Anatomy
Mayo Clinic College of Medicine
Rochester, Minnesota

Clifford Perlis, MD
Associate Professor (Clinical)
Keystone Dermatology Partners and Department of Dermatology
Temple University Lewis Katz School of Medicine
King of Prussia, Pennsylvania

Christine Poblete-Lopez, MD
Clinical Associate Professor
Lerner College of Medicine

Vice Chair
Department of Dermatology
Cleveland Clinic
Cleveland, Ohio

Renelle Pointdujour-Lim, MD
Oculoplastic and Orbital Surgery Department
Wills Eye Hospital at Thomas Jefferson University Hospital
Philadelphia, Pennsylvania

Kucy Pon, MD, FRCPC
Assistant Professor
Division of Dermatology
University of Toronto
Toronto, Canada

E. P. Prens, PhD, MD
Professor of Dermatology
Department of Dermatology
Erasmus University Medical Center
Rotterdam, Netherlands

Kevin Prier, MD
Medical Student
The University of Texas Southwestern Medical Center
Dallas, Texas

Michael P. Rabinowitz, MD
Oculoplastic and Orbital Surgery Department
Wills Eye Hospital at Thomas Jefferson University Hospital
Philadelphia, Pennsylvania

Ross C. Radusky, MD
SoHo Skin and Laser
New York, New York

Rachel Redenius, MD
Department of Dermatology
University Hospitals of Cleveland
Cleveland, Ohio

Karen E. Revere, MD
Assistant Professor
Oculoplastic and Orbital Surgery
Department of Ophthalmology
Children's Hospital of Philadelphia
Assistant Professor
Department of Ophthalmology
Scheie Eye Institute
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Bertrand Richert, MD, PhD
Professor of Dermatology
Department of Dermatology and Venereology
Brugmann-St Pierre - Queen Fabiola Children's University Hospitals
Université Libre de Bruxelles
Brussels, Belgium

Darrell S. Rigel, MD
Rigel Dermatology Group and Department of Dermatology
New York University

New York, New York

Ashley Rudnick, BS
Miami, Florida

Neil Sadick, MD
Sadick Dermatology
New York, New York

Rashmi Sarkar, MD, MNAMS
Professor
Department of Dermatology
Maulana Azad Medical College and Lok Nayak Hospital
New Delhi, India

Deborah S. Sarnoff, MD
Cosmetique Dermatology Laser
New York, New York

Amy J. Schutte, MD
Chief Resident
Division of Dermatology
Southern Illinois University School of Medicine
Springfield, Illinois

Golsa Shafa, BS
Department of Dermatology and Cutaneous Surgery
University of Miami, Miller School of Medicine
Miami, Florida

Sejal Shah, MD
SmarterSkin Dermatology
New York, New York

Basel Sharaf, DDS, MD
Department of Surgery
Division of Plastic Surgery
Mayo Clinic
Rochester, Minnesota

Allen F. Shih
MD/MBA candidate
Yale University School of Medicine
New Haven, Connecticut

Thuzar M. Shin, MD, PhD
Assistant Professor of Dermatology
Department of Dermatology
University of Pennsylvania
Philadelphia, Pennsylvania

Melissa Shive, MD, MPH
Department of Dermatology
University of California-Irvine
Irvine, California

Sirunya Silapunt, MD
Associate Professor
Department of Dermatology
University of Texas McGovern Medical School at Houston
Houston, Texas

Cassandra J. Simonetta, MD
Department of Dermatology

Saint Louis University
St. Louis, Missouri

Joseph F. Sobanko, MD
Director of Dermatologic Surgery Education
Department of Dermatology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

Teo Soleymani, MD
Department of Dermatology
Stanford University
Redwood City, California

Luis Soro, DO
Shino Bay Cosmetic Dermatology, Plastic Surgery & Laser Institute
Fort Lauderdale, Florida

Mary L. Stevenson, MD
Department of Dermatology
New York University Langone Medical Center
New York, New York

Molly Storer, MS
Department of Dermatology
Massachusetts General Hospital
Boston, Massachusetts

Lauren C. Strazzulla, BA
New York University School of Medicine
New York, New York

Carolyn Stull, MD
Department of Medicine
Drexel University
Philadelphia, Pennsylvania

Rie Takahashi, MD, PhD
Specialty Training and Advanced Research (STAR) Fellow
Division of Dermatology/Dermatologic Surgery
University of California, Los Angeles (UCLA)
Los Angeles, California

Kathryn J. Tan, MD
Clinical and Cosmetic Fellow
Department of Dermatology
Icahn School of Medicine of Mount Sinai
New York, New York

Kenneth K. Tanabe, MD
Professor of Surgery
Harvard Medical School
Chief
Division of Surgical Oncology
Massachusetts General Hospital
Deputy Clinical Director
Massachusetts General Hospital Cancer Center
Boston, Massachusetts

Aashish Taneja, MD
Fine Skin
Orland Park, Illinois

Vahe Tirakyan
Infusio Beverly Hills
Beverly Hills, California

Emily Tongdee, BS
Florida International University
Herbert Wertheim College of Medicine
Miami, Florida

H. H. van der Zee, MD, PhD
Dermatologist
Department of Dermatology
Erasmus University Medical Center
Rotterdam, Netherlands

Amy Vandiver, MD, PhD
Student
Department of Dermatology
Johns Hopkins University School of Medicine
Baltimore, Maryland

K. R. van Straalen, MD
PhD student
Department of Dermatology
Erasmus University Medical Center
Rotterdam, Netherlands

Gian L. Vinelli, MD
Department of Dermatology
Icahn School of Medicine at Mount Sinai
New York, New York

A. R. J. V. Vossen, MD
PhD student
Department of Dermatology
Erasmus University Medical Center
Rotterdam, Netherlands

Jill S. Waibel, MD
Private practice
Miami Dermatology and Laser Institute
Miami, Florida
Subsection Chief of Dermatology
Baptist Hospital
Miami, Florida
Voluntary Assistant Professor
Dermatology Faculty
University of Miami, Miller School of Medicine
Miami, Florida

Abigail Waldman, MD
Department of Dermatology
Brigham and Women’s Hospital
Boston, Massachusetts

Heidi A. Waldorf, MD
Associate Clinical Professor
Dermatology
Icahn School of Medicine of Mount Sinai
Private Practice
Waldorf Dermatology Aesthetics
Nanuet, New York

Margaret A. Weiss, MD
Maryland Dermatology Laser, Skin, & Vein Institute
Hunt Valley, Maryland

J. Michael Wentzell, MD
North Sound Dermatology
Mill Creek, Washington

Andrea Willey, MD
Director
Surgical & Aesthetic Dermatology
Mohs & Reconstructive Surgery
Sacramento, California

Greg Williams, MBBS, FRCS (Plast), ABHRS
Farjo Hair Institute
London, United Kingdom

Douglas C. Wu, MD, PhD
Private Practice
Cosmetic Laser Dermatology
San Diego, California

Allan E. Wulc, MD, FACS
Associate Clinical Professor
Department of Ophthalmology
Perelman School of Medicine
University of Pennsylvania
Philadelphia, Pennsylvania

John A. Zitelli, MD
Adjunct Clinical Associate Professor
Departments of Dermatology, Otolaryngology, and Plastic Surgery
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania

Preface

Dermatologic surgery is a young field. During the past four decades, dermatology has pivoted from a primarily medical specialty to an organ-based medical and surgical subspecialty.

Dermatologic surgeons in the United States now not only perform more surgical excisions and linear repairs for skin cancer than all other specialists combined, but the majority of local flaps and grafts as well. At the same time, dermatologic surgeons have wholeheartedly embraced an evidence-based approach to surgical care, and the dramatic expansion in everything from clinical trials to survey studies during the past few decades has been astonishing.

Similarly, aesthetic dermatology has undergone an expansionist trend, with studies suggesting that dermatologists are increasingly seen as the experts of choice for cosmetic procedures.

There are many outstanding dermatologic surgery textbooks both in and out of print, and ideally the reader—whether a budding dermatologic surgeon or a wizened expert—should pore over as many of these as possible.

One of the goals for this text was to produce a book that, at least in rough measure, would reflect the proportion of time, effort, and training required for any given subject. Thus, for example, no fewer than five full chapters (in addition to numerous other sections) are dedicated to Mohs surgery. Similarly, a total of 17 richly illustrated chapters, including those devoted to particular flap techniques and regional approaches to reconstruction, address flap and graft closures, because exposure to a breadth of approaches may be transformative in allowing the trainee to develop a surgical eye. Since anatomy is the foundation on which all surgery is built, the anatomy chapter is centered on a true ground-up cadaveric study of head and neck anatomy with an eye to clinical relevance.

Dermatologic Surgery is, therefore, a bridge text, with the benefits of a single-volume multiauthor global dermatologic surgery textbook coupled with the strengths of a dedicated flap and reconstructive text. It includes not only flap chapters but reconstructive chapters for specific anatomic locations as well. This combination provides both fundamental flap technique didactics and a regional reconstructive approach, which cements the breadth of reconstructive options available to the dermatologic surgeon.

Diversity in dermatology is important, not only for surgeons, but for patients as well. Thus, this text includes a chapter focused on ethnic and gender differences in filler use, a chapter on laser use in skin of color, and a detailed chapter on the burgeoning field of female genital rejuvenation. The world of dermatologic surgery is changing rapidly, and therefore chapters on ethics, billing and financial considerations, clinical research, radiation therapy, body contouring, and others have been included. Cosmetic dermatologic surgery is a rapidly evolving field; therefore, this text takes a real-world approach to the use of fillers and neuromodulators, since the majority of their use in dermatologic surgery is outside of the narrow confines of FDA-approved indications.

By devoting special sections to surgical treatments by disease state for everything from melanoma and dysplastic nevi to hidradenitis and vitiligo, both a forward- and backward-referencing capability are added. Similarly, for cosmetic treatments, the book includes chapters that are centered not only on a given treatment (vascular lasers, dermabrasion, or fillers) but also by condition or concern, so that the reader can learn approaches both from the ground up and in a natural didactic fashion based on the patient's presenting concerns.

Full-length high-quality videos are an essential adjunct to learning procedural techniques, and this text is accompanied by the largest video resource of its kind ever compiled. This resource, coupled with close to 3,000 high-quality clinical photographs and nearly 500 professional medical illustrations, including infographics with surgical pearls for each chapter—with many pearls stratified by beginner tips, expert tips, cautions, patient education points, and even billing tips—help make this text truly unique.

Finally, this text is the first of its kind to include a chapter dedicated solely to laser treatment for burns and trauma. This chapter should serve as a resource and inspiration for clinicians eager to help those who may stand to benefit the most from some of the techniques discussed throughout this book.

I am honored to have an all-star cast of section editors who helped with recruiting chapter authors. These section editors include prominent academic and private-practice dermatologic surgeons who, among other honors, have served as president of the American Board of Dermatology, president of the American College of Mohs Surgery (two of the section editors), president of the American Society for Dermatologic Surgery, and editor in chief of the *Dermatologic Surgery* journal.

Jonathan Kantor, MD, MSCE, MA

Credits for Figures

The following figures have been used with permission from these McGraw-Hill Education publications:

Goldman GD, Dzubow LM, Yelverton CB. *Facial Flap Surgery*. New York: McGraw-Hill Education; 2013:
Chapter 20: Figures 20-5 and 20-6.
Chapter 21: Figures 21-1, 21-2, 21-3, 21-4 parts A, B, and E, 21-16, and 21-20.
Chapter 22: Figure 22-4.
Chapter 23: Figures 23-7, 23-8, 23-13, and 23-18.
Chapter 27: Figure 27-1.
Chapter 35: Figure 35-5.
Chapter 40: Figures 40-21, 40-22, 40-23, 40-24, 40-25, 40-26, 40-27, 40-28, 40-29, 40-30, 40-31, 40-32, 40-33, 40-34, 40-35, 40-36, 40-37, 40-38, 40-39, 40-40, 40-41, 40-42, 40-43, 40-44, 40-45, 40-46, 40-47, 40-48, 40-50, 40-51, 40-52, and 40-53.
Chapter 41: Figure 41-15 part D.

Hadzic A. *Hadzic's Peripheral Nerve Blocks and Anatomy for Ultrasound-Guided Regional Anesthesia*. 2nd ed. New York: McGraw-Hill Education; 2012:
Chapter 45: Figures 45-6 and 45-8.

Kantor J. *Atlas of Suturing Techniques: Approaches to Surgical Wound, Laceration, and Cosmetic Repair*. New York: McGraw-Hill Education; 2016:
Chapter 6: Figures 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7, 6-8, 6-9, 6-10, 6-11, 6-12, 6-13, 6-14, 6-15, 6-16, 6-17, 6-18, 6-19, 6-20, 6-21, 6-22, 6-23, 6-24, and 6-25.
Chapter 13: Figures 13-1, 13-2, 13-3, 13-4, 13-5, 13-6, 13-7, 13-8, 13-9, 13-10, 13-11, 13-12, 13-13, 13-14, 13-15, 13-16, 13-17, 13-18, 13-19, 13-20, 13-21, 13-22, 13-23, 13-24, 13-25, 13-26, 13-27, 13-28, and 13-29.
Chapter 18: Figures 18-27 and 18-33.
Chapter 19: Figure 19-8.
Chapter 31: Figure 31-4 parts A and B.

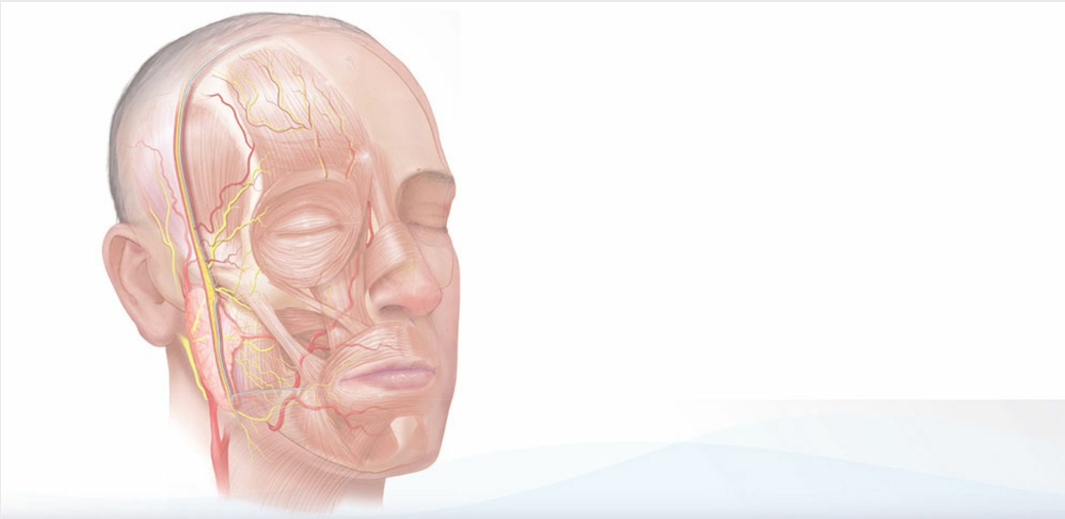
Morton DA, Foreman KB, Albertine KH. *The Big Picture: Gross Anatomy*. New York: McGraw-Hill Education; 2011:
Chapter 45: Figure 45-7.

Part I

FUNDAMENTALS

CHAPTER 1 Surgical Anatomy, Surface Anatomy, and Cosmetic Subunits

Nirusha Lachman
Wojciech Pawlina
Basel Sharaf
Kevin N. Christensen



SUMMARY

- Conceptualizing superficial anatomy as a three-dimensional-layered system helps understand the course and location of important neurovascular structures as they travel in a stepwise pattern in and between the muscular, bony and fascial planes to reach their terminal areas of supply and innervation.
- When approaching anatomically susceptible regions ("danger zones"), understanding the depth, course, and relation of these structures as they traverse anatomical boundaries provides the key to successful surgery.

Beginner Pearls

- Striated muscles of the face (muscles of facial expression) produce movement of the overlying soft tissue by creating tension transmitted by fibrous strands (retinacula) that connect the SMAS to the skin.
- Facial nerve branches, while generally protected by the SMAS, are surgically vulnerable as they reach areas of transition along their course toward their final destination.
- The forehead and temple are functionally related to the scalp, and through SMAS can easily glide over the skull.

Expert Pearls

- The internal carotid artery via its ophthalmic branch supplies a central triangular area including the eyes, superior nose, and central portion of the forehead.
- The angular artery and vein cross the medial canthal tendon and contribute to an important site of anastomosis just superior to the tendon between branches of the external carotid (facial artery) and internal carotid (ophthalmic artery).
- Nasal blood supply is mainly from the angular artery externally and the sphenopalatine artery internally, with smaller contributions from the superior labial and ophthalmic arteries.
- The parotid gland is contained within a shiny, tight fascial sheath (the parotid fascia), which helps differentiate it from fat.

Don't Forget!

- The key area of anastomosis between the external and internal carotid arteries is located above the medial canthal tendon where the angular artery communicates with the dorsal nasal branch of the ophthalmic artery.
- Both the facial artery and the marginal branch of the facial nerve lie deep to the fibers of the platysma.

Pitfalls and Cautions

- Erb's point, located 6 cm below the midpoint of a line connecting the angle of the mandible with the mastoid process, provides a landmark for the exit point of the superficial cervical nerves and the accessory nerve (cranial nerve XI).
- The mandibular branch of the facial nerve crosses over the facial artery about 5 to 10 mm above the point at which the facial artery crosses the mandible.

CHAPTER 1 Surgical Anatomy, Surface Anatomy, and Cosmetic Subunits

INTRODUCTION

Successful surgical reconstruction of the skin and soft tissues involves an understanding of the architecture of the superficial face and how to maintain its natural anatomy following surgical manipulation. Anatomically, the superficial face displays significant variation in skin thickness, texture, color, subcutaneous fat, and laxity.

Naturally occurring lines divide the face into demarcated areas referred to as cosmetic units. As these cosmetic units tend to display anatomical homogeneity, surgical repair for ideal cosmetic outcome should be based on preservation of the subunits by maintaining incision lines along or within natural contour lines. Cosmetic units are demarcated by contour lines that divide the face anteriorly into the (1) forehead, (2) nose, (3) cheeks, (4) eyes, and (5) lip. Anterolaterally, contour lines bound the (6) cheeks and laterally the (7) ears. Each of these areas is then divided into subunits.

The description of the anatomy is based on visualization of structures as they travel from one anatomical plane to another along their course and distribution. It is important to keep in perspective the changing relationships that exist between the fascial, superficial, and deep muscle layers and the important traversing neurovascular structures. As these relationships are mostly predictable, a thorough understanding of the underlying anatomy within the operative field limits hesitation and improves surgical confidence.

KEY PRINCIPLES FOR UNDERSTANDING FACIAL ANATOMY

Relaxed skin tension lines of the face

Striated muscles of the face (muscles of facial expression) produce the movement of the overlying soft tissue by creating tension transmitted by fibrous strands (retinacula) that connect the superficial musculoaponeurotic system (SMAS) to the skin. In younger individuals, this tension is opposed by elastic fibers within the skin. With progressive aging, however, changes in the configuration of collagen fibers and the decreased ability of the elastic fibers to resist this tension result in the formation of wrinkle lines along these retinacula attachments. Relaxed skin tension lines (RSTLs), therefore, run perpendicular to the underlying muscle fibers; for example, wrinkle lines on the forehead run horizontally since the frontalis muscle contracts vertically.

Understanding the profiles of RSTLs is a key element in surgical planning with the goal of minimizing visible scarring. Techniques for scar reduction have been well described in the literature, and one principle is to align the long axis of the repair within or as close as possible to the RSTL to promote merging of the scar into the wrinkle line. While RSTLs are typically more pronounced and easily identifiable in elderly patients, the application of the anatomical arrangement of the underlying muscle fibers and its directional relationship to the fibrous septa is helpful in accentuating RSTLs when not easily identifiable. Therefore, having patients perform exaggerated facial expressions will expose these lines, while gentle manipulation of the skin may also highlight RSTLs (Fig. 1-1).

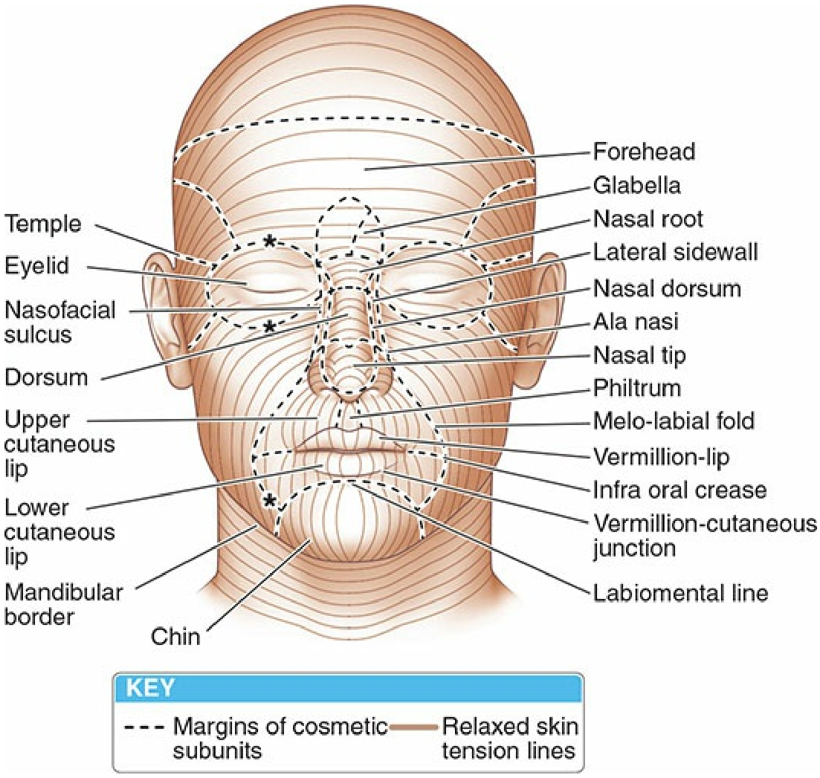


Figure 1-1. Diagram illustrating cosmetic subunit boundaries and relaxed skin tension lines.

UNDERSTANDING THE FASCIAL PLANES OF THE FACE AND NECK

The anatomy of the face and its subunits presents itself through a distinct arrangement of fascial planes that enclose subcutaneous tissue, superficial muscles, nerves, and blood vessels. Deconstructing the complex relationships that exist between these planes provides a view of the course and relations of vascular networks and important traversing branches of the superficial motor and sensory nerves. Understanding and predicting the trajectory of the branches of an intricate plexus of motor and sensory nerves within the muscular architecture is crucial to minimizing complications associated with dermatologic surgery.

A few basic concepts are strategic to predicting potential challenges that accompany surgical manipulation of the superficial face:

1. The face can be dissected through principle fascial planes that consist of skin, subcutaneous fibroadipose layer, SMAS, space containing traversing nerves and retaining ligaments, and deep fascial layer (Fig. 1-2).[1,2]

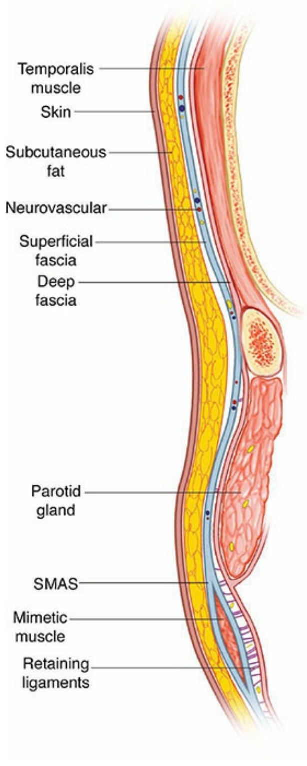


Figure 1-2. Conceptual illustration demonstrating layers of the face from superficial to deep. (By permission of Mayo Foundation for Medical Education and Research. All rights reserved).

2. Muscles of facial expression are not set within the same architectural plane. They are attached to the dermis and are reinforced by retaining ligaments while maintaining an arrangement within a stepped configuration (Fig. 1-3).[2]

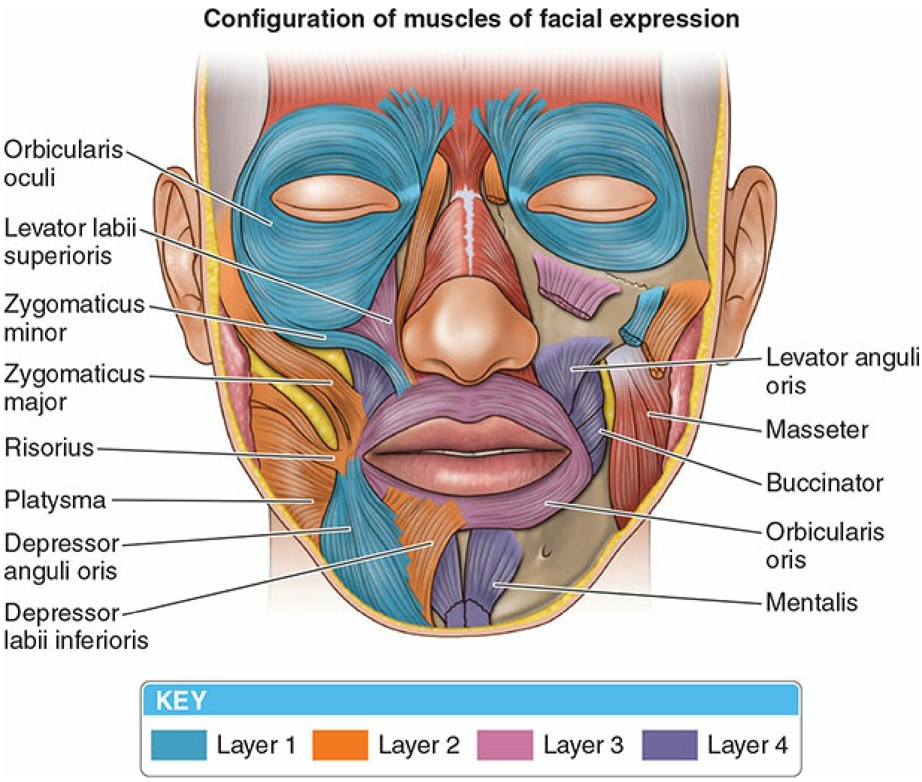


Figure 1-3. Diagram illustrating stepped configuration and arrangement of muscles of facial expression (mimetic muscles).

3. Exiting branches of the facial nerve are the principal motor suppliers of the muscles of facial expression and they tend to innervate these muscles through their deep surfaces, overlying muscles only as they traverse from their points of origin to innervation (Fig. 1-4).[3,4]

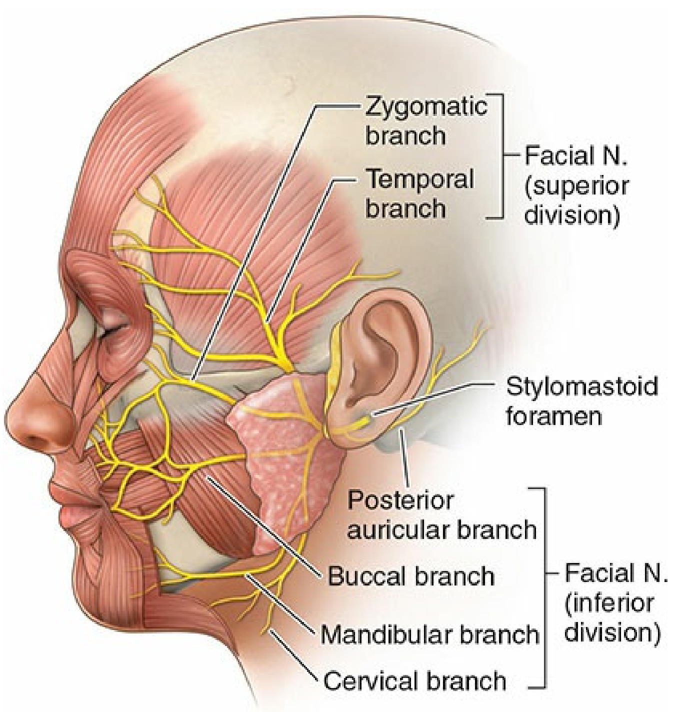


Figure 1-4. Diagram illustrating standard pattern of distribution of branches of the facial nerve.

4. Facial nerve branches exit the parotid fascia along its anterior margin, often networking as they travel from a deep to superficial plane, while still lying deep to the SMAS plane (Fig. 1-5).[5]

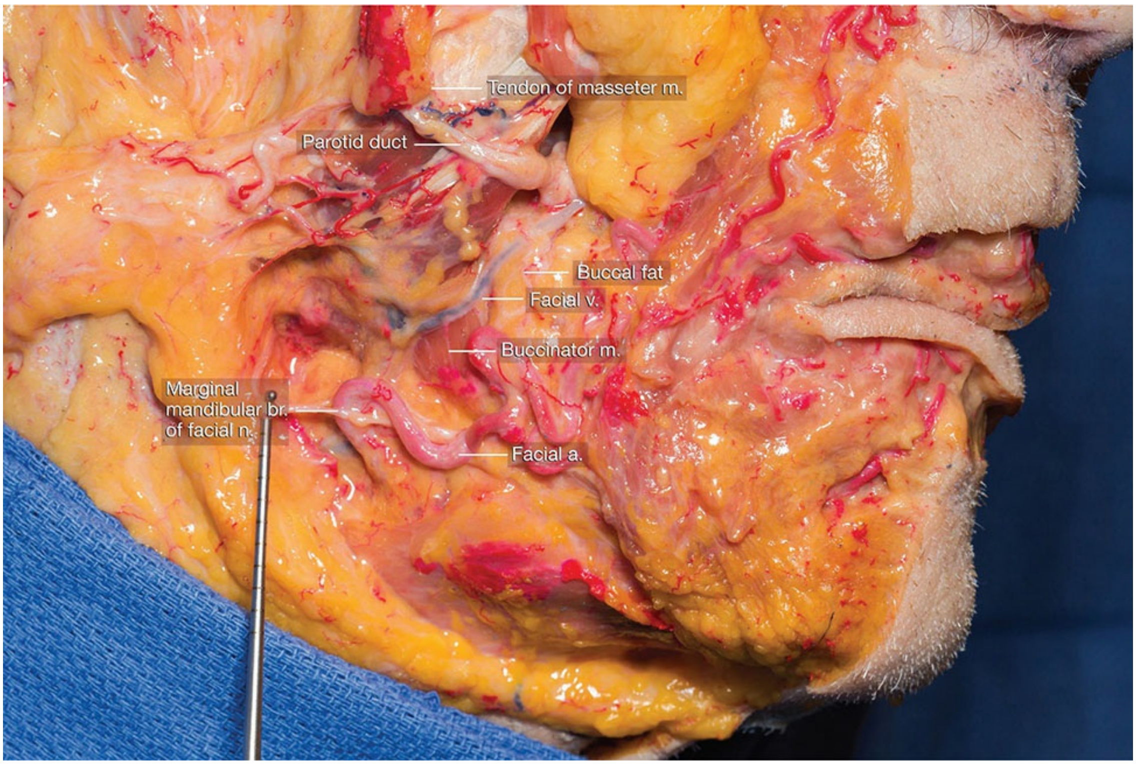


Figure 1-5. Deep dissection of facial nerve with reflected upper portion of parotid gland.

5. Facial nerve branches divide into a variable number of rami, and in the mid-lateral face form a plexus of interconnected communications including connections between the facial nerve and the trigeminal nerve branches (Fig. 1-6).[5,6]

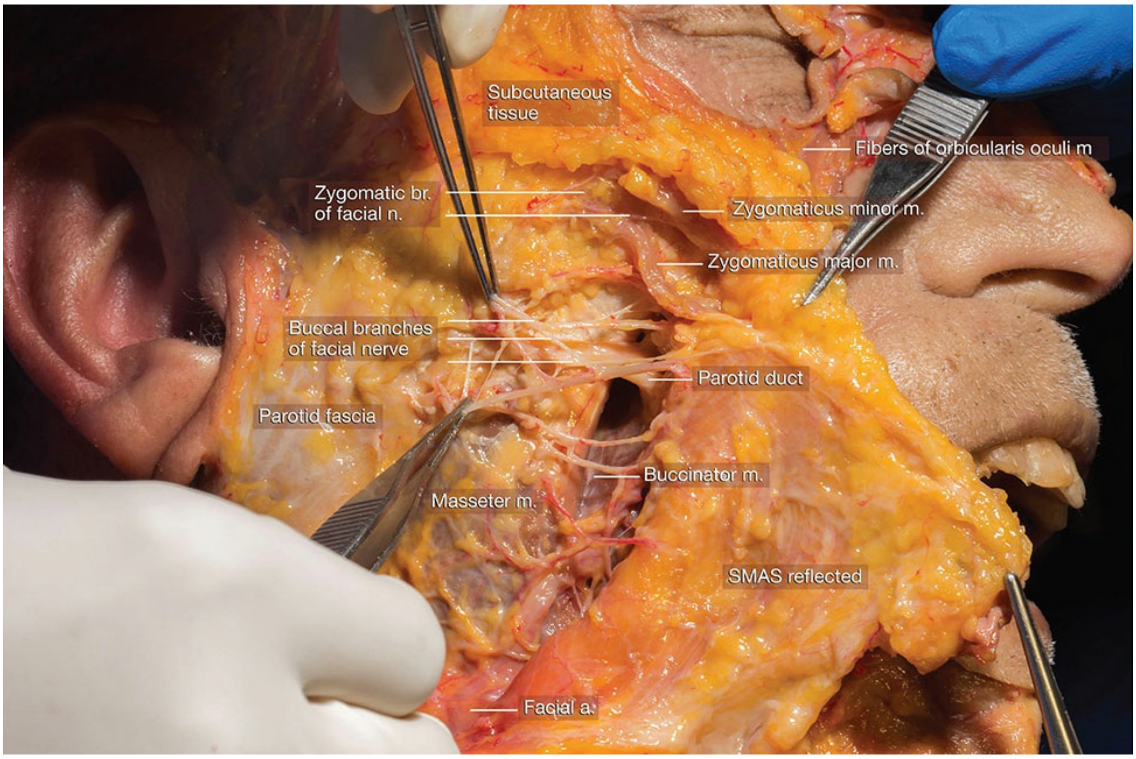


Figure 1-6. Dissection of facial nerve deep to SMAS.

6. While the SMAS splits to enclose muscles of facial expression, it remains continuous with fascia of the platysma, superficial parotid fascia, galea aponeurotica, and superficial temporal fascia (temporoparietal fascia) (Fig. 1-2).[7]
7. While the superficial temporal vessels are contained within the SMAS, the sub-SMAS plane remains relatively avascular (Fig. 1-7).[7]

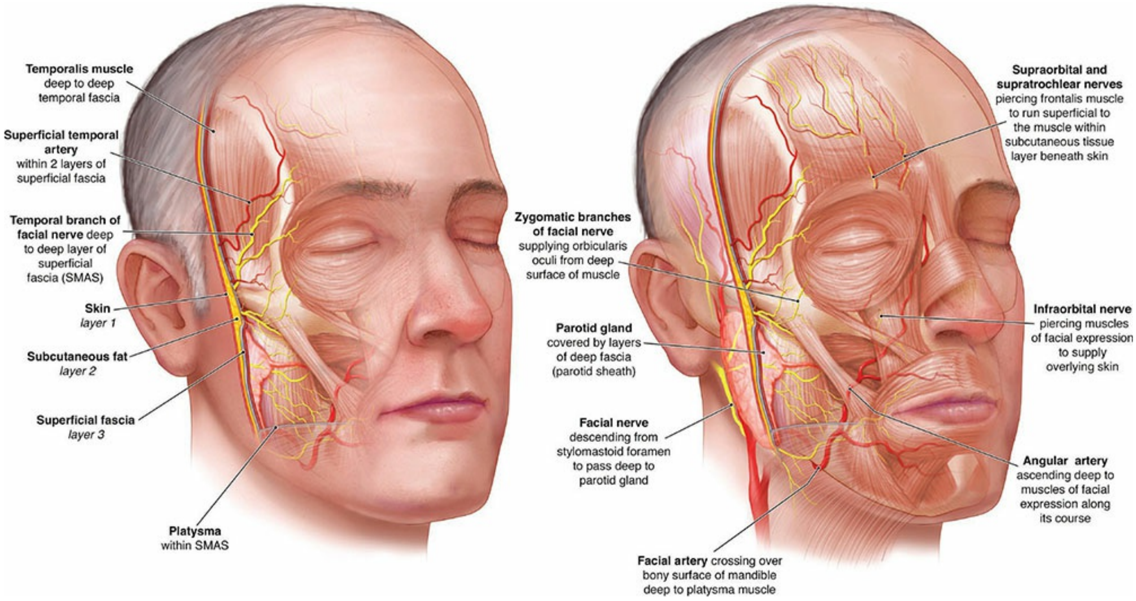


Figure 1-7. Conceptual illustration demonstrating relationship of structures within layers of the face from superficial to deep. (By permission of Mayo Foundation for Medical Education and Research. All rights reserved).

8. Trigeminal nerve branches travel in a plane above the SMAS and then exit the supraorbital, infraorbital, and mental foramina, and travel in a deep to superficial direction toward the skin, where they lie within the subcutaneous fibro-adipose layer (Fig. 1-8).[4,8–10]

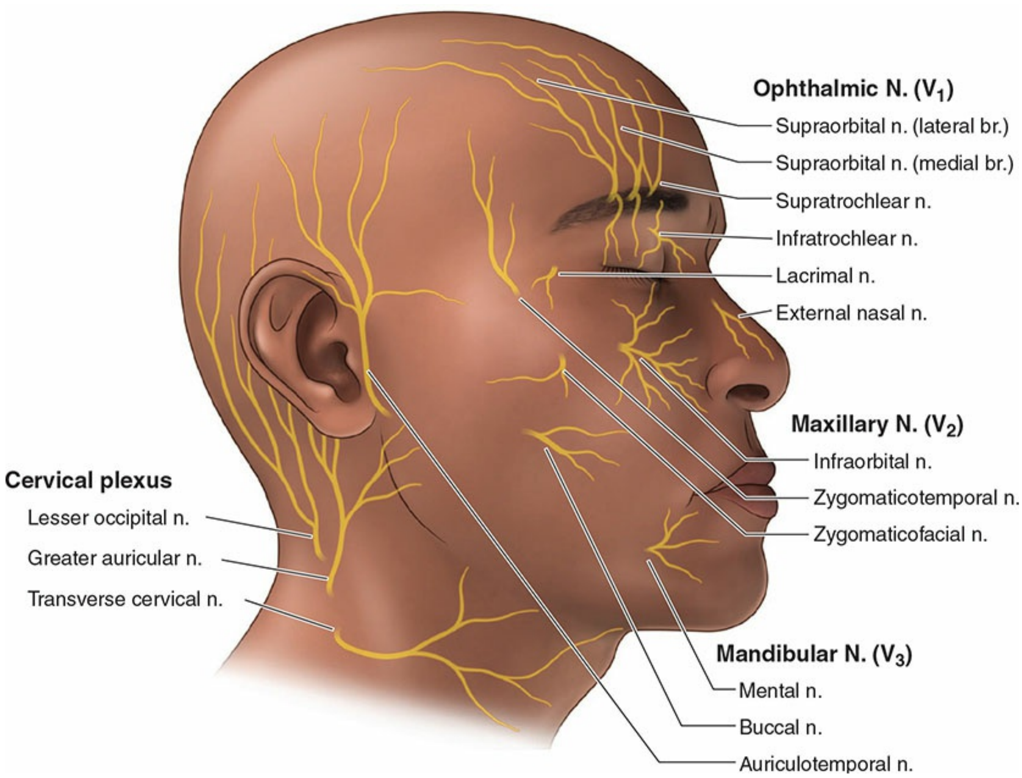


Figure 1-8. Diagram illustrating distribution patterns of sensory branches of the trigeminal nerve.

9. The facial artery and its branches travel deep to the SMAS and run along a superficial course to cross palpable bony boundaries or penetrate the SMAS (Fig. 1-7).[11,12]
10. The thickness of the subcutaneous layer varies significantly and displays fat compartments that are predictable and distinct within cosmetic subunits. The layer is more uniform in thickness over the scalp, while compaction of the subcutaneous tissue around the eyelids and lips appears to make this layer almost nonexistent.[1,2,13,14]

Concept of the superficial musculoaponeurotic system

The concept of the SMAS is best understood by looking at the SMAS as a single continuous layer of organized fibrous network that divides at predictable locations in order to enclose the muscles of facial expression and keep them connected to the dermis.

Histologically, SMAS is described as a three-dimensional (3D) architecture of collagen, elastic fibers, adipose, and muscle tissue.[2,4,7,15] Typically, the arrangement of SMAS determines the flexibility of the overlying structures. For example, SMAS can exhibit a meshwork of fibrous septa that envelops lobules of fat within an interconnecting fibrous network[15] connected to facial muscles or periosteum. This type of arrangement is best demonstrated in the forehead; parotid, zygomatic, infraorbital regions; and lateral nasolabial fold.[15]

Alternately, in and around the upper and lower lip regions, SMAS exhibits an intermingling arrangement of collagen, muscles, and elastic fibers extending up to the dermis. Around these areas, single adipocytes, rather than adipose tissue accumulations (compartments), are interposed between the fibers. These regions represent highly innervated areas where numerous sensory nerve branches may be encountered during microscopic visualization.[7]

With regard to SMAS and its relationship with deeper investing fascia, two important points can be made about the fascia associated with temporalis muscle and the fascia associated with the masseter muscle. (1) As the temporalis muscle arises from the superior temporal line and the floor of the temporal fossa, it fans out to pass medially to the zygomatic arch and inserts onto the coronoid process and anterior border of the ramus of the mandible.[16–18] A dense layer of deep fascia overlies the superficial surface of the muscle and is referred to as the *deep temporal fascia* which extends superiorly to attach to the superior temporal line. Deep temporal fascia is overlapped by the auricularis muscle anteriorly and superiorly by the epicranial aponeurosis and part of orbicularis oculi muscle.[4,9]

In a region above the zygomatic arch, on the lateral aspect of the head, fascia continuous with the SMAS is separated from the temporal fascia by a layer of loose connective tissue with some adipose tissue and is commonly referred to as the *superficial temporal* or *temporoparietal fascia*. Within its two layers, the temporoparietal fascia[11,16,19] contains the superficial temporal vessels,[17] auriculotemporal nerve, and temporal branches of the facial nerve en route to the frontalis and portions of the orbicularis oculi muscles (Figs. 1-2 and 1-7).

(2) The deep fascia of the masseter muscle is intimately connected to the deep layer of the parotid capsule. As the deep investing fascia divides to enclose the parotid gland, it is connected to the masseteric fascia and is often seen as a composite parotid–masseteric fascia.[4,9] This close association between the fascial layers is mostly unyielding and does not provide easy access to a surgical plane. The superficial layer of the parotid fascia is continuous once again with the SMAS.

Topographic framework of the superficial face

The five-layer construct typically associated with the scalp can be applied in understanding the fascial framework of the face.[2] Most superficially, the first layer is the skin, with its epidermis and underlying dermis (Layer 1) varying in thickness, density, and regional conformation.[2] The subcutaneous plane (Layer 2) contains volume-defining adipose tissue and a fibrous "retinacular cutis" which is composed of dense irregular connective tissue characterized by thick, irregular bundles of mostly type I collagen and elastic fibers.[20] The reticular layer contains portions of retaining ligaments that traverse through the subcutaneous tissue (varying regional density) connecting the dermis to the SMAS.[1,7]

The SMAS layer (Layer 3) is continuous over the entire face. The muscles of facial expression are contained within the composite superficial fascia (Layers 1–3) and lie within this layer, followed by deeper set muscles providing more functional roles (e.g., orbicularis oculi, orbicularis oris).[7,15,16,21] Layer 3 reflects the galea aponeurotica of the scalp, superficial temporal fascia over the temporal region, orbicularis fascia in the orbital area, SMAS over the inferior face (mid and lower), and the platysma in the neck.[15]

Layer 4 consists of soft tissue spaces, facial ligaments, deep portions of the muscles of facial expression, and segments of the facial nerve branches traversing toward points of innervation.[1,2] On the lateral face, anterior to the ear and extending down toward the posterior border of platysma, the superficial fascia fuses with the deep fascia (fibrous capsule of parotid gland), creating a tightly bound composite of Layers 1 to 5 thereby reducing Layer 4 to an undissectable plane (Fig. 1-2).[2]

Layer 5 is formed by the deep fascia overlying the superficial muscles of mastication (deep temporal fascia, masseteric fascia), by the periosteum covering the bone, and the parotid fascia forming the unyielding fibrous capsule of the parotid gland (Figs. 1-2 and 1-7).[1,2,9,15]

Surgically relevant anatomy within cosmetic units

In addition to Salasche et al.'s[22] detailed and insightful account of the anatomy related to the surgery of the skin, recent research has added to the understanding of key anatomical concepts regarding dermatologic surgery within cosmetic units.[23,24] The ensuing discussion of relevant anatomy has been built on the anatomy encountered during superficial dissection within these territories along with well-established reviews and current literature.

Forehead

- Muscles acting on the forehead and eyebrow: frontalis, corrugator supercilii, and procerus.
- The forehead and temple are functionally related to the scalp and through SMAS can easily glide over the skull.
- The supraorbital and supratrochlear neurovascular bundles supply this region.

The forehead extends from the hairline to the eyebrows in a vertical direction and ends laterally at the temporal ridges. Skin of the forehead varies in dermal thickness, decreasing as it extends superiorly toward the hairline. Additional, while more taut in younger individuals, the skin of the forehead in older patients tends to be more mobile, usually as a result of chronological or actinic damage. Beneath the skin, the subcutaneous layer is minimal, usually not more than about 1 mm thick. Just deep to the subcutaneous tissue, the SMAS encloses the frontal or anterior belly of the occipitofrontalis muscle with its vertically oriented fibers. As the thickness of the muscle tends to decrease with age, these fibers can be rather sparse in older patients, making the traversing neurovascular structures easier to reach.

Between the left and right anterior bellies of occipitofrontalis, a fascial extension known as the galeal median raphe is present. The galeal raphe is devoid of muscle fibers and does not usually contain any significant associated neurovascular structures. Inferiorly, superolateral fibers of the orbicularis oculi can be visualized as they interface with the medially located fibers of procerus and corrugator supercilii.

It is helpful to remember that the frontalis muscle is enveloped by superficial and deep investing layer of the SMAS and periosteum. The supratrochlear and supraorbital nerves are important structures that provide sensory innervation to the scalp and skin. They exit the supraorbital foramen within a neurovascular bundle above the orbital rim (Fig. 1-9). Christensen et al.[25] described the origin and depth of the supraorbital nerve. The neurovascular bundle originates an average of 26 mm from the midline and is 7.5 mm deep at its origin beneath the corrugator supercilii muscle, continuing superficially above frontalis muscle.

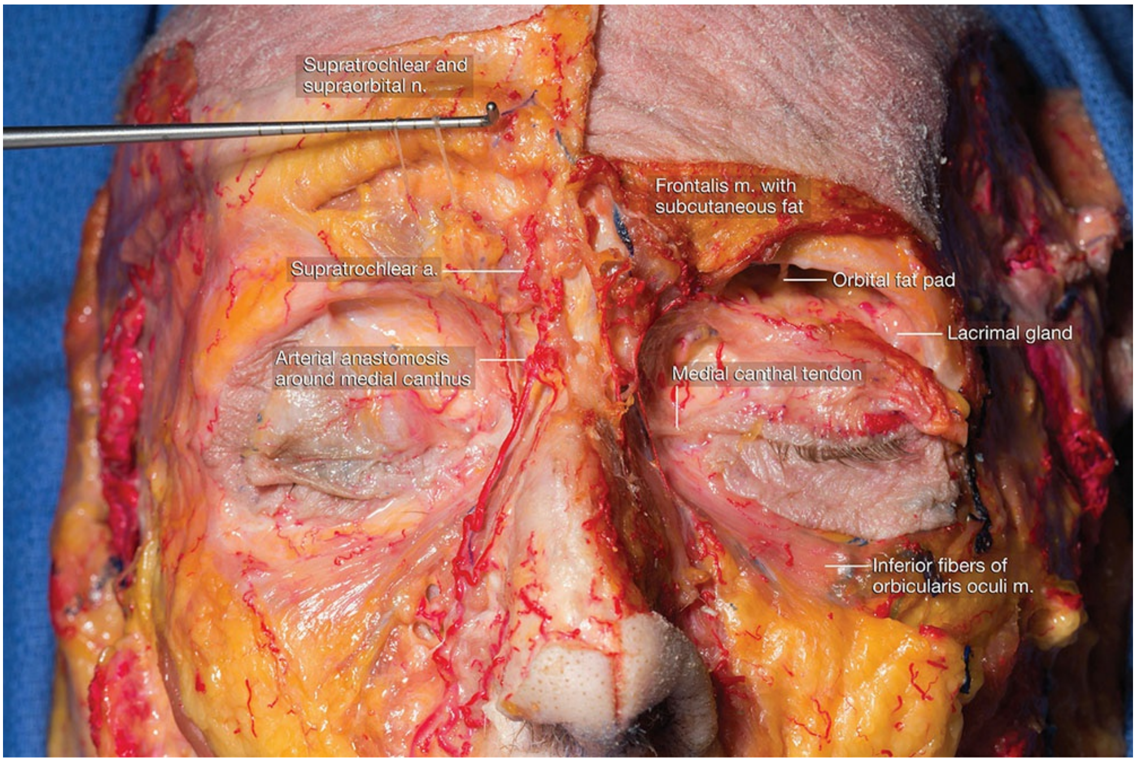


Figure 1-9. Anterior view of dissection of the upper face highlighting supratrochlear and supraorbital nerves.

The forehead receives vascular supply centrally from the right and left supratrochlear and supraorbital arteries and bilaterally by the anterior branch of the temporal arteries. These vessels are located in the subcutaneous tissue and are predictable in their location. The supratrochlear artery serves as the basis of the axial paramedian forehead flap (Fig. 1-10), and therefore knowing that the origin of the neurovascular bundle is approximately 13 mm from the midline, in line with the medial canthus, may be helpful. Furthermore, the neurovascular bundle originates above the brow from the supraorbital foramen and is initially deep to the corrugator supercilii and above the periosteum. The bundle courses through the corrugator supercilii, initially deep to the frontalis, but as they move superiorly they branch and become more superficial, piercing the SMAS and coursing through the frontalis to reach the subcutaneous tissue (Fig. 1-11). Details of arterial diameter, depth, and branching patterns of the superficial temporal artery have been extensively described,[26] averaging 2 mm in diameter at a depth of 1 to 2 mm and with an average of nine visible branches. Rich collateral circulation of the forehead skin supports the use of random pattern cutaneous flaps.

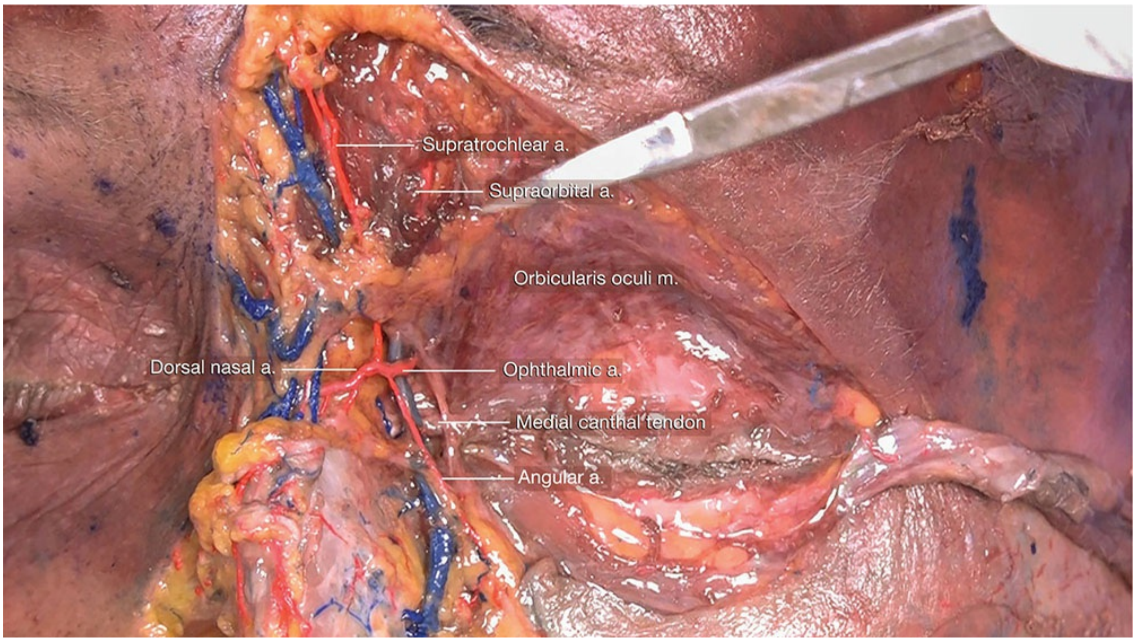


Figure 1-10. Anatomy of anastomosis around the medial canthus of the left eye.

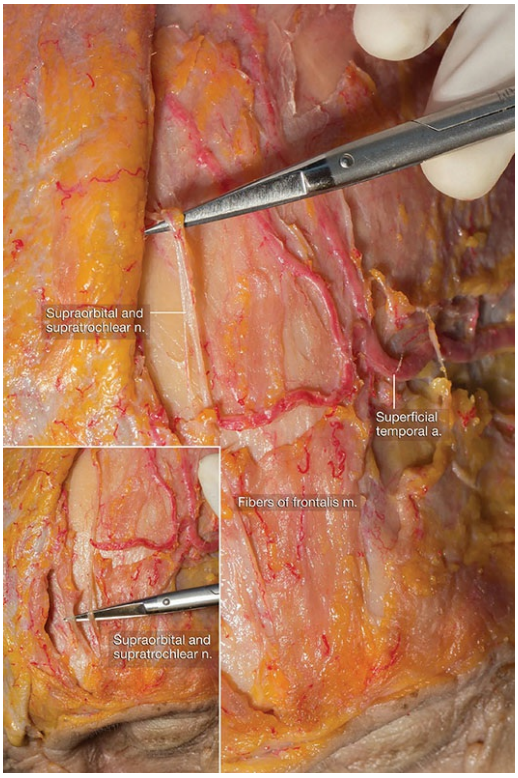


Figure 1-11. Supraorbital and supratrochlear nerves coursing over fibers of frontalis muscle.

Temple

- The superficial temporal artery travels within the layers of the superficial temporal fascia.
- Rich anastomosis occurs between branches of the superficial temporal artery and supraorbital artery.
- The auriculotemporal nerve runs deep and posterior to the superficial temporal artery.
- The frontal branch of the facial nerve is most vulnerable as it crosses the zygomatic arch as a single trunk en route to the deep surfaces of the frontalis muscle.

The temporal fossa contains a relatively sparse amount of subcutaneous tissue devoid of muscles of facial expression, with the exception of traversing fibers of the orbicularis oculi muscle and even fewer fibers of the anterior auricular muscle. Two distinct layers of fascia are contained within this unit. The deep temporal fascia, which is a continuation of the investing fascia containing the deeper temporalis muscle as it becomes continuous with the periosteum of the skull; and the superficial temporal fascia, which is a continuation of the SMAS as it connects to the galea aponeurotica (Fig. 1-12). In this region, the superficial temporal fascia is of anatomical and subsequent surgical importance as it contains within its layers key vascular and neural structures as they traverse between the fascial layers. The superficial temporal artery along with its branches and sensory nerves, including the auriculotemporal nerve, can be accessed within the layers of the superficial temporal fascia (Fig. 1-12). The motor branches of the facial nerve remain deep to the superficial temporal fascia as they course toward the deep surface of the orbicularis oculi and frontalis muscles (Fig. 1-6). The superficial temporal fascia forms a continuous layer with the galea aponeurotica, but splits medially to enclose the frontalis and orbicularis oculi muscles and laterally the superficial periauricular fibers. Inferiorly, the superficial temporal fascia is adherent to the zygomatic arch. Immediately adjacent to the superficial layer of the superficial temporal fascia, the subcutaneous fatty layer separates it from the overlying dermis. Fibrous septa create a more taut area as one moves toward the scalp, with relatively greater laxity just above the zygomatic arch. Numerous cutaneous vessels and nerves lie in this interval between the fat and fascia, which is important to remember when undermining in this area. The deep layer of the superficial temporal fascia glides over the loose connective tissue of the deep temporal fascia, deep to which the temporalis muscle can be visualized (Fig. 1-12).

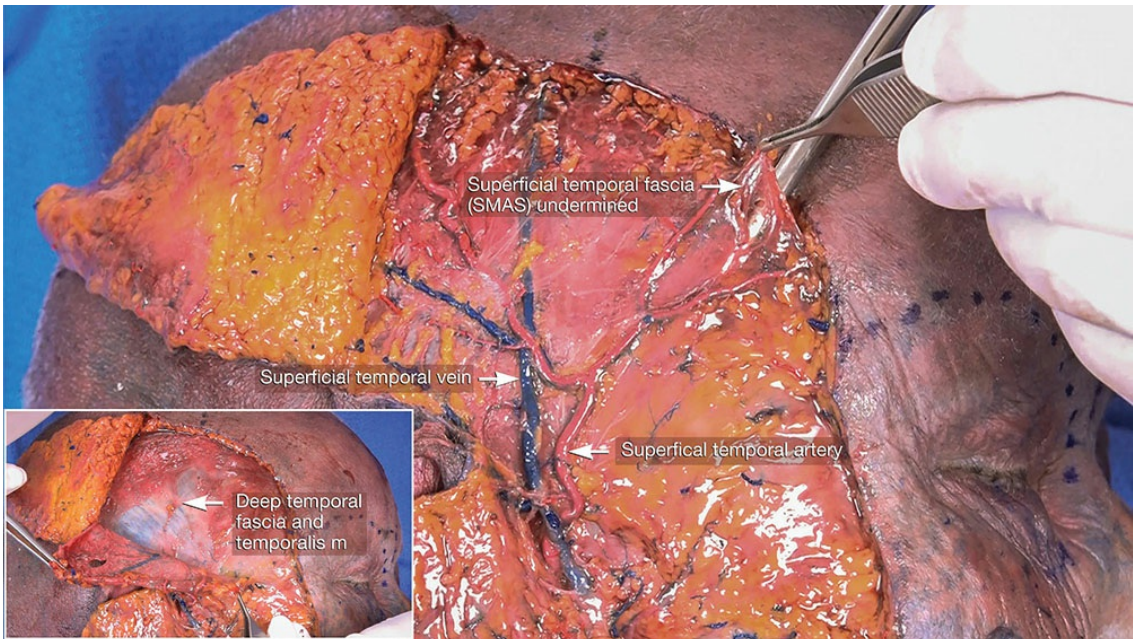


Figure 1-12. Dissection of superficial temporal fascia reflected to show superficial temporal vessels.

The primary source of vascular supply to the temple comes from the superficial temporal artery, a terminal branch of the external carotid artery. The superficial temporal artery emerges from the superior pole of the parotid gland as it pierces the parotid fascia anterior to the tragus (Fig. 1-12). Inferior to it, the transverse facial artery runs below and in line with the zygomatic arch. The artery is accompanied by the corresponding veins, and usually divides anteriorly into anterior and posterior branches, with two or sometimes three significant sized pedicles. The anterior branch follows a distinct tortuous course, especially prominent in elderly patients, to supply the temple and the temporal scalp region. Branches anastomose freely with the posterior parietal branches as well as contributions from the supraorbital artery. From an anatomical standpoint, it is important to note that while the superficial temporal artery lies within the layers of the superficial temporal fascia, the corresponding veins are located within the subcutaneous layer. As the arteries continue toward the scalp, they also come to lie within the subcutaneous plane just above the superficial temporal fascia.

Sensory innervation to the temple is achieved via the maxillary and mandibular divisions of the trigeminal nerve. The auriculotemporal nerve (Fig. 1-13) travels posterior and deep to the superficial temporal artery and branches as it runs within the same fascial plane as the artery as they proceed toward the scalp. The skin adjacent to the lateral canthus is supplied by a branch of the maxillary artery, with the zygomaticotemporal nerve emerging from the lateral orbital wall. Additionally, the zygomaticotemporal nerve innervates an area of scalp between the territories of the auriculotemporal and supraorbital nerves (Fig. 1-8). Emerging from the superior pole of the parotid gland, the temporal branch of the facial nerve crosses superficial to the zygomatic arch as a single branch within the superficial temporal fascia increasing its vulnerability to surgical injury (Fig. 1-14). With the use of surface anatomical landmarks, the temporal branch may be visualized along a line 0.5 cm below the tragus to a point approximately 1.5 cm superior to the lateral edge of the eyebrow. The temporal branch of the facial nerve supplies the frontalis muscle from the deep lateral edge with few branches contributing to fibers of orbicularis oculi and those of surrounding muscles of facial expression.

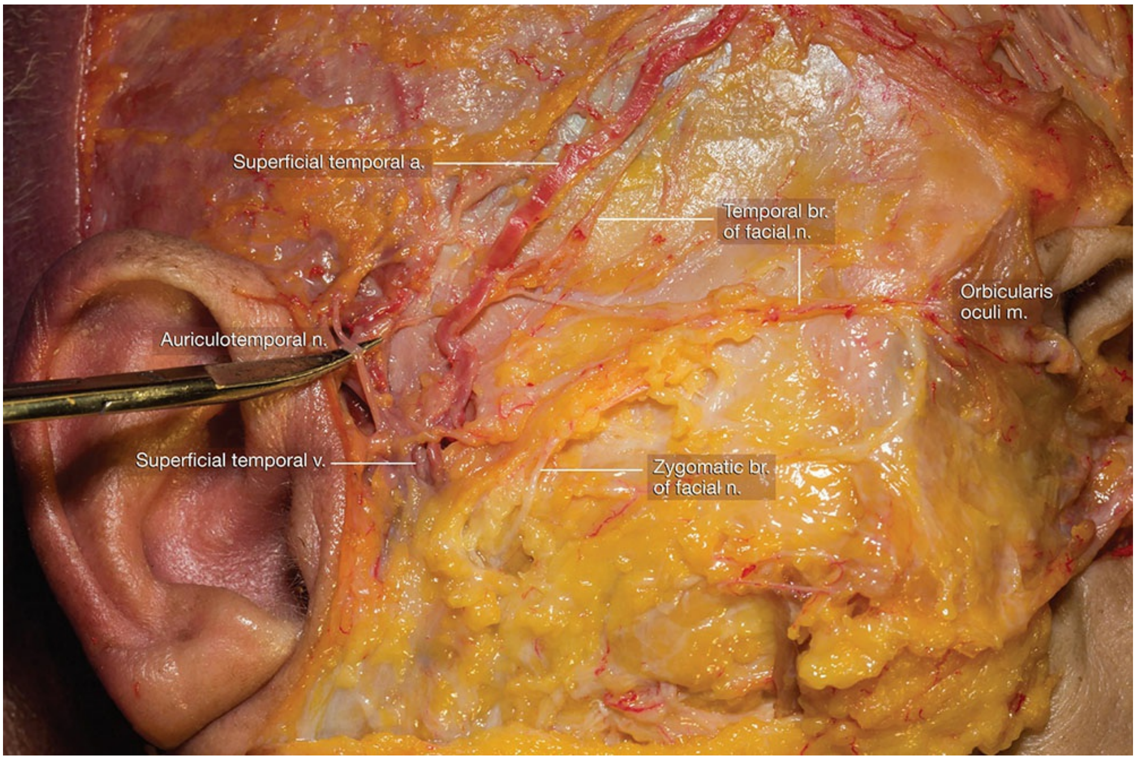


Figure 1-13. Dissection of temporal region highlighting the auriculotemporal nerve.

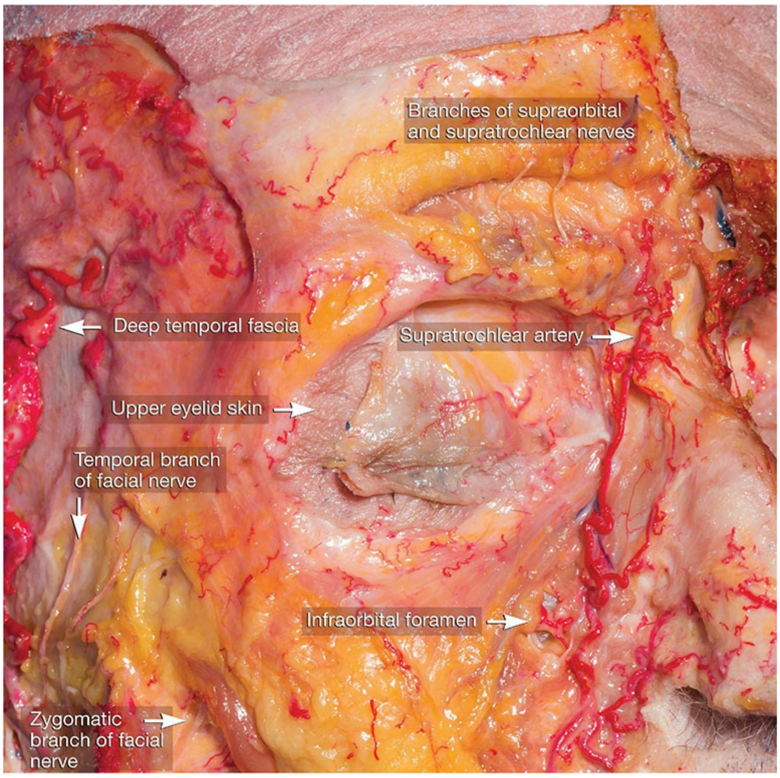


Figure 1-14. Dissection demonstrating relationship between superficial temporal artery and temporal branch of the facial nerve.

Superficial orbital region and eyelid

- Skin of the eyelids is very thin with only a thin fascial layer between it and fibers of the orbicularis oculi muscle. There is no fat beneath the dermis.
- Lacrimal canaliculi are deep to the medial canthal tendon.
- The angular artery and vein cross the medial canthal tendon and contribute to an important site of anastomosis just superior to the tendon between branches of external carotid (facial artery) and internal carotid (ophthalmic artery).

The orbital rim is formed laterally by the zygomatic process of the frontal bone and the frontal process of the zygomatic bone. The frontal bone forms the superior orbital margin as well as the roof of the orbit, with the superciliary arch of the frontal bone defining the superior orbital rim.

Along the mid-pupillary line, the superior orbital rim presents a notch, sometimes a foramen (>25%), known as the supraorbital notch/foramen, through which the supraorbital vessels and nerves are transmitted (Fig. 1-9).

The medial orbital margin is formed by the maxillary process of the frontal bone along with the frontal process of the maxillary bone. The maxillary bone forms the floor of the orbit and the infraorbital rim. The lateral canthus lies in contact with the sclera, whereas the medial canthus is separated from the sclera by the caruncle and the lacrimal lake. The caruncle contains sweat and sebaceous glands, whereas the lacrimal lake provides a collection area for tear fluid before passing through the lacrimal canaliculi.

The skin around the eyelids is very thin, with only a thin fascial layer between it and the fibers of the orbicularis oculi muscle. Unlike the usual anatomic relationship of skin to subcutaneous tissue, there is no fat beneath the dermis. Understanding this arrangement provides insight into the depth of dissection as the subdermal space is approached. There are no significant superficial nerves or vessels in this subfascial space. Additionally, skin over the tarsal plates is tightly adherent, whereas the preseptal area allows for greater mobility. Another point of importance when understanding the layers of tissue around the eye is to remember that the region over the orbital septum, just proximal to the tarsal region, presents with several layers. Following the skin, subcutaneous tissue orbicularis oculi, and orbital septum, there is a layer of orbital fat followed by the aponeurosis of the levator palpebrae superioris, Muller's muscle, and then conjunctiva (Fig. 1-15).

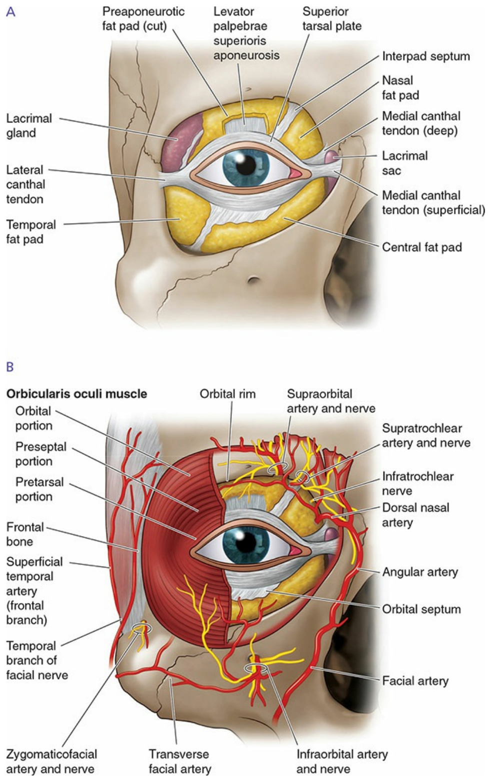


Figure 1-15. Diagram illustrating basic anatomy of the eye.

The orbicularis oculi and levator palpebrae superioris muscles are two predominant muscles of surgical concern. The orbicularis oculi is best described as two parts—the orbital portion and the palpebral portion. These portions of the muscle contract independently, the orbital portion under voluntary control and the palpebral fibers under both voluntary and involuntary control. The upper portion is innervated by the temporal branch of the facial nerve, whereas the lower fibers are innervated by the zygomatic branch of the facial nerve. The action is to tightly close the lids together. The orbital fibers attach to the orbital rim and blend in with the surrounding muscles of facial expression—the frontalis superiorly and the procerus medially. Corrugator supercilii lies beneath the medial aspect of the orbital fibers, and their origin from the medial orbital crest and insertion into the upper medial portion of the eyebrows bring the eyebrows medially.

The palpebral portion of the orbicularis oculi overlies the pretarsal and preseptal regions. Preseptal fibers cover the orbital septum of both upper and lower lids. It is important to note that the upper and lower preseptal fibers attach to the respective areas of the medial canthal tendon, and this arrangement has significant impact on the functioning of the lacrimal canaliculi. The continuation of these fibers laterally toward the lateral canthal tendon helps in bringing the lids together to produce winking and blinking actions. The pretarsal portion is attached firmly to the tarsal plate. Their connections maintain a similar anatomical arrangement as the medial and lateral preseptal muscles and are connected to the medial and lateral canthal tendons. The palpebral muscle unit is an important contributor to the mechanism of tear movement.

The medial canthal area is frequently a site for surgical excisions. Several important anatomical structures should be considered when working around this area. The lacrimal canaliculi are deep to the medial canthal tendon. However, they are secured at a deeper plane and relatively protected by an undisrupted tendon. The angular artery and vein traverse the area on their ascent within the nasolabial groove. They cross the medial canthal tendon and contribute to an important site of anastomosis just superior to the tendon between branches of the external carotid (facial artery) and internal carotid (ophthalmic artery) (Fig. 1-9).

The upper lid has two fat pads: the pre-aponeurotic and nasal units,[22] and it may be difficult to distinguish between them and the lacrimal gland which lies in a lateral position on the upper lid. The lower lid contains a nasal, central, and lateral fat pad. Their connection to the orbital septum laterally and via its fascia to the inferior oblique muscle medially makes the muscle susceptible to injury (Fig. 1-15). The levator palpebrae superioris and its aponeurosis are responsible for raising the eyelid, and are innervated by the oculomotor nerve. It is important to remember that the muscle arises in the apical region of the orbit and continues in its superior most location in an anterior direction. It is easily identifiable during dissection as it exists as a well-defined, flat, or sometimes more bulky muscle. As it approaches anteriorly, it divides into an aponeurosis, and posteriorly reflects into Muller's tarsal muscle. Fibers also attach to the orbicularis oculi and are connected to the overlying skin by fibrous strands. The lower lid is retracted by the extraocular inferior rectus muscle and also contains a tarsal muscle.

The tarsal plates are dense fibrous tissue plates that begin at the lacrimal puncta medially and extend to the lateral commissures. Numerous meibomian sebaceous glands are embedded vertically within the tarsal plates.[4,22]

As previously mentioned, arterial supply to the eyelids is derived from extensive anastomosis between the internal and external carotid arteries. Branches from the ophthalmic, facial, and superficial temporal arteries perfuse both the upper and lower lids. Additionally, the maxillary artery via the infraorbital artery also contributes to the extensive vascularity, as its branches anastomose with the ascending branches of the transverse facial, facial, and angular arteries. The main venous drainage of the eyelids occurs via the superficial temporal, angular, and facial veins. Both arterial and venous systems present as vascular arcades along the upper and lower lids (Fig. 1-16).

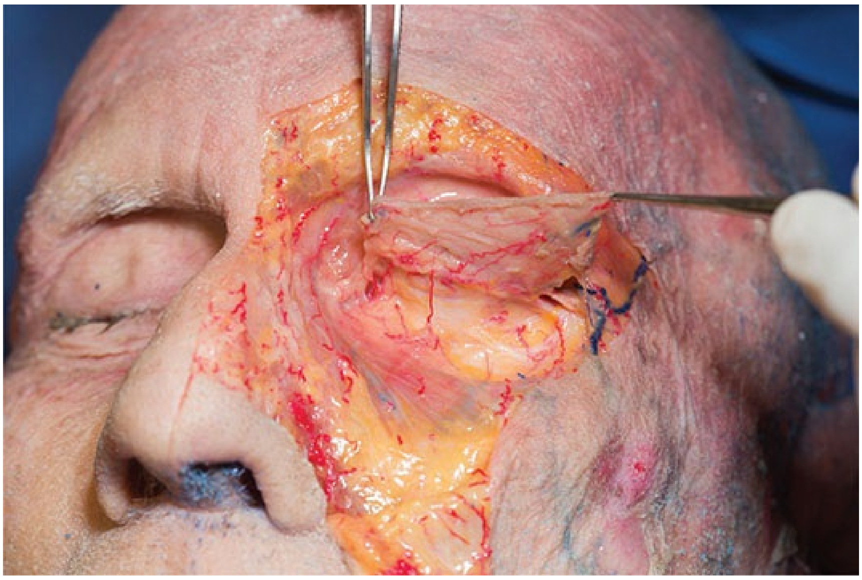


Figure 1-16. Dissection demonstrating arterial arcades around the eyelids.

Nose

- The nose is divided into root, dorsum, lateral walls, tip, alae, and columella.
- Most of the alae are composed of skin and fibrofatty tissue.
- Blood supply is mainly from angular artery externally and the sphenopalatine artery internally, with smaller contributions from the superior labial and ophthalmic arteries.
- Sensory innervation is derived from infraorbital branch of the maxillary nerve and infratrochlear and external nasal branches of the anterior ethmoidal nerve (ophthalmic nerve).

The challenge with conducting surgery on the nose is twofold. On the one hand, the nose presents with complex anatomy consisting of skin, cartilage, and nasal mucosa within a rather small anatomical boundary. Secondly, the mid-face location of the nose places a premium on cosmetic outcome, which reinforces the importance of thoroughly understanding the anatomy that will facilitate effective surgical repair and outcome. In its simple description, the nose may be divided into the root, dorsum (bridge), lateral side walls, and the lobule (Fig. 1-17). The lobule is further divided into the nasal tip, the infra-tip, and the alae. When viewed from below, the infra-tip lobule presents a soft triangular area anteriorly, a columella that extends inferiorly and separates two nostrils bound by the nostril sills, and laterally the alar base and rim. Together, the bony pyramid, septum, alar cartilages, and the cartilaginous vault form the main structural support of the nose.

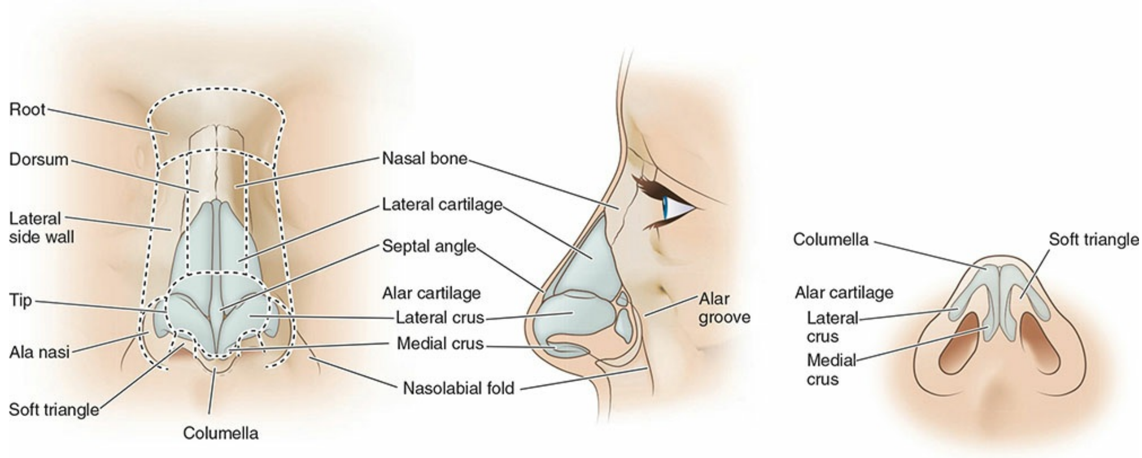


Figure 1-17. Diagram illustrating basic anatomy of the nose.

The nasal bones articulate along the midline and with the frontal processes of the maxillae laterally. Superiorly, the nasal bones articulate with the nasal processes of the frontal bone and inferiorly with the perpendicular plate of the ethmoid bone. Nasal bones are thickest superiorly but thin out inferiorly where they may be easily damaged. There is an overlap between these lower and upper borders of the lateral cartilages. Skin over the bony pyramid is loose, fairly mobile, and can be easily undermined.[22,23]

The lateral cartilages are a continuation of the nasal bones, being overlapped superiorly by these bones and inferiorly by the upper border of the lateral crura of the alar cartilages. Ligamentous tissue connects both these overhangs.

The nasal septum consists of bone, cartilage, and soft tissue which include all of its articulating craniofacial bony structures. A septal or quadrangular cartilage anchors to the perpendicular plate of the ethmoid bone and maintains structural integrity of the bony septum. The membranous septum, a soft tissue composite, consists of two layers of vestibular skin separated by loose connective tissue. Depressor septi muscle traverses the membranous septum and attaches to the inferior border of the septal cartilage.[4,22]

The lobule is the most mobile portion of the nose due to the lack of any fixed cartilaginous joints. The support of the lobule comes from the paired alar cartilages suspended by soft tissue ligaments. The soft tissue portion of the ala does not contain cartilage but rather is structurally maintained by a thickened dermis with no underlying subcutaneous fat, making detecting an ideal dissection plane challenging in this area.

The key muscles around the nose include procerus, levator labii superioris alaeque nasi, nasalis, and depressor septi muscles. Procerus extends from the frontalis muscle across the root of the nose and blends in with the transversely positioned nasalis muscle. It is important to remember that the plane deep to nasalis is continuous with the subgaleal plane, which maintains a bloodless field of dissection. The levator labii superioris alaeque nasi arises from the maxilla and sends fibers to the medial upper lip and the lateral ala. The most medial portion of these muscle fibers is referred to as the depressor septi, which pulls down on the septum and keeps the airways patent (Fig. 1-18).

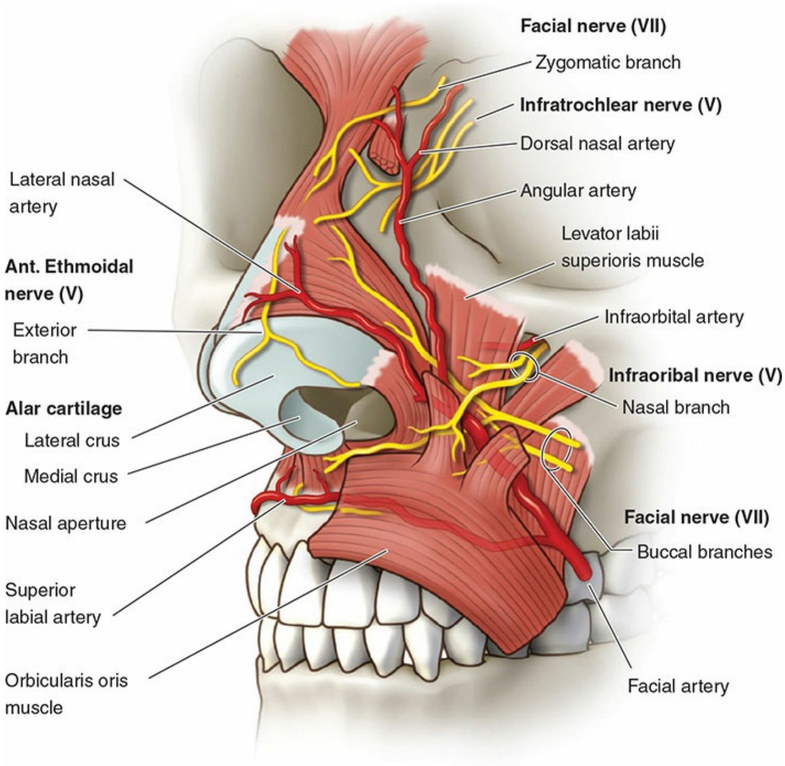


Figure 1-18. Diagram illustrating deeper anatomy around the nose.

The nose receives a rich blood supply which is a surgical advantage and allows for versatility in flap design and orientation. While blood supply is mainly from the angular artery externally and the sphenopalatine artery internally, with smaller contributions from the superior labial and ophthalmic arteries, the largest vascular contribution is derived from the external carotid system. The superior and inferior labial arteries are branches off the facial artery and they continue along the lateral aspects within the nasolabial grooves as the ascending angular artery en route to the medial canthal anastomotic site. The angular artery gives off many small branches to the sidewalls, ala, and dorsum, and form free and contralateral anastomoses terminating through a connection with the dorsal nasal artery (Fig. 1-19). This point of anastomosis is highly predictable, and its consistent presentation makes it a very viable pedicle for flap construction. The glabella and mid-portion of the forehead is supplied by the supratrochlear artery, a branch of the ophthalmic artery that is also a reliable vascular pedicle in nasal reconstruction of the dorsum and tip of the nose (Fig. 1-20). Deep to the nasal bone, the external nasal artery emerges onto the dorsum of the nose (Fig. 1-21). It is usually accompanied by the external branch of the anterior ethmoidal nerve which supplies sensory innervation to the dorsum and tip of the nose. The infraorbital artery also contributes to vascular anastomosis around this area. Venous drainage follows the pattern of arterial supply and does not display any anatomy of significance.

Figure 1-19. Dissection demonstrating ascent of the facial and angular artery within the nasolabial region.

Sensory innervation to the nose is achieved through branches of the ophthalmic and maxillary divisions of the trigeminal nerve. Ophthalmic division supplies the area along the midline of the nose, whereas the maxillary division via the infraorbital nerve (Fig. 1-20) innervates the alae, lower lateral walls, and columella. The root and upper nasal bridge along with the upper lateral walls is supplied by the infratrochlear nerve that approaches the nose in a medial direction from above the medial canthal tendon.

Figure 1-20. Dissection of the anterior left cheek highlighting the infraorbital nerve.

Ear

- The external ear is divided into the auricle (pinna), the external auditory meatus and canal, and the external surface of the deeper set tympanic membrane.
- Blood supply to the ear is derived from superior and inferior auricular branches of the superficial temporal artery and the deep auricular

branch of the maxillary artery.

- The external ear receives a rich sensory innervation from overlapping cranial and cervical nerves.
- The auriculotemporal nerve travels posterior to the superficial temporal vessels and supplies the anterior portion of the auricle and anterior helix.
- The auriculotemporal nerve lies posterior to the superficial temporal artery and vein, and exits the superior parotid fascia as it traverses the parotid gland.
- The mastoid area is supplied by C2, C3 ventral rami derived via the lesser occipital nerve. Concha is supplied by variable overlapping innervation from cranial nerves VII, IX, and X, which also supply the posterior aspect of the external meatus and tympanic membrane and posterior auricular sulcus.

For the dermatologic surgeon, understanding the architecture of the ear is essential to repairing both large and smaller defects. When undermining, performing a primary closure, or during mobilization, knowledge of the variation in skin thickness, elasticity, relationship to the underlying cartilage, and pattern of perfusion helps in producing the most effective repair.

The external ear is divided into the auricle (pinna), the external auditory meatus and canal, and the external surface of the deeper set tympanic membrane.[22] The auricle consists of a complex cartilaginous framework that is thrown into folds and grooves. The cartilage is covered by tightly bound skin with very little subcutaneous tissue, often with no subdermal fat at all. While the skin is tight anteriorly, posteriorly it offers a little more flexibility. The most inferior portion of the auricle, the lobule, has no cartilaginous base and consists of subcutaneous fat and skin. There are two distinct curves that extend superior to the lobule: (1) the outer helix—an anteriorly curved fold that continues posterosuperiorly from the lobule toward the upper limit of the tragus where it blends in with the crus of the helix; and (2) the antihelix, separated from the helix by a groove known as the scaphoid fossa. The tragus, an anterior extension of the auricular cartilage, is separated from the antitragus by the intertragal space. A deep concave groove referred to as the concha leads to the external auditory meatus. The concha is further subdivided into a more superior impression, the cymba, and an inferior, larger impression, the cavum (Fig. 1-22).[4,9,22]

While variations exist, in its standard anatomical position the ear is situated laterally, lies somewhat between the eyebrows and the base of the nose with the helix protruding beyond the antihelix. Ligamentous fibers connect the auricle to the skull and contain rudimentary intrinsic muscles. Extrinsic muscles are of little clinical significance, but it is helpful to note that these muscles of facial expression—the anterior, posterior, and superior auricular muscles—are contained within the SMAS and innervated by branches of the facial nerve.

The length of the external auditory meatus and canal measures 2.5 to 3.5 cm. The canal itself has both bony and cartilaginous parts.[22] Laterally, the cartilaginous component is continuous with the auricular cartilage, while medially, it is attached to the bony meatus. The cartilaginous portion is mostly present in the inferior aspect of the canal. Superiorly, the canal is bound by the squamous temporal bone. The true bony portion of the canal tunnels between the squamous and tympanic parts of the temporal bone. Around the lateral portion of the external meatus the skin is thicker, with sebaceous, cerumeniferous glands and hair. The bony portion contains very thin layer of epithelium and is devoid of hair and glands. Of particular clinical interest are the fissures within the cartilaginous portion of the canal. These randomly arranged fissures, known as fissures of Santorini, offer potential avenues for developing skin cancers to spread into surrounding tissue.

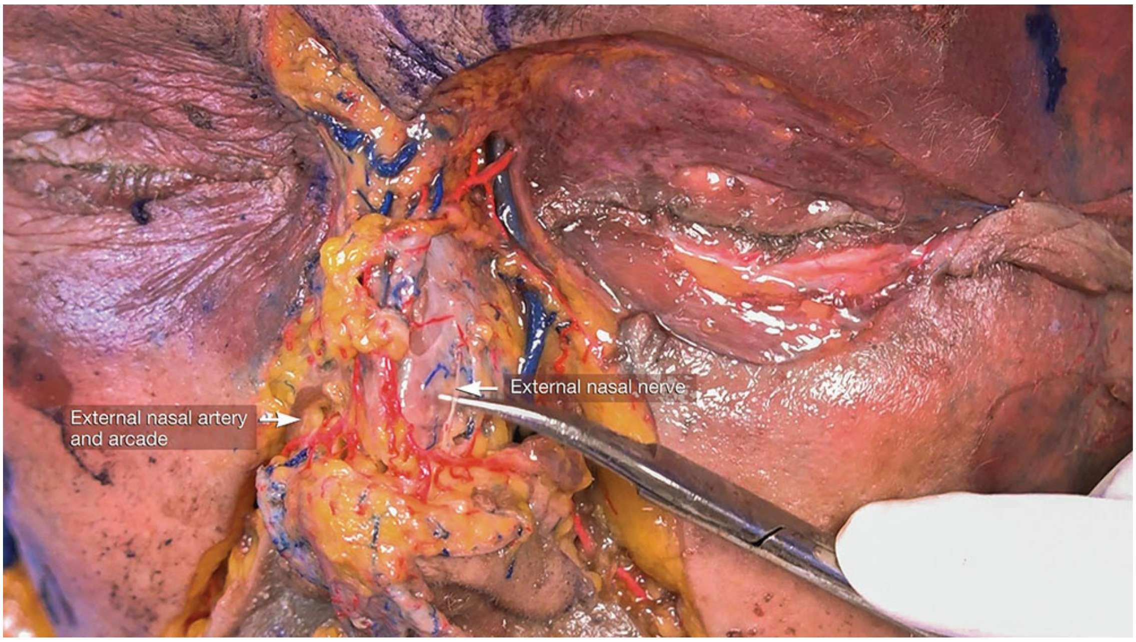


Figure 1-21. Superficial dissection of anterior nose demonstrating the external nasal nerve and vessels.

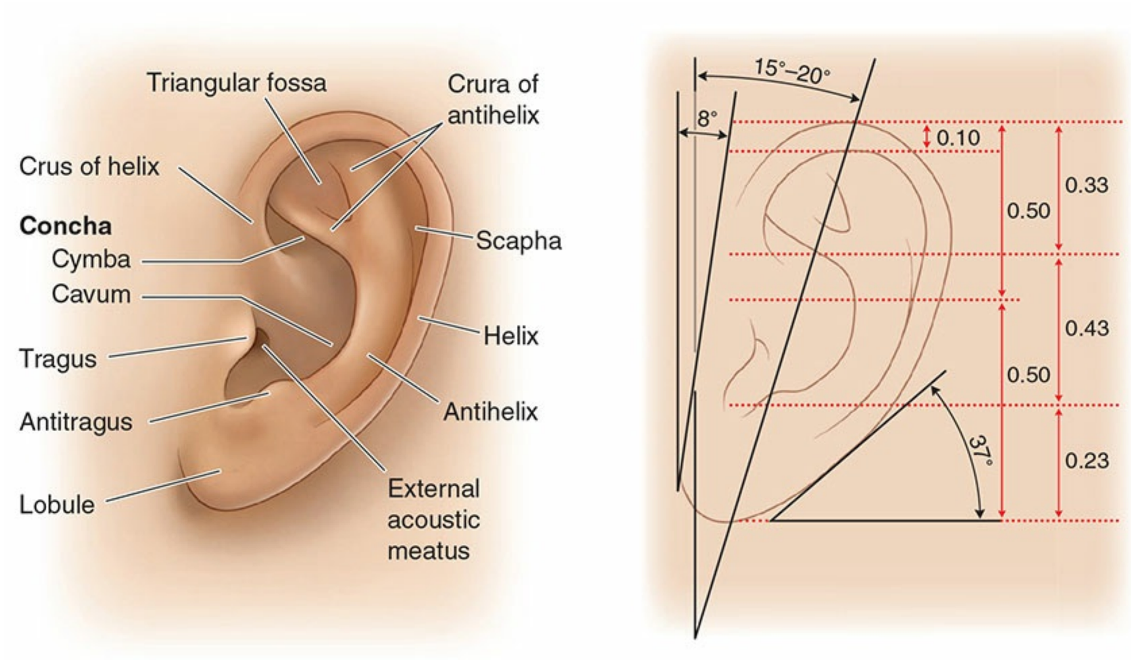


Figure 1-22. Diagram illustrating basic anatomy of the external ear.

The rich blood supply to the ear is derived from superior and inferior auricular branches of the superficial temporal artery and the deep auricular branch of the maxillary artery. Additionally, the posterior auricular artery, a branch of the external carotid artery, supplies the posterior aspect of the ear. Arterial branches are arranged as a single layer of vessels within the skin as a consequence of the sparsity of subcutaneous fat. The venous pattern corresponds with the arterial supply, and drainage is via the superficial temporal and retromandibular veins.

The external ear receives rich sensory innervation from overlapping cranial and cervical nerves. The mandibular division of the trigeminal nerve gives off the auriculotemporal nerve, which travels posterior to the superficial temporal vessels and supplies the anterior portion of the auricle and anterior helix. Additionally, the auriculotemporal nerve supplies the anterior and superior walls of the auditory canal as well as a portion of the external surface of the tympanic membrane (Fig. 1-13). Injury to the auriculotemporal nerve may be limited by recalling that it lies posterior to the superficial temporal artery and vein and that inferiorly it exits the superior parotid fascia as it traverses the parotid gland. The great auricular nerve (C2, C3 ventral rami) supplies most of the medial surface of the auricle as well as the posterior portion of the lateral surface of the auricle. This will include most of the helix and antihelix. The mastoid area is also supplied by C2, C3 ventral rami but its innervation is derived via the lesser occipital nerve. The concha is variably innervated by cranial nerve VII, and the meatus is innervated by cranial nerves IX and X.[4,9,22] These cranial nerves also supply the posterior aspect of the external meatus and tympanic membrane and posterior auricular sulcus.

Lips and Chin

- Orbicularis oris muscle has no bony attachment and is innervated by the buccal branch of the facial nerve through its deep surfaces.
- Blood supply is derived from superior and inferior labial arteries arising from the facial artery.
- Innervation of the upper lip is achieved via the infraorbital nerve (V2) and of the lower lip via the mental nerve (V3).
- Redundancy of skin as well as mucosa around the commissural junction enables mobility and flexibility when the mouth is opened.
- Sensory innervation to the chin is supplied by the mental nerve branches (V3).
- Lip depressor muscles and mentalis are innervated by the marginal mandibular branch of the facial nerve.

Surgery of the lips lends itself to both cosmetic and functional importance. Disruption of the architectural contour of the lips has far-reaching consequences for the patient, making preservation and restructuring of the anatomy of utmost importance. While not often considered, the lip constitutes more than just the vermillion.[22] It extends superiorly to the nose and inferiorly to the chin, corresponding with the circularly arranged fibers of the orbicularis oris muscle. The boundary line of the upper lip lies at the junction of the columella, nasal sill, and alar crease below the base. Laterally, the upper lip extends to the nasolabial fold, a point at which the lip elevators insert into the orbicularis oris fibers. The upper lip is divided by a vertically placed philtrum bound by philtral columns on either side and inferiorly by a downward arch referred to as Cupid's bow. The vermillion is composed of a modified mucosal membrane with a rich underlying vascular supply. There are no underlying sweat, salivary, or sebaceous glands.[4,22] A redundancy of skin as well as mucosa around the commissural junction enables mobility and flexibility when the mouth is opened. A group of muscles of facial expression for elevation, depression, and retraction insert deep to the commissural skin.

The underlying anatomy of the lip is not complex, and contains the orbicularis oris fibers covered by mucous membrane (toward the oral cavity) and skin. The muscle fibers have a very close relationship with the dermis via muscular slips, limiting the ease with which dissection and reflection of the skin are possible. Bulging of the muscle fibers creates a corresponding surface marking known as the "white roll" or "white line" along the vermilion–cutaneous junction.[4,9,22] Orbicularis oris muscle has no bony attachments, and is circumferentially arranged to facilitate sphincteric action.

Motor innervation of the orbicularis oris is derived from the buccal branch of cranial nerve VII. Most of the angle elevators as well as the lip itself are supplied by the buccal branch. As the buccal branches exit the parotid fascia, they flank the parotid duct as they travel medially toward the orbicularis fibers to then pass deep to the muscle, innervating it from the deep surface (Fig. 1-23). The marginal mandibular branch of cranial nerve VII contributes to the depressors, again passing through the deep surface of the muscles. Sensory nerves are abundant and derived from the infraorbital branch of the maxillary nerve (CN V_2) (Fig. 1-24) reaching the upper lip, and from the mental nerve (terminal branch of the inferior alveolar nerve, a branch of mandibular nerve CN V_3) reaching the lower lip. Numerous small branches are encountered upon reflection of the skin. The main nerve trunks, however, may be accessed at the infraorbital foramen and the mental foramen. The infraorbital and mental foramina are generally located in a fixed position relative to the alae and oral commissure, respectively.

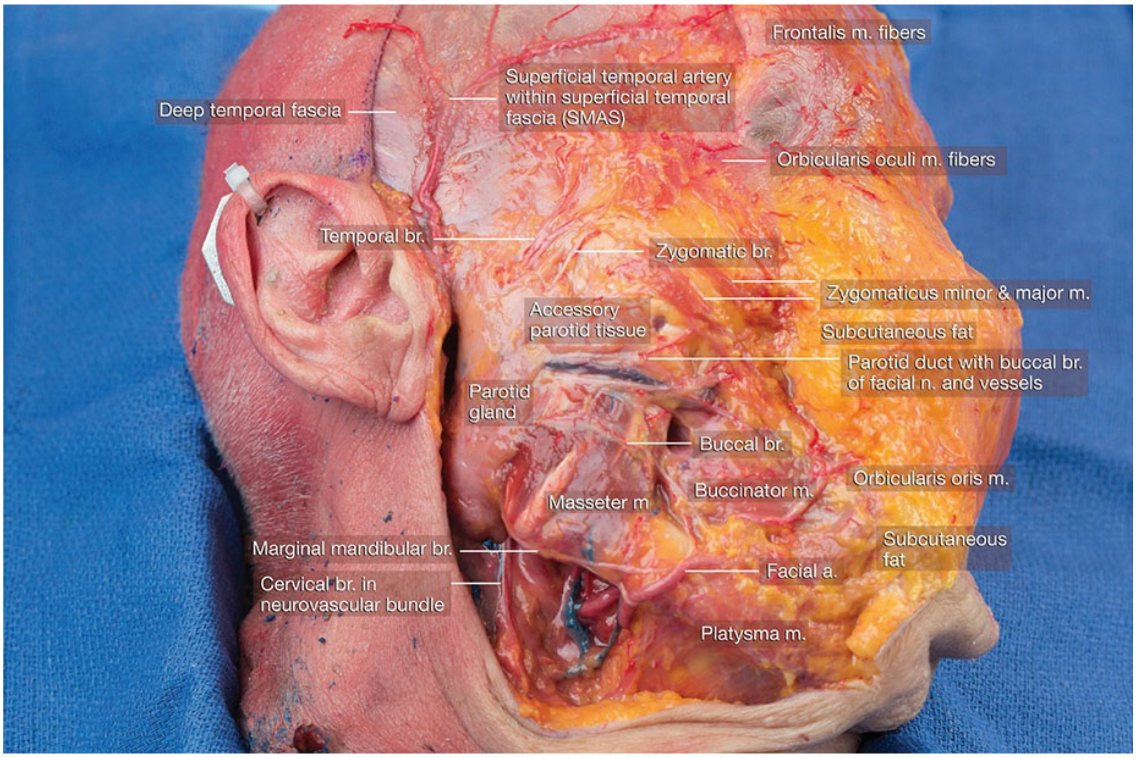


Figure 1-23. Dissection of the lateral face with skin and subcutaneous layers reflected medially.

Figure 1-24. Anterolateral view of lower face with skin and subcutaneous tissue over upper lip reflected inferiorly.

Blood supply to the lips is achieved through an anastomotic arterial arcade formed by the superior and inferior labial arteries (Figs. 1-24 and 1-25). These branches arise from the facial artery around the angle of the mouth. However, oftentimes the inferior labial artery may originate at a lower point, as the facial artery crosses over the angle of the mandible. With this branching pattern, the inferior labial artery may lie lower than its normal position and ascend toward the midline of the chin. Both the superior and inferior labial arteries are often highly tortuous, especially in older individuals, and run deep to the fibers of orbicularis oris. Skin over the lips is supplied by vertically ascending and descending branches off the arcades.

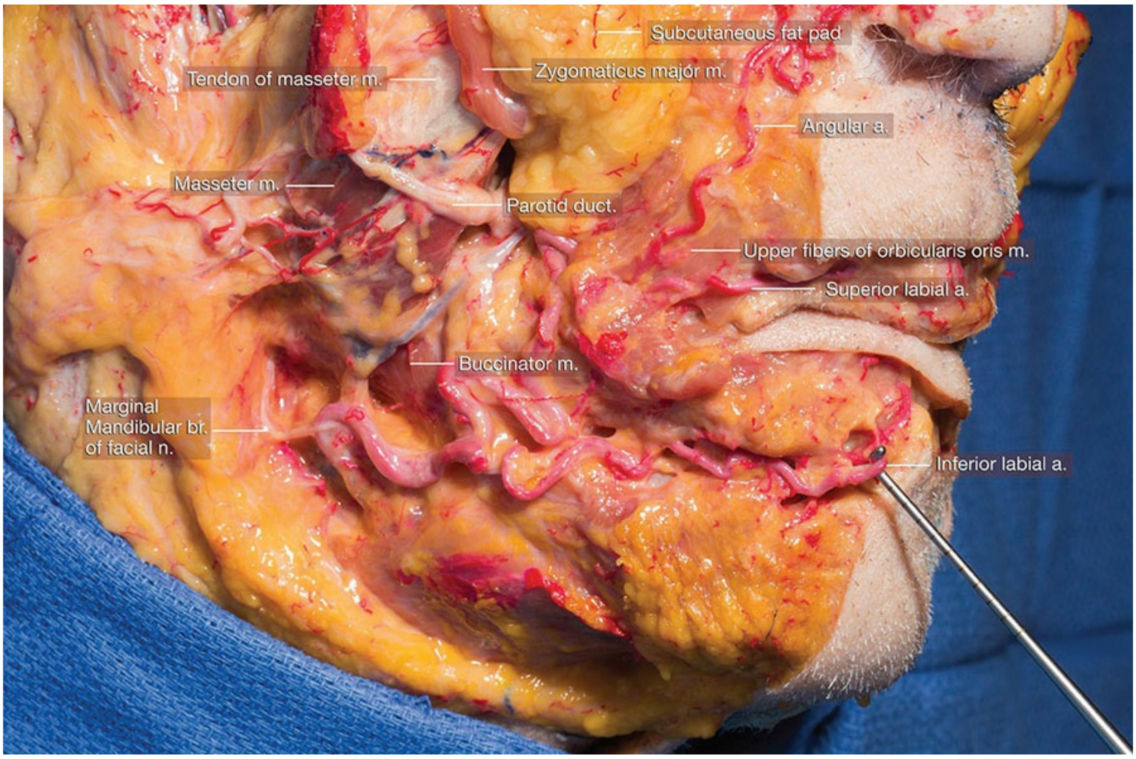


Figure 1-25. Lateral view of dissection of regional anatomy around the mid cheek and mandibular region.

The chin is a relatively fixed anatomical structure that is composed mostly of muscles of facial expression acting on the lower lip. The chin extends from the mentolabial crease to the most inferior point along the midline of the mandible. In older individuals, RSTLs are visible and can be distinguished between (1) the radially extending lines around the lower lip area with diagonal extensions toward the angles of the mouth and (2) the variable lines around the mental region that are determined by the shape of the chin.[22] As the muscles of facial expression insert directly into the skin, very little subcutaneous tissue is found in this area. Creating a dissection plane is somewhat difficult as the taut insertion of the muscles limits undermining in this region.

Muscles of the chin include overlapping fibers of the orbicularis oris muscle that mingles with the fibers of the platysma and other surrounding regional muscles. Laterally, the depressor anguli oris attaches to the medial aspects of the mandible and the oral commissure to pull the angle of the mouth downward. On the front of the mandible, the depressor labii inferioris is partially overlapped by the depressor anguli oris. Two slips of the mentalis muscle arise from the mandibular midline and insert onto the skin of the chin, maintaining a variable gap between them (Fig. 1-3). All these muscles are supplied by the marginal mandibular branch of the facial nerve. The marginal mandibular nerve is easily visualized as it passes along the bony margin to enter the chin deep to the angle of the mouth. Since the marginal mandibular nerve is often seen as a single exposed trunk before branching to supply these muscles, injury to the trunk will result in unopposed action of the antagonists of these muscles (Fig. 1-26).

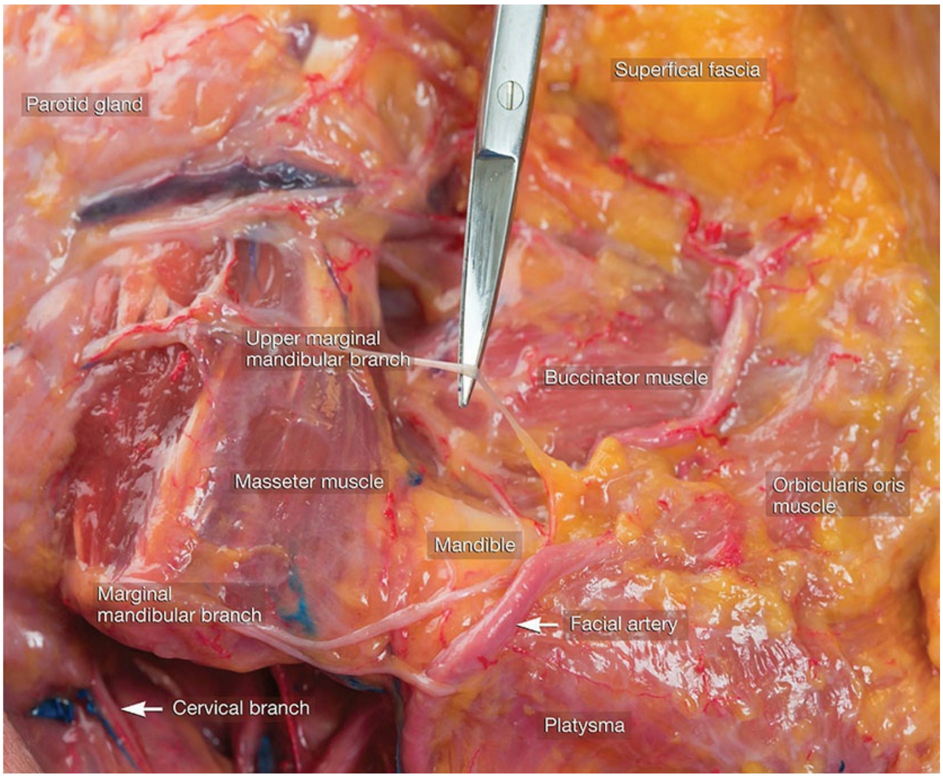


Figure 1-26. Dissection highlighting the marginal mandibular branch of the facial nerve and its relationship to the facial artery.

The mental nerve exits the mental foramen as a terminal branch of the inferior alveolar nerve. It is a purely sensory nerve and displays a tuft-like branching pattern. With aging, mandibular bone resorption may change the relative location of the mental foramen, bringing it a little higher toward the superior margin due to the decreasing height of the alveolar processes.

Cheek

- The anterior region includes the buccinator muscle, buccal fat pad, buccal branches of the facial nerve, and the downward traversing parotid duct.
- The parotid region is dominated by the parotid gland and underlying deep masseter muscle.
- The parotid duct and facial artery are easily identifiable landmarks in this region.
- The marginal mandibular nerve is a key structure in the mandibular region as it consistently crosses the facial artery deep to the fibers of platysma.

Anatomically, the cheek extends from the anterior border of the ear, limited medially by the nose, lips, and chin, and from the mandible up to the zygomatic arch and orbital rim. However, to best appreciate the cosmetic unit of the cheek, it is best described in three regions: the anterior, mandibular, and masseter–parotid regions.[4,9,22]

The *anterior region* contains many of the muscles of facial expression. The risorius is very superficial and of variable size, sometimes even absent. The zygomaticus major and minor as well as the levator labii superioris and the levator labii superioris alaeque nasi originate from the zygomatic bone and orbital rim, and are overlapped by the fibers of the orbicularis oculi muscle. When reflecting the skin over this region, zygomaticus minor is seen more superficially than the rest of the muscles, with only a few millimeters of subcutaneous tissue overlying it (Figs. 1-6 and 1-23). Since the facial nerve branches maintain their course and innervation deep to the muscles, injury to these branches is less likely provided that the plane of dissection remains superficial to the muscle plane.

Along the medial aspect of the anterior cheek, the facial artery can be seen anterior to the facial vein after crossing the mandible to ascend toward the angle of the mouth where it gives off the labial branches and subsequently traverses the nasolabial grove as the angular artery. Within the nasolabial groove, the angular artery can be accessed with little difficulty by dissecting within the subcutaneous tissue and overlying muscle slips of the zygomaticus major and minor muscles (Fig. 1-19). The angular artery then terminates at the medial canthus just above the medial canthal tendon by anastomosing with the ophthalmic branch of the internal carotid artery (Fig. 1-19). The deepest structures in this region of the cheek are the buccinator and levator anguli oris muscles. Unlike the other muscles of facial expression, the buccinator is a relatively fleshy muscle. It lies within a drop-down plane covered by a significant amount of fatty tissue, often referred to as the buccal fat pad (Fig. 1-25). The buccinator is pierced by the parotid duct as well as blood vessels and buccal branches of the maxillary nerve en route to supply sensory innervation to the buccal mucosa.[4,9,22] The buccal fat pad itself lies technically in the medial cheek. This fatty mass is well defined and contained by a thin layer of fascia, and on its surface the facial nerve branches can be visualized crossing over the fat pad still deep to the SMAS (Fig. 1-6). Superiorly, the infraorbital nerve branches out as a leash of nerves to supply sensory innervation to the medial cheek. The supraorbital foramen is easily palpated on most individuals.

The *masseter–parotid region* offers a very important anatomical landmark—the deeply set masseter muscle. A muscle of mastication supplied by the trigeminal nerve, the masseter can be easily visualized and palpated when the jaw is clenched. Its strong attachments extend between the zygomatic arch and the ramus of the mandible, and its anterior musculotendinous border provides an important landmark for key facial structures. The posterior half of the masseter is covered by the parotid gland. Contained within its own fascia, the parotid gland, wedged along the preauricular mandibular region, is separated from the masseteric fascia which is a continuation of the superficial layer of deep cervical fascia. The lower anterior portion of the masseter may be overlapped by the fibers of the platysma in most individuals.

When visualized on unembalmed cadaveric specimens, the parotid gland displays a yellowish color, very similar to the living patient. It may sometimes be confused with subcutaneous fat as it is relatively close to the skin itself (Fig. 1-23). Unlike the subcutaneous tissue, however, the parotid gland is contained within a shiny, tight fascial sheath, the parotid fascia, which may help in differentiating it from fat. On the anterior border of the gland, the parotid duct can be located as it travels horizontally and then downward into the buccal fat. It consistently crosses over the masseter muscle before turning sharply toward the buccinator to pierce it and enter the oral cavity opposite the upper second molar. From its surface anatomy, the parotid duct may be located in the region of intersection between the tragolabial line,[22] and the anterior edge of the masseter muscle and, additionally, along the zygomatic arch about 2 cm below it. The parotid duct is a prominent structure and provides a reliable anatomical landmark. As the parotid duct lies deep to the SMAS, it is crossed by fibers of the zygomatic branch of the facial nerve and also flanked by the upper and lower buccal branches of the facial nerve (Figs. 1-5, 1-6, and 1-23).

The transverse facial artery, arising from the external carotid artery, passes parallel to the parotid duct between it and the zygomatic arch. It also crosses over the anterior margin of the masseter muscle. The superficial temporal artery exits the parotid fascia below the zygomatic arch just anterior to the tragus (Fig. 1-27).[4,9,22] It passes posterior and deep to the parotid gland as one of the terminal branches of the external carotid artery. The facial artery and vein (posterior to the artery) also travel beneath the SMAS as they cross over the mandible. The facial artery and vein can be located just anterior to the masseter muscle. The facial artery, which travels in a tortuous ascending course, is often more prominently tortuous in older individuals. The mandibular branch of the facial nerve crosses over the facial artery about 5 to 10 mm above the point at which the facial artery crosses the mandible.

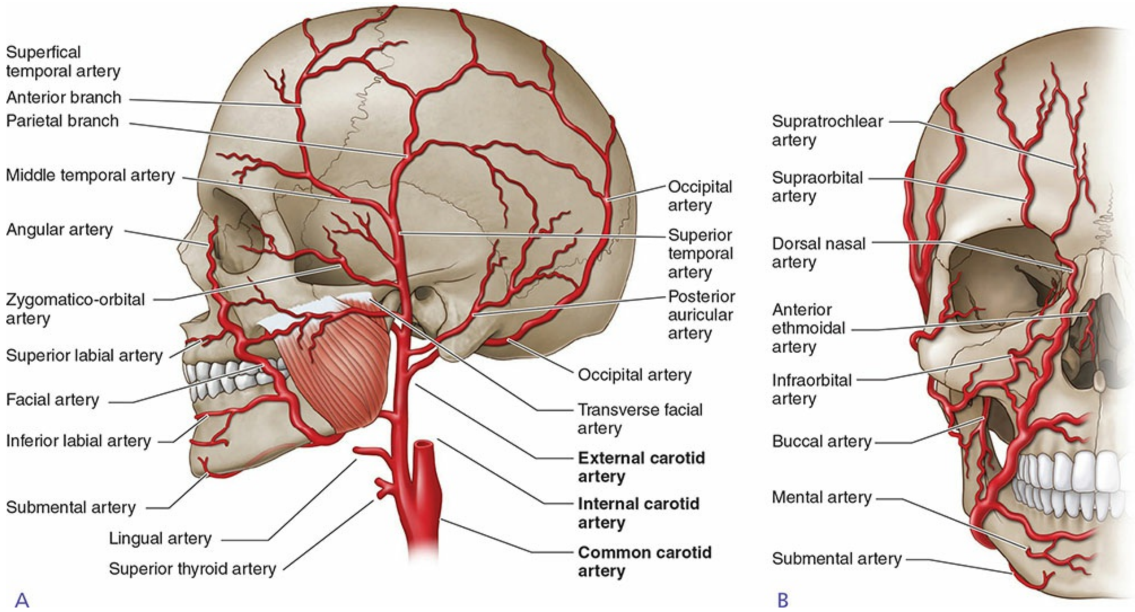


Figure 1-27. Diagram illustrating the arterial pattern and supply to the face.

The mandibular region extends from the anterior margin of the masseter muscle to the chin. Three predominant muscles are encountered after reflecting the skin in the region. The platysma lies within the superficial fascia and inserts into the skin of the lower lip, blending in with the fibers of the orbicularis oris muscle. The depressor anguli oris, which originates on the mandible and inserts onto the angle of the mouth, also sends fibers that blend in with those of the platysma and orbicularis oris.

Both the facial artery and the marginal branch of the facial nerve lie deep to the fibers of the platysma. In most individuals, the marginal branch of the facial nerve maintains a course above the mandibular rim, crossing the facial artery to supply the depressors of the lips and the mouth. While there are usually two branches, the mandibular branch of the facial nerve can exist as a single nerve or have as many as four branches (Fig. 1-26).

SURGICAL CONSIDERATIONS

Muscles of the face

The muscles of facial expression and the superficial group of muscles of mastication form the basis for the muscular framework of the face (Fig. 1-3). Muscles of facial expression lie at varying depths just deep to the subcutaneous tissue. They attach from the facial skeleton to the overlying dermis in a 3D configuration from deep to superficial.[2,3,6,14,27] Seen from this four-layered overlaying construct, the deepest muscles include buccinator, mentalis, and levator anguli oris. At the next level, the orbicularis oris and levator labii superioris can be visualized, followed by the more superficial depressor labii inferioris, risorius, platysma, zygomaticus major, and levator labii superioris alaeque nasi. Fibers of the depressor anguli oris, zygomaticus minor, and orbicularis oculi can be identified most superficially. All the muscles (except for the deepest layer) are innervated by the branches of the facial nerve passing through their deep surfaces.[4,9]

Branches of the facial nerve

Facial nerve branches, while generally protected by the SMAS, are surgically vulnerable as they reach areas of transition along their course toward their final destination.

Injury to the facial nerve and its branches during surgical exposure has been a topic of detailed discussion.[2,5,6,15,28–32] A few key points can help guide dissection around facial nerve branches: (1) Facial nerve exits its intracranial course through the stylomastoid foramen and immediately gives off the posterior auricular nerve which passes behind the ear toward auricularis posterior and the occipital belly of occipitofrontalis muscles. (2) At the posteromedial surface of the parotid gland, just before this point or within the gland, the facial nerve branches into a superior temporofacial and inferior cervicofacial division. (3) Facial nerve divides and reconnects through an extensive branching pattern before it exits the parotid fascia along the medial margin to give rise to five main trunks: temporal, zygomatic, buccal, mandibular, and cervical.[4,9,29] (4) Main branches lie within the parenchyma of the parotid gland and are not at risk for injury during superficial surgical procedures unless the parotid gland or parts of it have been resected (Fig. 1-4). (5) Vulnerability to injury of the facial nerve branches increases as they travel toward their areas of innervation. (6) Facial nerve branches are most susceptible to injury in their transition from Layer 5 (deep fascial plane) to Layer 4 (soft tissue spaces).[2,15,29] (7) Along their course, branches of the facial nerve lie deep to the SMAS and can be safely encountered as long as the plane of dissection is maintained above the SMAS (Fig. 1-6).

Anatomic points of consideration to limit vulnerability of facial nerve branches to injury

1. Temporal branches emerge from the upper margin of the parotid fascia and cross the zygomatic arch. Usually three to four branches supply frontalis and parts of orbicularis oculi (Figs. 1-4, 1-6, and 1-14).
2. Zygomatic branches cross the zygomatic arch and bone and are in direct contact with periosteum. As they cross the bony eminence, they lie directly under the skin with no subcutaneous protection (Figs. 1-4, 1-6, and 1-23).

3. Buccal branches flank the parotid duct along its upper and lower margins. Keeping the parotid duct in view helps maintain a safe zone limiting injury to the buccal branches as they travel toward the buccinator, nasalis muscle fibers, and the upper portions of the orbicularis oris muscle (Figs. 1-5 and 1-23).
4. The marginal mandibular branch travels frequently as a single branch, and often as two branches running above, along, or about 1 cm below the inferior border of the mandible. It consistently crosses over the facial artery, making it vulnerable to injury once the facial artery is approached. The platysma offers a layer of protection over the marginal mandibular branches and the mandible-traversing portion of the facial artery (Fig. 1-26).
5. The cervical branch is located deep to the platysma as it descends from the lower border of the parotid gland maintaining its position on the deep surface of the muscle. It is only vulnerable to injury if the fibers of platysma are reflected (Fig. 1-23).

Anatomic points of consideration to avoid injury and maximize vascular sources for reconstruction

The superficial arterial supply to the face includes a rich anastomotic network of branches originating from the external and internal carotid arteries. Through extensive anastomoses, these major vascular trunks provide reliable pedicles and contribute to the microvascular infrastructure of the superficial face. The external carotid artery includes a vast network of arborizing, anastomotic, and tortuous arteries varying in size and depth within the fascial planes. The internal carotid artery via its ophthalmic branch supplies a central triangular area including the eyes, superior nose, and central portion of the forehead.[4,9] The key area of anastomosis between external and internal carotid arteries is located above the medial canthal tendon where the angular artery communicates with the dorsal nasal branch of the ophthalmic artery (Fig. 1-19).

The superficial temporal artery ascends behind the temporomandibular joint, anterior to the tragus and auriculotemporal nerve. It crosses the zygomatic arch and branches over a wide surface deep to the skin and within the layers of the superficial temporal fascia. The supraorbital and supratrochlear arteries run along the same territory as a neurovascular bundle with the supraorbital and supratrochlear nerves. The larger supraorbital artery usually anastomoses with the superficial temporal artery (Fig. 1-12).

The anastomosis of the angular branch of the facial artery with the dorsal nasal artery above the medial canthal ligament is an area of surgical importance (Figs. 1-10 and 1-19). While the course of the facial artery within the nasolabial fold is well known, its infrequent course outside the fold has been documented. The artery has been recorded passing through the fold in up to 90% of individuals, and at least 5 mm outside the territory or crossing it in up to 45% of individuals.[10,33] In the nasolabial region, the facial artery along with its superior and inferior labial arteries may not always maintain a submuscular position. Lee et al.[33] provide anatomical evidence for the vessels travelling superficial to the surrounding muscles of facial expression and sometimes looping deep and superficial to the muscle fibers.

Anatomy of the neck

Understanding the superficial anatomy of the neck begins with the ability to visualize key structures bound by palpable landmarks. The topographic anatomy of the neck is marked by consistent musculoskeletal structures that present triangular spaces seen from the anterior and lateral aspects (Fig. 1-28). Surgical approaches to the neck can be enhanced by keeping the following anatomical points in perspective:

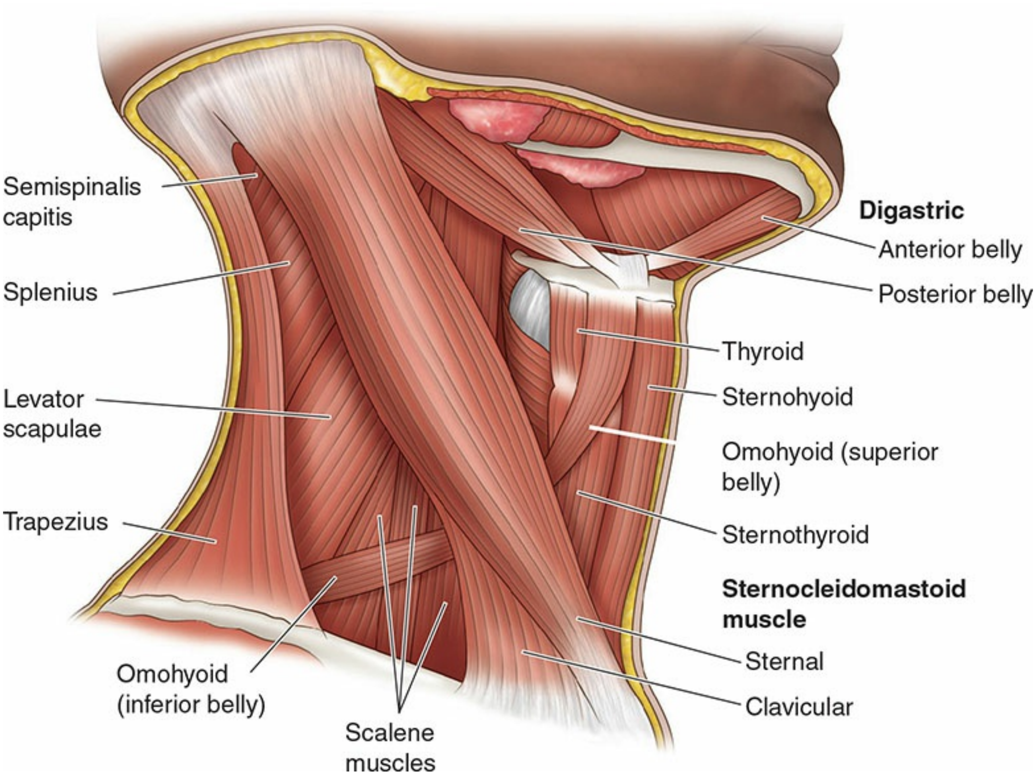


Figure 1-28. Diagram illustrating the anatomical boundaries and structures within the posterior triangle of the neck.

1. The most prominent landmark in the neck, the sternocleidomastoid muscle (SCM), provides the primary boundary for differentiating the anterior and posterior triangles.
2. The most superficial muscle of the neck, the platysma, is invested by superficial cervical fascia (continuous with the SMAS), creating a thin

muscular veil over the superficially traversing cutaneous nerves.

3. Superficial cervical nerves, the great auricular, lesser occipital and transverse cervical nerves, are encountered at the posterior border of the SCM when platysma muscle is reflected.
4. Erb's point, located 6 cm below the midpoint of a line connecting the angle of the mandible with the mastoid process, provides a landmark for the exit point of the superficial cervical nerves and the accessory nerve (cranial nerve XI).[34]
5. The external jugular vein travels along a vertical course on the superficial surface of SCM anterior to the great auricular nerve to the base of the neck where it pierces the deep cervical fascia.

Triangles of the neck

The triangles of the neck are formed by visible and palpable landmarks of its musculoskeletal framework. The anterior triangle is bound posteriorly by the anterior margin of the SCM, superiorly by the inferior margin of the mandible, and anteriorly by the sternohyoid and sternothyroid muscles. The posterior triangle is bound anteriorly by the posterior border of the sternocleidomastoid and posteriorly by the anterior border of the trapezius muscle and lateral portion of the clavicle (Fig. 1-28).

The anterior triangle may be further subdivided by the posterior and anterior bellies of the digastric muscle and hyoid bone into the submental, submandibular, carotid, and muscular triangles (Fig. 1-29).

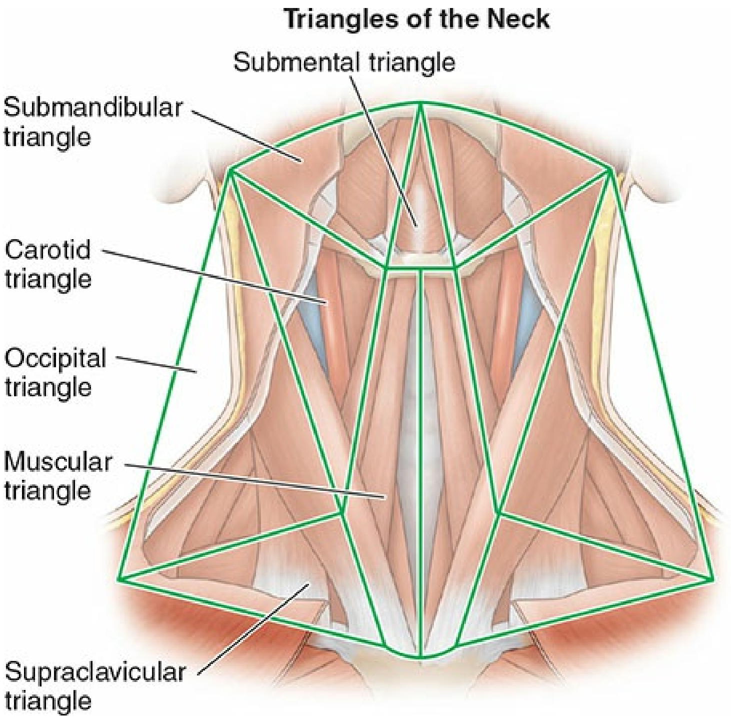


Figure 1-29. Diagram illustrating the sub-divisions of the triangles of the neck.

- Submental triangle: The flat mylohyoid muscle forms the floor, with the nerve to mylohyoid running along this surface; it contains few structures of significance other than subcutaneous fat, fascia, and lymph nodes.
- Submandibular triangle: The submandibular gland is the most prominent structure. It contains lymph nodes and the proximal portion of the facial artery as it courses between the parts of the submandibular gland; the low-hanging marginal mandibular branch of the facial nerve passing below the mandibular margin must be considered within this space.
- Carotid triangle: The carotid sheath containing the common carotid artery, internal jugular vein, and vagus nerve fills the space. The ansa cervicalis (branch of cervical plexus) motor contribution to strap muscles loops over the anterior surface of the carotid sheath; internal and external carotid arteries originate within this triangle; the hypoglossal nerve may be seen as it travels along the uppermost portion of the triangle from posterior to anterior.
- Muscular triangle: Contains the strap muscles (infrahyoid), including sternohyoid, sternothyroid, omohyoid and thyrohyoid muscles, and traversing muscular branches of the cervical nerves.

The posterior triangle (Fig. 1-28) can be further divided anatomically by the inferior belly of the omohyoid into the occipital and supraclavicular triangles. However, these divisions are rarely differentiated clinically. The deepest aspect of the posterior triangle, the floor, is formed by the parallel arrangement of deeper, smaller, neck muscles. Superiorly, the triangle contains the splenius capitus. Inferiorly, the levator scapulae (an important muscular landmark for isolation of the accessory nerve) lie above the posterior and middle scalene muscles. It is surgically useful to note that these muscles are covered by the prevertebral fascia (deep cervical fascia) on the top of which lies the superficial layer of deep cervical fascia.

In the next layer, two important nervous structures lie over and between the muscles of the floor of the posterior triangle. The proximal portion of the trunks of the brachial plexus lie anterior to the middle scalene muscle and are covered by the overlying prevertebral fascia. Injury to the trunks of the brachial plexus is unlikely as long as the prevertebral fascia remains uninterrupted.

Perhaps, one of the most emphasized structures of surgical interest in the posterior triangle is the accessory nerve (CN XI) (Fig. 1-30). As it descends over the levator scapulae muscle to pass beneath the trapezius muscle, the course of the accessory nerve can be traced along the midline