Objectives

- Wound healing
- Sutures
- Equipment
- Flap design
- Surgical Principles
- Suturing techniques
Before we suture, Let’s learn more about the injury/wound
THE WOUND
What Happens to the Wound?

• Inflammatory response
  – Outpour of tissue fluids
  – Accumulation of cells and fibroblast
  – Increased blood supply
  – Leukocyte production of proteolytic enzymes
  – Dissolve and remove damaged tissue debris
What Happens to the Wound?

- Fibroblasts begin to form collagen fiber
Wound Healing

**Activity of Wound Healing Components**

- **Immediate Injury Response** (Vasospasm/Clot Formation)
  - Time of Incident: 6h, 24h

- **Granulocyte Activity** (Inflammatory Phase)
  - Time of Incident: 6h, 24h, 3d, 5d, 7d

- **Epithelial Cell Growth**
  - Time of Incident: 6h, 24h, 3d, 5d, 7d

- **Macrophage Activity** (Inflammatory Phase)
  - Time of Incident: 24h, 3d, 5d, 7d, 14d, 30d, 60d

- **New Vessel Formation**
  - Time of Incident: 3d, 5d, 7d, 14d, 30d, 60d

- **Fibroblast Activity** (Collagen Formation)
  - Time of Incident: 3d, 5d, 7d, 14d, 30d, 60d
Not all wounds are healing equally...
Factors Affecting Wound Healing

• Age
  – Slow metabolism and impaired circulation

• Weight
  – Excess fat → makes tissue vulnerable to trauma and infection

• Nutritional status
  – Essential to support cellular activity and collagen synthesis
Factors Affecting Wound Healing

• Dehydration
  – Results in electrolyte imbalance $\rightarrow$ affects cellular metabolism, oxygenation, cardiac function, kidney function, hormone function $\rightarrow$ impaired healing process

• Inadequate blood supply
  – Poor oxygenation / circulation will impair healing process
Factors Affecting Wound Healing

• Immune response
  – HIV, chemotherapy, catabolic steroid user
  – Allergy to suture materials

• Presence of chronic disease
  – Endocrine disorders, localized infection, malignancies

• Radiation therapy
  – Impairment of healing → substantial wound complications
WOUND CLASSIFICATION
Wound Classification

• Wounds can be divided into two groups
  – Clean or contaminated
  – Probability of contamination increases rapidly and directly related to the length of time since the injury

• Contamination of a clean wound is usually by Streptococcus

• Multiple bacteria become involved if mucosal layers are violated
Wound Classification

• When is the wound “contaminated”
  – Wounds that involve the mucosal linings of the oral cavity

• Saliva may carry normal oral flora to deeper structures and lead to development of a wound infection

• Simple lacerations and abrasions have a lower bacterial content
Wound Contamination

• Factors that ↑ chances for infection:
  – Crushing of tissue, embedding of foreign bodies, and contamination of saliva

• The total number of bacteria present within the wound is a major concern in the development of an infection
  – Inoculum must exceed $10^5$ organisms per gram of tissue
HEALING CHARACTERISTICS

The wound
Tensile Strength

Days Post Injury

% Wound Tensile Strength

1 YEAR

2 3 7 10 14 18 20 25 30 40 50 60 70 100 150 200 300
Types of Healing

- Primary intention
- Second intention
- Tertiary intention
Types of Wound Healing

- **Primary intention**
  - **Phase I**: Inflammatory response (1-5 days)
  - **Phase II**: Migration/proliferation (5-14 days)
  - **Phase III**: Maturation/remodeling (14 – done)
Types of Healing

- **PRIMARY** – “Golden Period” of closure is within first 6 hours
  - Approximation of wound edges
  - Minimum scar
Types of Healing

• **SECONDARY**
  – Granulation with increased scar formation
  – Prolonged healing
  – Due to infection, excessive trauma, tissue loss, poor approximation

• **What to do?**
  – Allow time for healing from inner layer to outer surface
  – Peridex and let it heal
Types of Healing

- **TERTIARY** (Delayed primary closure)
  - Candidate for closure after cleaning, debridement
  - Leave it open with 4-5 days of antibiotics
  - Precise and secure approximation of edges needed
  - Not common in dentistry
Complications in Wound Healing

- Infection
  - Bacterial, viral, fungal
- Dehiscence
  - Old/debilitated patients
  - Tissue failure
  - No difference in dehiscence rate between *vertical* versus *transverse* incisions
SUTURES
HISTORY OF SUTURES

Ancient Indian doctor: beetle head
Edwin Smith Papyrus 1600 BC
Galen AD 150 uses catgut, silk
Joseph Lister 19th century soaked catgut in phenol
SUTURE IS A STRAND OF ANY MATERIAL USED FOR

• Ligating blood vessels
• Transfixing
• Approximating tissues
What Materials Have Been Used?

- Hemp
- Gold
- Silver
- Linen
- Thorn
- Cotton
- Kangaroo tendons
- Animal intestine
- Human Hair
THE IDEAL SUTURE
Moynihan 1912

• Monofilament
• Absorbable
• Predictable absorption
• Use for any Procedure
• Easy to handle
• Minimal Tissue Reaction
• High Breaking Strength
• Holds Knots Securely
• Sterile

Sir Berkeley Moynihan
Famous British abdominal Surgeon 1865-1936
Choice of Suture

• Familiarity
• Ease of handling
• Tissue characteristics
• Knowledge of physical and biological characteristics of the suture
• Patient factors-infection, debility, obesity
Suture Materials

• Primary purpose for suture
  – Approximate wound margins
  – Enhance tissue healing

• Early role of suture
  – Wounds do not gain strength until 4-6 days after injury
  – Approximating of tissues depending on suture strength

• The relationship between gradual loss of suture strength and slow increase of wound strength must be considered
Suture Material Size

- Refers to the diameter of material
- The more zeroes in the number, the smaller the diameter i.e. 5-0 < 3-0
- Smaller the size, less tensile strength
  - 9-0 or 10-0 for microsurgery
  - 5-0 or 6-0 facial skin closure
  - 3-0 or 4-0 for muscle, deep skin, intra oral mucosa
<table>
<thead>
<tr>
<th>Nonabsorbable</th>
<th>Absorbable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monofilament</td>
<td>Braided</td>
</tr>
</tbody>
</table>
Nonabsorbable Sutures

ADVANTAGE

– Permanent Wound Support

DISADVANTAGE

– Foreign body left
– Suture Extrusion
Absorbable Sutures

ADVANTAGE

– Broken down by body
– No Foreign body left

DISADVANTAGE

– Time of Wound Support
Monofilament

ADVANTAGE

- Smooth surface
- Low friction
- Less drag
- Less tissue Trauma
- Less tissue Infection
- No capillarity action

DISADVANTAGE

- Handling and knotting
- Stretch ability and bending-PLIABILITY
Braided

ADVANTAGE
– Strength
– Soft and pliable
– Good handling

DISADVANTAGE
– Capillary action
– Tissue trauma
– Tissue drag
– Tissue cutting
– Harbors bacteria
Classification of Sutures

Non-Absorbable
- Natural Silk
- Synthetic Nylon
- Synthetic Propylene
- Synthetic Polyester
- Synthetic SS
- Synthetic Titanium

Absorbable
- Natural Plain Gut
- Natural Chromic Gut
- Synthetic Vicryl
- Synthetic PDS
Suture Type

NON-ABSORBABLE
<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tissue Reaction</th>
<th>Tensile Strength</th>
<th>Knot Security</th>
<th>Uses and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silk</td>
<td>Braided</td>
<td>++ ++</td>
<td>++</td>
<td>+++</td>
<td>Easy to handle but has increased potential for infection</td>
</tr>
<tr>
<td>Nylon (Ethisol, Dermalon)</td>
<td>Monofilament</td>
<td>++ ++</td>
<td>+++</td>
<td>++</td>
<td>Commonly used in skin closure but high degree of memory; requires several throws for secure closure</td>
</tr>
<tr>
<td>Polypropylene (Prolene)</td>
<td>Monofilament</td>
<td>+ ++ ++</td>
<td>+++</td>
<td>+</td>
<td>High degree of memory, low tissue adhesion; good for subcuticular pull-out technique</td>
</tr>
<tr>
<td>Dacron (Mersilene)</td>
<td>Braided</td>
<td>+++ +</td>
<td>++</td>
<td>+++</td>
<td>Easy to handle, good knot security; like silk but less risk to tissue for inflammation and infection</td>
</tr>
<tr>
<td>Polybutester (Novafil)</td>
<td>Monofilament</td>
<td>+ + ++ ++</td>
<td>+++</td>
<td>+ ++</td>
<td>Excellent handling, strength, and security; expands and contracts with changes in tissue edema</td>
</tr>
</tbody>
</table>
Silk

- Natural Nonabsorbable – Braided
- Made from Silkworm Cocoons
Silk

- Multifilaments of silk are twisted or braided together to form a strand
- Superior in handling, ties down smoothly
- Natural elasticity insures a secure knot
- Good intraorally for areas of tension
Silk

- Do not use for face
  - Due to amount of bacteria contained within filaments

- Wicking effect

- Never be used in area of wound infection
Summary for Silk

- Very Good Handling
- Very Good Knotting
- **STANDARD** for many years
Nylon

• First synthetic nonabsorbable monofilament

• Replaced monofilament silk

• Minimum acute inflammatory reaction

• Biologically inert
Nylon

- General soft tissue approximation

- Memory Effect
  - Pass through fingers when unpacking
  - Need more knot throw to counter

- Good for skin closure
  - Due to elastic nature, high tensile strength
Nylon

• Advantage
  – Easy tissue pass through
  – No capillary effect
  – Strong elasticity
  – Long duration wound support

• Disadvantage
  – Absorbs water
Prolene

- Synthetic
- Nonabsorbable
- Monofilament
Prolene

- Synthetic linear monofilament
- Nonabsorbable with blue or clear color
- Replaced monofilament nylon
Prolene

• Minimum acute inflammatory reaction

• No tissue adherence, good for “pull-out” suture

• Memory Effect

• Good for general soft tissue closure
Prolene

• Advantage
  – Better control
    • Up to 30% extension w/o breaking
  – Indefinite tensile strength
  – Excellent handling
  – Less thrombogenic

• Disadvantage
  – Minimum oral cavity application
Gore-Tex Suture
Gore-Tex Suture

• Polytetrafluoroethylene (ePTFE) biomaterial
  – Best known as Teflon (discovered in 1938)
• Monofilament, *Non-absorbable*
• Reduce blood loss
  – Needle approximate thread diameter
    • Allow suture to fill needle hole → reduce bleeding → better hemostasis
• Reduce tissue trauma
  – Minimal suture friction
• Excellent handling characteristic
Gore-Tex Suture

• Procedures using Gore-Tex

• Common Usage
  – Vascular surgery
    • Chordae tendineae / mitral valve repair
  – Hernia repair
  – Oral Health
    • Soft, flexible surface
    • No snagging or knotting of the thread
Suture Type

RESORBABLE
Resorbable Suture

- Trend:
  - Increasing popularity for all surgery
    - Less post operative inflammation
    - Easier post operative appointment
  - No obligatory suture removal
Resorbable Suture

• Natural Resorbable
  – Broken down by body enzymes

• Synthetic Resorbable
  – Broken down by hydrolysis
<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tissue Reaction</th>
<th>Tensile Strength</th>
<th>Tissue ½ Life (Days)</th>
<th>Uses and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gut</td>
<td>Natural</td>
<td>++++</td>
<td>++</td>
<td>5-7</td>
<td>For mucosal closures, rarely used</td>
</tr>
<tr>
<td>Chromic gut</td>
<td>Natural</td>
<td>++++</td>
<td>++</td>
<td>10-14</td>
<td>For oral mucosa, perineal, and scrotal closures; can be annoying to patients because of stiffness</td>
</tr>
<tr>
<td>Polyglycolic acid-PGA (Dexon)</td>
<td>Braided</td>
<td>++</td>
<td>+++</td>
<td>25</td>
<td>For subcutaneous closure; coated version easier to use but requires more knots (Dexon-Plus)</td>
</tr>
<tr>
<td>Polyglactin 910 (Vicryl)</td>
<td>Braided</td>
<td>++</td>
<td>+++</td>
<td>28</td>
<td>Comes dyed and undyed; do not use dyed on face; irradiated polyglactin excellent for mucosal closures</td>
</tr>
<tr>
<td>Polyglyconate (Maxon)</td>
<td>Monofilament</td>
<td>+</td>
<td>+++</td>
<td>28-36</td>
<td>For subcutaneous closure; less reactive and stronger than PGA and polyglactin</td>
</tr>
<tr>
<td>Polydioxanone (PDS)</td>
<td>Monofilament</td>
<td>+</td>
<td>+++</td>
<td>36-53</td>
<td>For subcutaneous closures that need high degree of security; stiffer and more difficult to handle than PGA or maxon</td>
</tr>
</tbody>
</table>
Tensile Strength Retention

Absorption Time
Absorbable Suture Type

NATURAL ABSORBABLE
CATGUT

• 99% purified collagen
  – From submucosa of sheep or cow intestine

• Essentially monofilament type

• Available types
  – Plain gut or Chromic gut
Fast Absorbing Gut

• All strength lost by 7\textsuperscript{th} day

• Absorption in 21-42 days

• Moderate tissue reaction

• Should be wet before using but NEVER soaked

• Dermal suture or low tension area ONLY
Plain Gut

- Tensile strength 7-10 days
- Absorption ~70 days
- Causes more tissue reaction
- Clinical usage
  - Ligate superficial vessels
  - Subcutaneous tissue lip
  - Oral mucosa
Chromic Gut

- Tensile strength last 10 – 14 days
- Absorption in 90-110 DAYS
- Moderate tissue reaction
- Treated with chromium salt
  - Brown color
  - Resist digestive enzyme
  - Prolong absorption
- Used intraorally, no to be used on skin
Cat Gut Suture

• Package contained fluids during storage
  – Keep it supple and hydrated

• Sterilized by Gamma irradiation
  – 2.5 mega rads

• Body reaction to impurities or mucopolysaccharides rare

• Suture should be kept wet but not soaked
## Cat Gut Absorption

<table>
<thead>
<tr>
<th></th>
<th>Plain</th>
<th>Chromic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wound Support</strong></td>
<td>7 – 10 days</td>
<td>10-14 days</td>
</tr>
<tr>
<td><strong>Mass Absorption</strong></td>
<td>60 – 90 days</td>
<td>90 – 110 days</td>
</tr>
</tbody>
</table>
Absorbable Suture Type

SYNTHETIC ABSORBABLE
Synthetic Absorbable

• Prepared from carbohydrates

• 2x stronger compared to natural absorbable

• Available types
  – Monofilament
  – Braided

• Dependable absorption rate
Synthetic Absorbable

• Fully absorbed without foreign residues

• Absorption by hydrolysis reaction

• Ease of handling
Sutures

- **Vicryl Rapide**\(^*\) (polyglactan 910)
  - 50% tensile strength in 5 days
  - 0 strength in 10-14 days
  - **Braided**, coated synthetic
  - Absorbable, low molecular weight
Vicryl Rapide*

• Elicits lower tissue reaction than chromic gut
• **Ideal for dental procedures**
Coated Vicryl

- Coated Vicryl (Polyglactan 910)
  - 75% tensile strength at 2 weeks, 40% at 3 weeks
  - Absorption at 56-70 days
  - Synthetic absorbable

![Graph showing strength retention comparison](image)
Coated Vicryl

• Minimal acute inflammatory reaction when buried in subcutaneous tissues

• Braided coated Vicryl behaved like monofilament
  – Reduced surface tension

• Indicated for general soft tissue approximation and/or ligation
Coated Vicryl

• Frequent Uses
  – General tissue/muscle approximation
  – Vicryl *PLUS* has popular oral mucosa usage. Ligatures, reproductive tract, ophthalmic..
  – Otherwise.... reproductive tract, orthopedics

Vicryl *PLUS* contains triclosan
Monocryl

- Monocryl (Poliglecaprone 25)
  - 60-70% tensile strength at 7 days, 30-40% at 14 days
  - Absorption at 91-119 days
  - Monofilament synthetic absorbable
MONOCRYL suture integrity maintained after multiple passes

Chromic gut suture frays after multiple passes, which may lead to increased tissue drag and weaker sutures.
Monocryl

- Highest strength among absorbables
- Most pliable with excellent handling properties
- Minimal acute inflammatory reaction
- Frequent use
  - Bladder, GI surgery.....
  - Not much indication for dental use
PDS

- **PDS II (Polydioxanone)**
  - 70% tensile strength at 2 weeks,
    50% at 4 weeks, 25% at 6 weeks
  - Absorption **180-210** days
  - Monofilament synthetic absorbable
  - Non-antigenic, only slight tissue reaction
PDS

• PDS
  – Absorption complete at 6 months
  – Indicated for all types of soft tissue closure
  – Significant memory, poor knot security

• Frequent Uses
  – For slow healing patient/compromised tissue
    Fascia, orthopedics...
Armamentarium

NEEDLE
Suture Needle

• Three basic components
  – The attachment end (swaged or eyed)
  – The body
  – The point
The Attachment End

Virtually all needles used today are swaged type
Suture Needles

- Swaged
  - Needle are permanently attached to the suture material
  - Eliminating the need for threading

- Allows needle to be drawn through tissue easier and with less tissue trauma
Types of Suture Needles

• Reverse cutting
• Conventional cutting
• Tapercut
• Taper
Reverse Cutting Needle

- Most commonly used in Oral Surgical procedures

- Two opposing cutting edges with the third cutting edge on the outer curvature of the needle

- Reduces danger of "cut-out"
Conventional Cutting Needle

• Two opposing cutting edges with the third on the inside curvature of the needle

• The needle changes from a triangular cutting tip to a flattened body

• Not commonly used in Oral Surgery
  – because cutting edge tends to pull through the edge of the flap with limited access
Taper Cut Needle

• Specifically designed to use on tough and/or delicate tissues
• The point of the needle has sharp reverse cutting tip
• All three edges of the tip are sharpened to provide uniform cutting
Taper Cut Needle

- Used to close deep tissue like muscle, periosteum, creating a smaller piercing of tissue, less chance of cutting through tissue
## Common Needle Types

<table>
<thead>
<tr>
<th>Needle Series</th>
<th>Type of Cutting Edge</th>
<th>Alloy</th>
<th>Point</th>
<th>Body</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>Reverse</td>
<td>420</td>
<td>▼</td>
<td>▼</td>
<td>Triangular to swage</td>
</tr>
<tr>
<td>P Prime</td>
<td>Reverse</td>
<td>Ethalloy</td>
<td>▼</td>
<td>□</td>
<td>Square-bodied</td>
</tr>
<tr>
<td>PS Prime</td>
<td>Reverse</td>
<td>Ethalloy</td>
<td>▼</td>
<td>□</td>
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<tr>
<td>PC Prime</td>
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<td>Ethalloy</td>
<td>△</td>
<td>□</td>
<td>Square-bodied</td>
</tr>
</tbody>
</table>

FS = for skin; P = plastic; PC = precision cosmetic; PS = plastic surgery.
Summary for Surgical Needles

• Manufactured from stainless steel wire
  – Heat treated
    • Provide: strength, hardness, malleability and sharpness

• Most common for closure of facial and oral mucosa lacerations
  – Reverse cutting needle

• Most commonly used curved needle is
  – 3/8 circle needle
    • Easily manipulated in relatively large and superficial wounds
OTHER INSTRUMENTS
Suturing Instruments

- Tissue Pick-Ups
- Needle Holders
- Hemostats
- Scissors
- Scalpel
Tissue Pick-Ups

These instruments only have fine delicate fingers so they *HOLD*, not *PIERCE* or crush the tissues to be sutured.

Adson w/o teeth  Adson w teeth  Adson Brown
Needle Holders

• Many different needle holders
  – Various beak size, shape, texture (smooth or serrated)

• Most common have locking handles and short beaks
Grasp the needle one-third to one-half of the distance from the swaged end to the point.
Hemostats

• Used primarily to remove foreign bodies, pick up tissue to be discarded

• **Not** to be used as a needle holder
Scissors

- Used for cutting suture

- Dean scissors
  - general purpose scissors,
    - for cutting suture and trimming mucosal tissue
How to hold Surgical Scissor?
Scalpel #15
How do I make / Design a flap?

FLAP DESIGN
Perfect Surgeon must have the **heart of the lion** and the **hands of a lady**, not the claws of a lion and the heart of a sheep

Sir Berkeley Moynihan, 19th century British Abdominal Surgeon
Indications for Mucoperiosteal Flap

• Myth
  – Flap is elevated only in the most extraordinary circumstances

• Reality is...
  – Utilize flap whenever there is the slightest indication that it might be helpful
Principles of Flap Design

- Broad base: to assure adequate blood supply

- Large enough to provide both visual and instrument access
  - Large flap heals as rapidly as a small flap
  - Flap does not heal from end-to-end by side-to-side
  - Post surgical pain does not correlate with size of the flap but more to the amount of bone removed.

- Repositioned and sutured over solid bone

- Avoids major anatomical structures (nerve and blood vessels)
Common Design of Flaps

• **Envelope Flaps**
  – 1 tooth distal and 2 teeth mesial

• **Flaps with vertical releasing incision**
  – 1 tooth distal and 1 tooth mesial
    • Includes papilla
  – Vertical release incision must be originating from either
    • Mesial or distal line angle
Contraindications for Placement of Vertical Release Incision lines

- **Canine Prominence**
  - Soft tissue defect due to frequent bone fenestration

- **Mental Foramen**
  - Avoid vertical incision near proximity of mental foramen

- **Palate**
  - Avoid vertical incision on the palate to void severing greater palatine vasculature and nerve
Contraindications for Placement of Vertical Release Incision lines

- Incisive Papillae
  - Avoid unnecessary incision through incisive papillae

- Bony lesion
  - Avoid placing incisions over bony lesion since dehiscence would result with delayed healing

- Major Frena
  - Avoid incision through major frena

- Lingual side of mandibular arch
  - Never Ever place vertical incision on lingual side of the mandibular arch
Flap Design

• Flap should be designed
  – When repositioned, it needs to be over an adequate margin of solid bone
    • ↑healing rate & ↓wound dehiscence

• Margin of flap should be at least 5mm from the margins of a bony defect!
An incision can be made from tip of one coronoid process down the anterior border of the ramus and along the crest of the alveolus to the tip of the coronoid process on the opposite without cutting any major structures except buccinators artery and long buccal nerve.
Mandibular Flaps

- Hazard areas for mandibular flap
  - Lingual region of 3rd molars
    - Lingual nerve damage
      - Permanent anesthesia and loss of taste
  - Premolar buccal vestibular region
    - Sever mental nerve/vessel
      - Permanent loss of labial sensation
    - Recovery of sensation maybe possible by proliferation of collateral innervation from C2,C3 and contralateral mental nerve
Mandibular Flap

• Hazard areas for mandibular flap
  – Improper incision / Scalpel Slip to depth of the vestibule near 2nd molar
    • Facial artery/ vein
      – Cross mandible at the anterior edge of masseter muscle
      – If cut, needs to ligate the vessel and/or prolonged firm pressure
    • Prevention:
      – Buccal releasing incision needs to be directed “upward toward” the crest of the alveolar ridge

• Summary:
  – Lingual Nerve, Facial Artery, Mental Nerve, Long Buccal Nerve, Buccinator (Buccal) artery.
Maxillary Flaps

• An incision running from one tuberosity to the other along the alveolar crest will sever............................NOTHING larger than a capillary.
Maxillary flaps

- Hazard area for maxillary flap
  - Greater palatine artery
    - Pass anteriorly toward incisive foramen
    - Runs between palatal gingiva and midline of the palate
    - If artery is cut, need direct pressure at proximal end of the vessel
  - Nasopalatine nerve
    - Avoid incision through incisive papilla

- Summary
  - Greater palatine vasculature, Nasopalatine nerve
NEVER PERFORM ANY VERTICAL INCISION(S) ON THE MANDIBULAR LINGUAL AREA
Type of Flap

• Full thickness
  – Mucosal tissue + Periosteum
  – Preserve periosteum
  – *Most popular flap in dentistry*

• Partial thickness (split thickness)
  – Periosteum is left attached to bone
  – Able to apically reposition flap
    • Increase amount of attached gingiva
  – *Special OMS/Perio procedures*
Flap Nomenclature

• Envelop flaps
  – Flap of choice for most procedures
  – Full thickness flaps
    • sulcular incision *without* vertical releasing incision
  – At least one tooth distal to two teeth mesial
    • Extend the “coverage” as clinically necessary
    • Add on one or two vertical release incision(s)
Modification of Basic Envelope Flap
Vertical Release Incision

• Important Principles about Vertical Release Incision
  – Mesial or distal line angle of a tooth
    • NEVER cut
      – In the middle of the papillae
      – At the most apical point of facial gingiva.
        » Likely to create mid facial gingival defect.
Modification of Basic Envelope Flap

- Important Principles about Vertical Release Incision
  - Apical portion must be wider than coronal portion
  - Beware of the blood supply pattern
Modification of Basic Envelope Flap

- Important Principles about Vertical Release Incision
  - Incision must be over “sound” bone
    - Surgeon must anticipate the outcome of the surgery before placing incision!!!!
Modification of Basic Envelope Flap

- Envelope flap with 1 Vertical Release incision
  - Next most useful flap for exodontia
  - Provide even greater access
    - Proximity to apex
    - Deeply impacted tooth

Notice the Papilla at the mesial extent Of the incision is included
Modification of Basic Envelope Flap

- Envelope Flap with 2 Vertical Release Incisions (rectangular flap)
  - 2 vertical releasing incisions added to a basic envelop flap
  
  - Basic flap with releasing incision design
    - 1 distal and 1 mesial from surgical site
Modification of Basic Envelope Flap

- **Curved Flaps (Semi-lunar)**
  - Full thickness
  - Not involving gingival sulcus
  - Placed partly in attached gingiva and extend into mucosal tissue
  - Utilization
    - Periapical endodontic surgery
    - Retrieval of small root tips
  - At least 2mm apical to the base of the gingival sulcus
    - Periodontal probing should precede incision

Figure III-8. Curved or semi-lunar flap.
Modification of Basic Envelope Flap

- **Pedicle Flap**
  - Long, narrow flap for complete tissue coverage over osseous cavity
  - Periodontology
    - Correct gingival recession
  - OMS
    - Closure of oro-antral fistula
  - High potential for necrosis and ejection
    - Technique sensitive to maintain adequate blood flow in the flap

A pedicle flap

Closure of oronasal fistula
How to Reflect a Full-Thickness Mucoperiosteal Flap

• 1) Grasping the Knife Handle
  – Hold like a pen and not in you palm

• 2) Making the Incision
  – #15 knife blade applied at right angle to tissue and underlying bone
  – Firm pressure
  – ONLY ONE pass incise tissue all the way to bone
    • Multiple passes will create ragged margins

• Edentulous area
  • Right angle to the ridge crest

• Dentate area
  • Into periodontal sulcus to the height of crestal bone
  • Incise all the way through periosteum on the first incision
How to Reflect a Full-Thickness Mucoperiosteal Flap

3) Flap Reflection

- Begin with sharp-pointed end of the elevator
  - Pry the interdental papilla free
  - Free the attached crestal gingiva
  - Complete for the entire length of incision

- Use Broad end of the elevator
  - Continue reflect attached gingiva & alveolar mucosa to the desired apical depth
How to Reflect a Full-Thickness Mucoperiosteal Flap

• **4) Flap Retraction**
  – Proper use of retractor is needed
    • Small flaps: use periosteal elevator
    • Larger flaps: use Minnesota, Austin or others
  – Place the tip of the retractor ON BONE

• Flap should be enlarged using knife & periosteal elevator followed by **passive** retraction
  – Aggressive retraction will tear flap
Closure of Surgical Wound

• Any surgical wound must be closed after flap
• Remove any surgical debris under flap prior to closure
  – Entrapment of debris/oral flora → post-surgical infection or ↑pain
• Copious normal saline irrigation needed
  – With detailed visual inspection
  – Watch for base of the flap

• Primary Objectives of wound Closure
  – 1) Restore tissue to its original location
  – 2) Move tissue to desired position
Suturing

• General Guidelines
  – Hemorrhaging should not be controlled by suturing of flaps
    • Must manage bleeding before suture
  – Intraoral suture should be left in place for 4-7 days
    • Extraoral is left for 3-5 days
  – Suture needle should pass from mobile tissue to non-mobile tissue
    • Suture needle pass through reflected flap tissue FIRST, then to the margin of unreflected tissue
  – Suture needle should not be too close to wound margin
    • Minimum 3mm from flap margins
COMMON SURGICAL PRINCIPLES
Surgical Principles

• Length and direction of the incision
  – Wound heals from side-to-side NOT end-to-end
  – Make incision parallel to the direction of fiber

• Dissection technique
  – Clean incision with even pressure stroke

• Tissue handling
  – Minimize tissue trauma, excess tension
Surgical Principles

• Hemostasis
  – Hematoma, seroma will interfere with wound closure / healing \(\rightarrow\) leading to infection

• Maintain moisture
  – Reduce desiccation of tissue

• Removal of foreign materials
  – Presence of fragments \(\rightarrow\) increase infection
Suturing Principles

• Elimination of dead space
  – Dead space cause separation of wound edge
  – Critical to healing

• Closing with sufficient tension
  – Proximate NOT strangulate !!

• Match flap heights absolutely, with flap edges everted
Suturing Principles

• Suture must be placed so that depth is greater than width

• The more tension on a wound, the closer the sutures to each other and the wound margins

• Cut out crushed tissue
Suture Sequence

1. The needle should enter the tissue at a 90 degree angle to the skin surface, approximately 2mm from wound margin

2. The needle should then be passed into the wound by rotation of the wrist along the arc of the needle

3. Pass the needle through the dermal layer / submucosal layer to assist in eversion of the wound margin
Suture Sequence

4. The needle should then be passed through the tissue of the opposite wound margin at the same level in the dermal layer and should exit the flap at the same distance from the wound margin as that of the insertion

5. Suture is tied without undue tension

6. Wound is cleansed

7. Proper dressings are placed on the wound if necessary
SUTURE TECHNIQUES
PRINCIPLE OF HALVING

A: Diagram showing the anterior maxillary region.
B: Diagram showing the posterior maxillary region.
C: Diagram illustrating the exposure of the buccal fat pad.
D: Diagram demonstrating the surgical technique.

Maybe helpful at posterior maxillary region WITH buccal fat pad exposed.
Maybe helpful at posterior maxillary region WITH buccal fat pad exposed.

Don’t start suturing an elliptical wound at the center, because you’ll end up with a gathered effect (a). Start at one end and come down the same distance on each wound edge with each stitch (b). As you approach the center, tension will increase so you must make your stitches closer together—and therefore closer to the wound edge (c), which means that they needn’t be placed as deeply.
Figure 3-12  Equalizing length of edges with a Burow’s triangle.
How to Deal with Stellate Laceration?

- Purse-string
  - Useful for stellate lacerations
Needle enter tissue at 90 degree then roll your wrist!

Make sure depth of the stitch is greater than width  

Eversion of margin
Inversion vs Eversion

Deeper than Wide

The textbooks tell us to evert wound edges by passing the needle at an angle away from the wound, giving us a bottle-shaped suture (a). This offsets the tendency of wound edges to become depressed with the usual scar shrinkage. The principle involved—and the angled needle is only one technique for following it—is that: a suture placed so that its width is greater than its depth will invert the wound edges (b); a suture placed so that its depth is greater than its width will evert the wound edges (c).
Mandibular anterior region may benefit from layered closure, if deep tissues are present!

Position of needle entrance & depth penetrance must be equal on both side of tissue.

Notice suture spacing vs suture width.
Multiple Interrupted

Continuous locking

Horizontal Matrices

Continuous
Helpful oral suturing techniques

DETAILED ILLUSTRATIONS
Horizontal Mattress Sutures
Continuous Mattress Sutures
Continuous Locking Sutures
Figure Eight Sutures
Securing Membrane
Thank you very much
The Santa Fe Trail, opened in 1821, generally followed old routes established by American Indians and then used by Spanish, Mexican, and American frontiersmen. Along with the Camino Real, the Santa Fe Trail was part of a trade network (shown here in 1845) linking Europe, New York, and St. Louis with Santa Fe and Mexico City. For well-armed and organized caravans, the trip was more weariesome than dangerous.

Illustration below by Robert McGinnis