

Algorithm in the Treatment of Facial Nerve Paralysis



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Disclosures

- No disclosure

Facial Nerve Paralysis

- Challenging Problem
 - High Morbidity
 - Functionally
 - Socially
 - Cosmetically
- Unfortunately, there is no perfect procedure that restores normal symmetric function

- There are many procedures at your disposal
 - Static vs. Dynamic
 - Eye vs. Forehead vs. Oral commissure
 - Nerve transfer, muscle transfer, nerve repair
- Each patient is different

PRINCIPLE #1

In facial paralysis, the problem is often not just the paralyzed side – it is the asymmetry

- Goal is to reduce the asymmetry, below the threshold of routine visual perception
- Often we address both sides of the face

4 Important factors

- Facial Analysis
 - (upper, mid & lower thirds of the face)
- How did it happen?
- **WHEN** did it happen?
- How much is the patient willing to go through?

Facial Analysis



- **Upper Facial Third**
 - Brow ptosis
 - Asymmetric Rhytids
 - Inability to close the eye
 - Lower eyelid laxity
- **Middle Third**
 - Nasal valve collapse
 - Malar sagging
- **Lower Third**
 - Asymmetric smile or at rest
 - Sagging skin
 - Drooling
 - Difficulty with eating or speaking

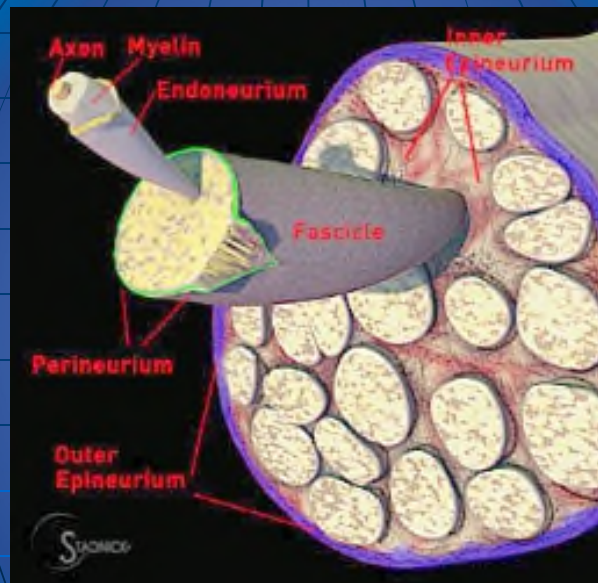


How did the injury happen?

- Bells Palsy?
- Iatrogenic?/Surgery?
- Trauma?
- Neoplastic?
- Congenital?

Nerve Injury

- Seddon's Classification
 - class I, II, III
 - Neurapraxia
 - Axonotmesis
 - Neurotmesis
- Sunderland Classification
 - Degrees 1-5



<http://www.radsourc.us/clinic/1105>

Nerve Injury

■ Neurapraxia

- Least severe
- Complete recovery expected
- Disruption of blood supply-> Ischemia
- Wallerian Degeneration does not occur distal to the injury site
- No actual “regeneration”
- Motor>Sensory
- Epineurium, Perineurium and Endoneurium are intact.

■ Axonotmesis

- More severe injury: Crush or stretch
- Axon and myelin sheath disrupted
- Supporting structures are preserved (perineurium, epineurium)
- Motor, sensory and autonomic are affected
- Wallerian degeneration occurs distal
- Regeneration takes time
- EMG shows Fibrillation potentials (FP's) and sharp waves

■ Neurotmesis

- Most severe injury with recovery potential
- Severe stretching, crush, contusion or transection
- Disruption of axons and myelin sheath as well as endoneurium, Schwann cells and +/- perineurium/epineurium
- Wallerian degeneration does occur
- EMG-> Same as axonotmesis -> + FP's and sharp waves

■ Sunderland Classification

- 1st degree-> Same as Neurapraxia
- 2nd degree-> Same as Axonotmesis
- 3rd degree
 - Endoneurium is damaged
 - Epi and perineurium are intact
 - Recovery is still possible
- 4th degree
 - Only epineurium is intact
 - Surgery is likely needed
- 5th degree
 - Nerve is transected
 - Surgery is required

When did it happen?

- Probably the most important question
 - Will determine what surgical techniques you have at your disposal
- Goals are to
 - Restore symmetry
 - Restore function

BIG PICTURE Surgical Treatment Overview

- **Dynamic Reanimation**

Vs.

- **Static Reanimation**

Static Reanimation

- Facial Slings
 - Limited Role



Static Reanimation

- Adjunctive treatments
 - Eyelid weight
 - Browlift
 - Nasal valve midface sling



Dynamic Reanimation

- **Nerve Re-innervation procedures**
 - Re-innervate the intrinsic facial muscles
 - Primary nerve repair
 - Cross face grafts
 - 12/7, 5/7, 11/7 nerve transfers
 - Time limit!!!: Ineffective after endplate fibrosis and muscle atrophy occur (approx 2 years)

- **Dynamic Muscle Reanimation**
 - Free tissue transfer
 - Regional muscle transfer

- This is why the “WHEN” question is so important
 - It is ideal to try to re-innervate the intrinsic muscles of the face

 - It gives you the most natural movements with the right vector of pull

 - Time limit in which you can do re-innervation!!
 - From the moment you denervate a muscle you develop muscle atrophy and motor end-plate fibrosis

PRINCIPLE #2

The earlier the re-innervation, the better the result

- Primary repair is first choice
 - Especially in the acute setting
 - Iatrogenic, trauma
 - Probably your best result
 - Even at it's best, you probably can get a 3/6 on HB scale

- In the setting of acute nerve injury, how long do you have before the distal branches stop stimulating?
 - 1-2 hours
 - <12 hours
 - <24 hours
 - <72 hours

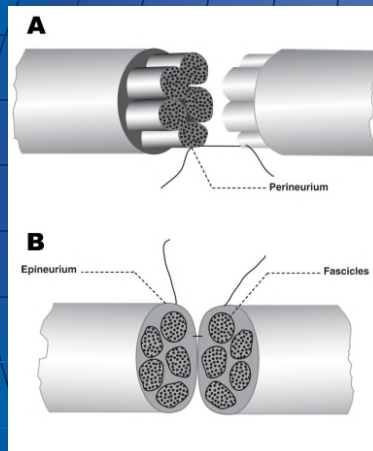
Primary Repair Principles

- No tension!!
- If you must, use a cable graft
 - Greater auricular nerve
 - Sural nerve



Position the cable graft
nerve correctly!!!:
impulse is
unidirectional

Epineural Repair

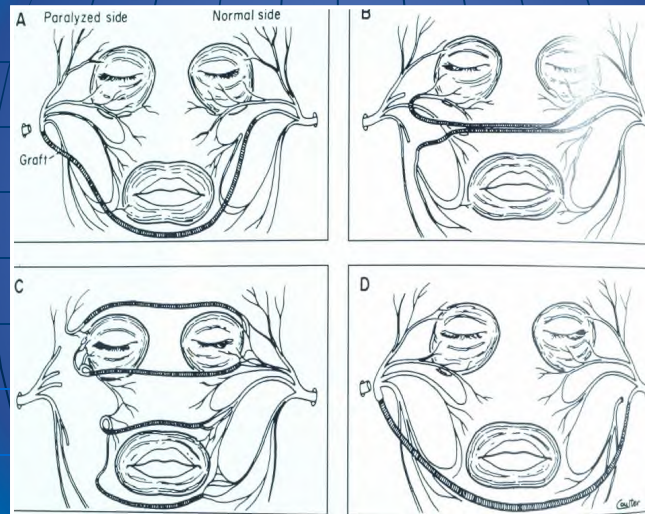


- No advantage to endoneurial or perineural suturing
- Fascicle alignment is key

Next best... Cross Facial Nerve Grafts?

- CFNG can achieve the gold standard in facial nerve reanimation
 - Synchronous and spontaneous movement
 - Can rehabilitate the blink reflex

Cross Facial Nerve Graft



Nerve Transfers in Facial Palsy

Julia K. Terzis, M.D., Ph.D.,^{1,2} and Petros Konofaos, M.D.^{1,2}

ABSTRACT

The facial paralysis patient suffers serious functional, cosmetic, and psychological problems with impaired ability to communicate. Despite the advances of recent years and the number of new techniques proposed in the literature, facial reanimation remains a challenge for the reconstructive surgeon. With the advent of microsurgery, reanimation of the paralyzed face took a major leap forward with the use of cross facial nerve grafts, nerve transfers, and free muscle transplantation. Today, nerve transfers represent the backbone of facial reanimation, especially in cases where reconstruction of the affected facial nerve is not feasible. The suitability of each nerve transfer is related to the type of facial palsy, time elapsed since injury, and the age and general health of the patient. The selected motor nerve must provide strong muscle contraction and allow the patient to control the facial movements. The purpose of this chapter is to present the senior author's (J.K.T.) experience in the selection of motor nerves that can function as possible donor nerves for dynamic facial reanimation. Indications and surgical technique for each procedure is also presented.

KEYWORDS: Facial palsy, nerve transfers, "babysitter" procedure, crossover techniques in facial palsy

Facial Plastic Surg 2008; 24: 177-193

- < 6 months works best
- Innervates intrinsic facial muscles
- You can use 2-4 branches
- Usually Bucco-zygom
- Orbicularis Oculi for blink

Terzis Rules for CFNG

- Do not take frontalis branch
- Do not sacrifice two neighboring branches
- You can use 50% of marg after it has arborized to smaller branches
- Identify the branch of the zygomatic that innervates oral commissure and elevators but not the orbicularis
- Tunnel the interposition graft first across the face first, then perform the microneural coaptations

Why aren't CFNG more common?

- Weeks to <6 months
- Often we wait to see if there is return in facial nerve function for >1 year
- Risks
 - Weakening the healthy facial nerve
 - Unpredictable outcome
 - Long time to see results

> 6 months to 2 years

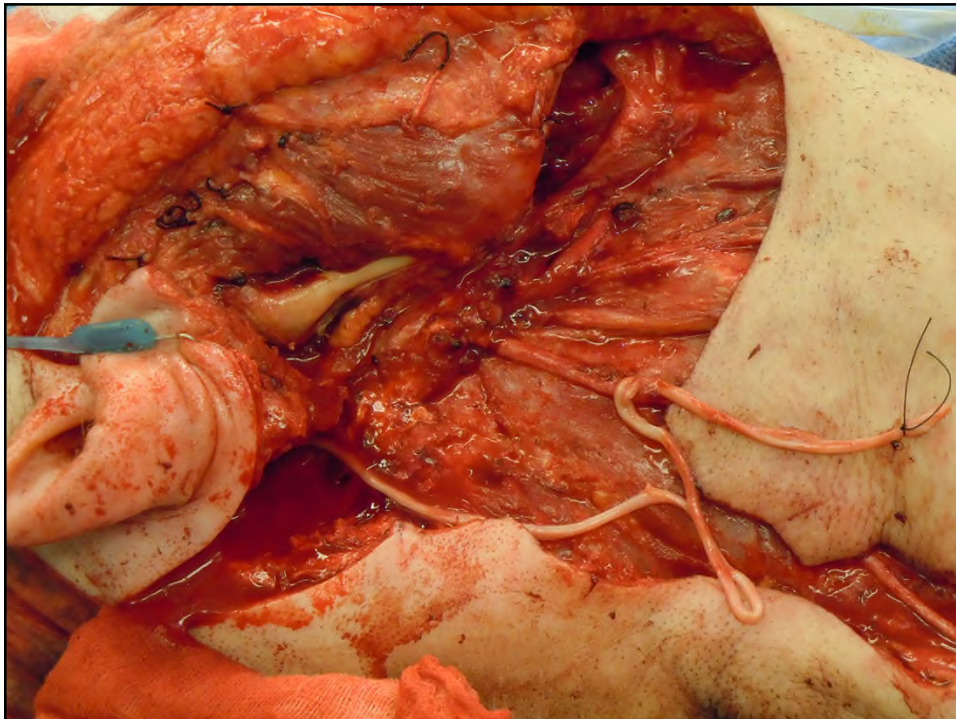
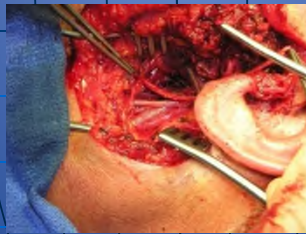
- You can still CFNG but...
- By the time the axons grow across the distance your facial muscles will have atrophied
- CFNG are weak donors
- You must do in conjunction with a **babysitting procedure**

Nerve Transfers

- **Babysitting procedure**
 - It's a nerve transfer
 - Innervates the facial muscles with a strong motor input from an adjacent cranial nerve
 - Prevents atrophy until the CFNG grows across

Nerve Transfers

- You can use nerve transfers as your primary re-innervation procedure (without a CFNG)
 - Hypoglossal-facial most common
 - 5/7 and 11/7 also used but with more morbidity



- The patient activates the facial muscles by activating the tongue
 - Movement in 4-6 months
 - Best achievable is III-IV
 - The movement is not spontaneous, they have to think about it
 - Not synchronous
 - Can be done at any time up to 2 years (as long as EMG shows FP's)



Mouth

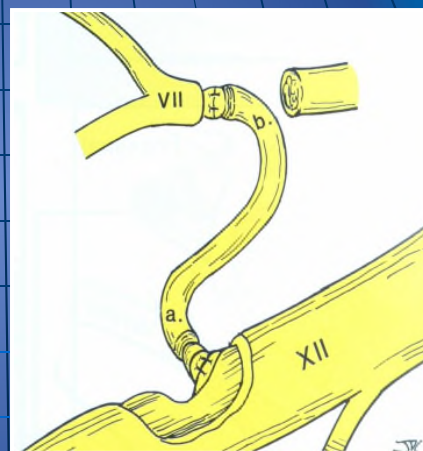
Hypoglossal-Facial

- Concern for morbidity
- Conley and Baker et al (1979)
 - Moderate lingual atrophy in 53%
 - Severe lingual atrophy in 25%



Hypoglossal-Facial anastomosis options

- 1. End to end
- 2. End (7th) to side (12th)
 - Drill out mastoid, transect and mobilize facial nerve
- 3. End to side (cable graft)
- Side to side (cable graft)



Hypoglossal-Facial

- Terzis et al. describes taking 40% of hypoglossal
 - Oligofascicular nerve
 - Can be split longitudinally under the microscope
 - Study
 - n=19 underwent babysitter procedure w/ XII
 - 70.26% had excellent results
 - No subject had decreased tongue function

> 2 years

- EMG shows no potentials
- Facial muscles are no longer suitable to re-innervate
- If you still want to try to obtain synchronous, spontaneous movement
 - CFNG
 - No babysitter needed
 - Microvascular muscle transfer

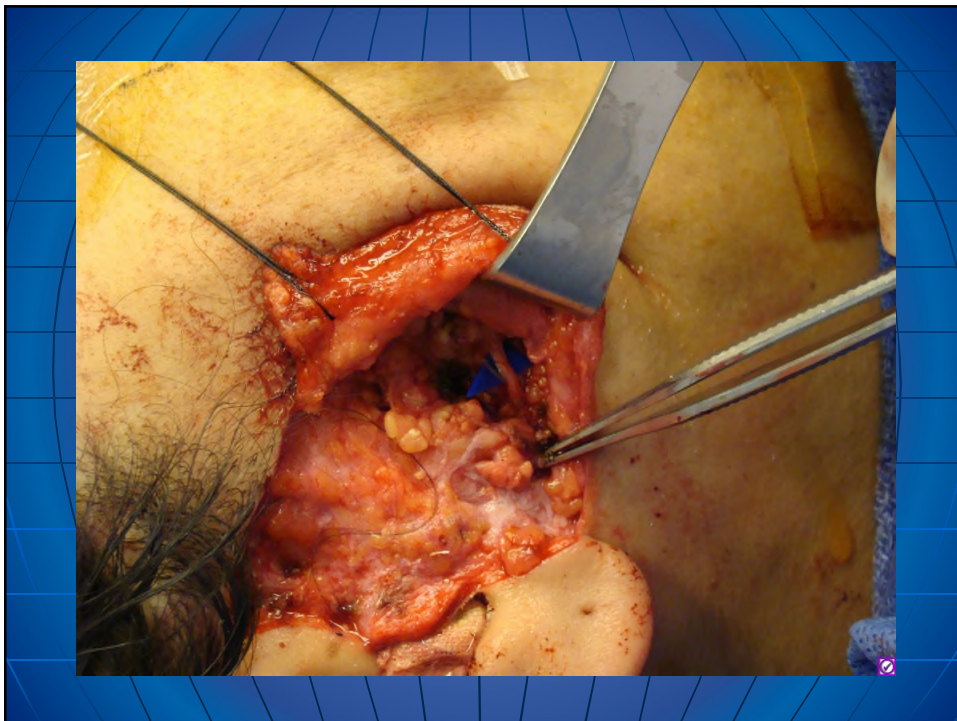
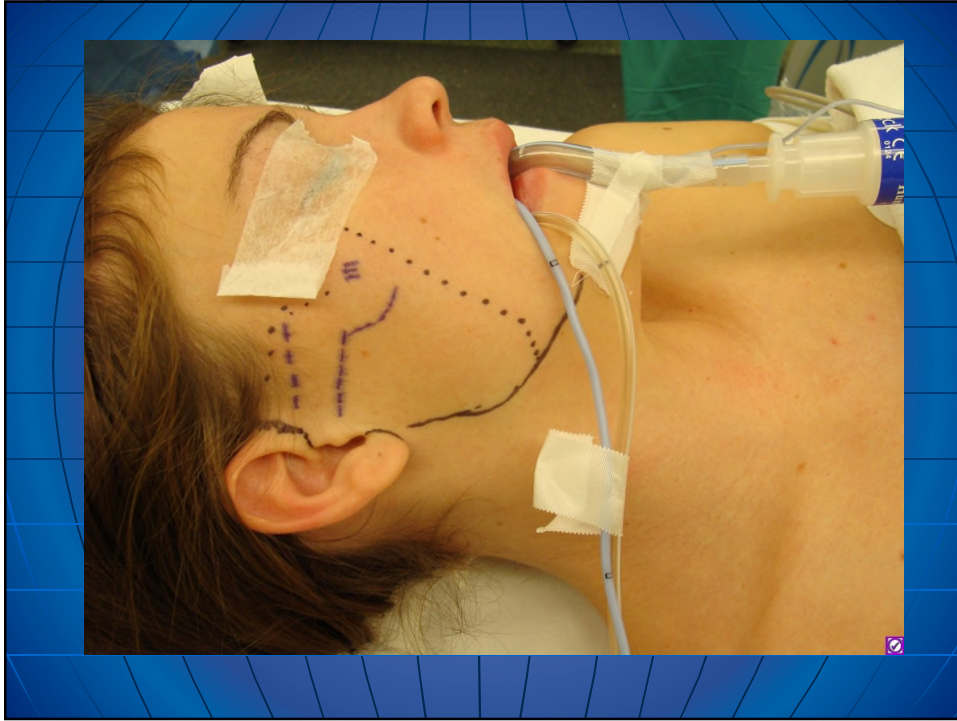
Muscle transfer options in long standing paralysis

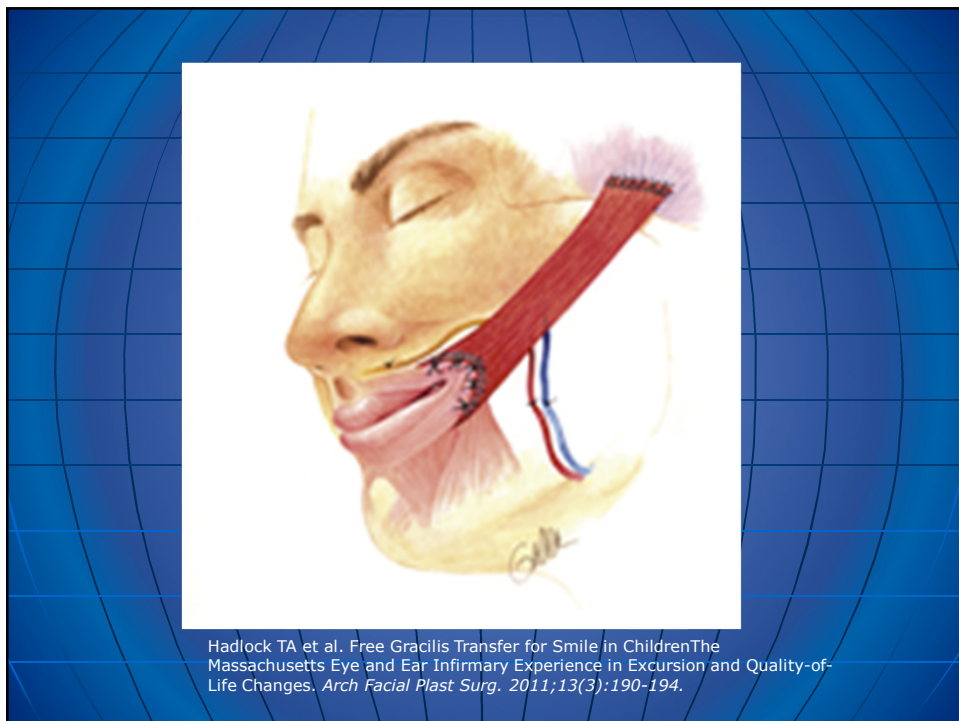
- Free tissue transfer
 1. Gracilis
 2. Pec minor
 3. latissimus

- Regional muscle transfer
 1. Temporalis
 2. Masseter



TWO STAGE GRACILIS FLAP



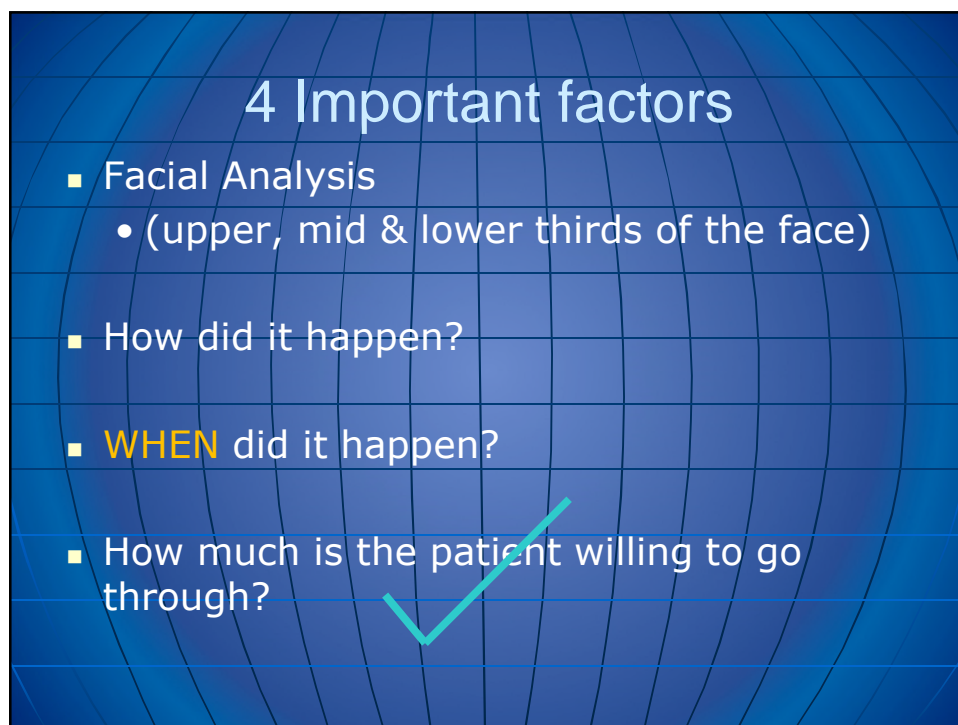
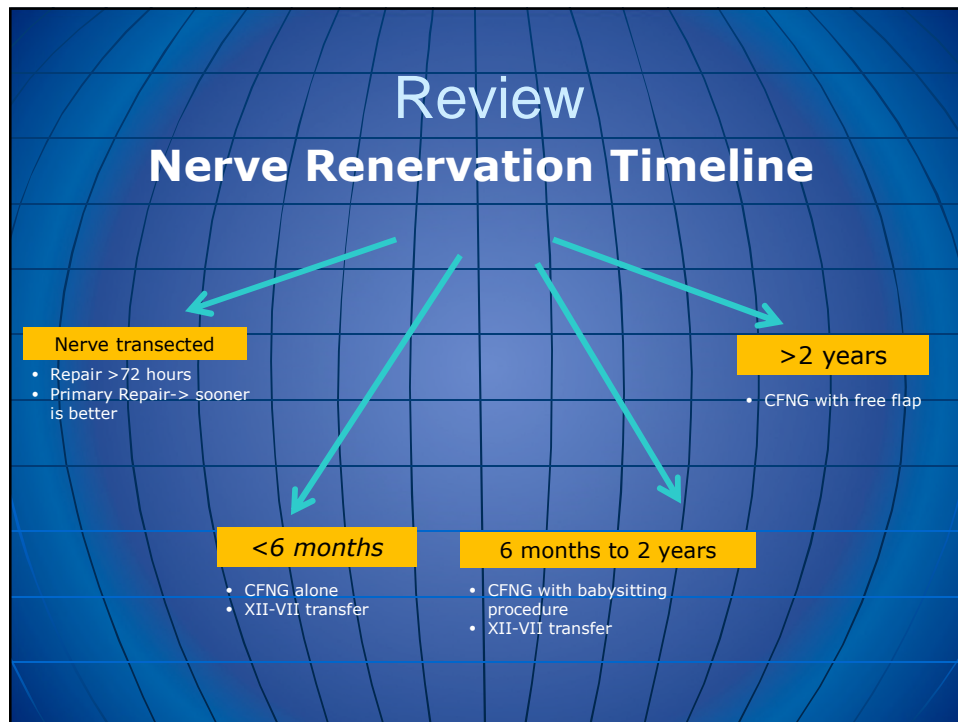




Biglioli et al. Recovery of Emotional Smiling Function in Free-Flap Facial Reanimation. *Jnl Oral Maxillof Surg.* 2012.



Hadlock TA et al. Free Gracilis Transfer for Smile in Children The Massachusetts Eye and Ear Infirmary Experience in Excurstion and Quality-of-Life Changes. *Arch Facial Plast Surg.* 2011;13(3):190-194.



Dynamic Reanimation

■ **Nerve Re-innervation procedures**

- Re-innervate the intrinsic facial muscles
 - Primary nerve repair
 - Cross face graft
 - 12/7, 5/7, 11/7 nerve transfers
- Time limit!!!: ineffective after endplate fibrosis and muscle atrophy occur (approx 2 years)

■ **Dynamic Muscle Reanimation**

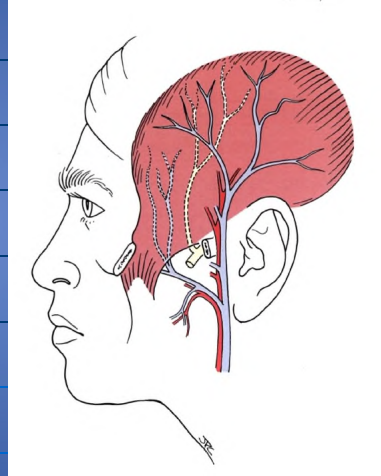
- Free tissue transfer
- Regional muscle transfer

Regional Muscle Slings

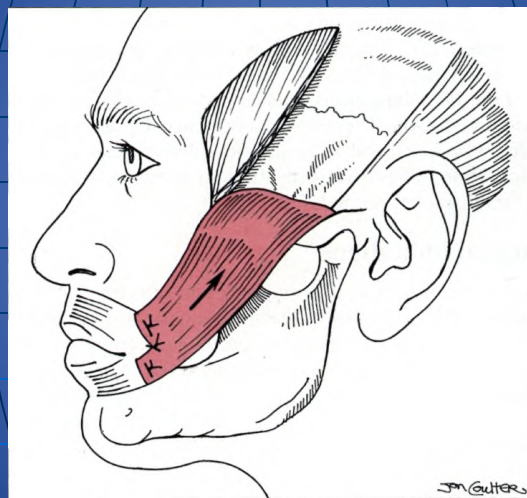
- Temporalis
- Masseter
- They remain innervated by their native CN V, and if connected to the oral commissure, a patient can be trained to initiate purposeful movement

Temporalis Sling

- Commonly used procedure in cases of longstanding facial nerve paralysis
 - Learned dynamic motion
 - Elevation of the oral commissure
 - Low risk



Temporalis Sling



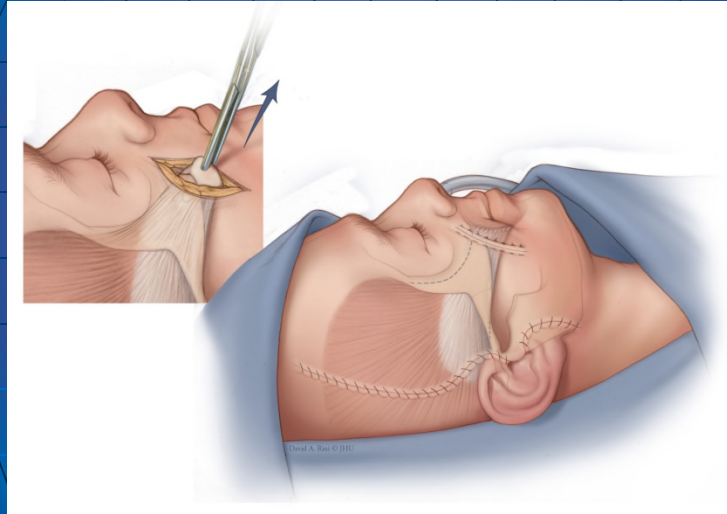
Temporalis Sling Disadvantages

- Does not provide true mimetic function
- Donor site defect
- Fullness over zygomatic arch
- Imprecision of amount of elevation
- Only addresses one area of paralyzed face - adjunctive measures still necessary
- Usefulness of temporalis muscle for future reconstruction affected



- **Temporalis Tendon Transfer**
 - Variation on temporalis sling procedure
 - July 2007

Temporalis Tendon Transfer



Temporalis Tendon Transfer

- Transfer the insertion rather than the origin

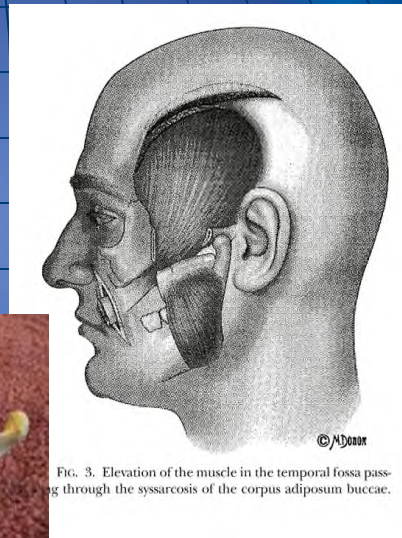


FIG. 3. Elevation of the muscle in the temporal fossa passing through the syssarcosis of the corpus adiposum buccae.

Temporalis Tendon Transfer Advantages

- No donor site defect
- No protrusion over arch
- Simple, with natural vector of pull
- Transoral approach possible
- Preservation of viable option for skull base reconstruction



• Further Technique refinement

- January 2011, Archives Facial Plastic Surg

ORIGINAL ARTICLE

Minimally Invasive Temporalis Tendon Transposition

Kofi D. Boahene, MD; Tarik Y. Farrag, MD; Liza Ishtit, MD; Patrick J. Byrne, MD

Objective: To describe a minimally invasive approach of the temporalis tendon transposition technique for dynamic reanimation in patients with long-standing facial paralysis.

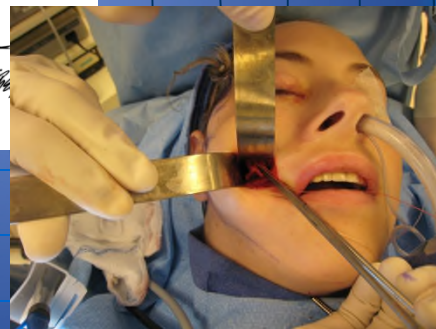
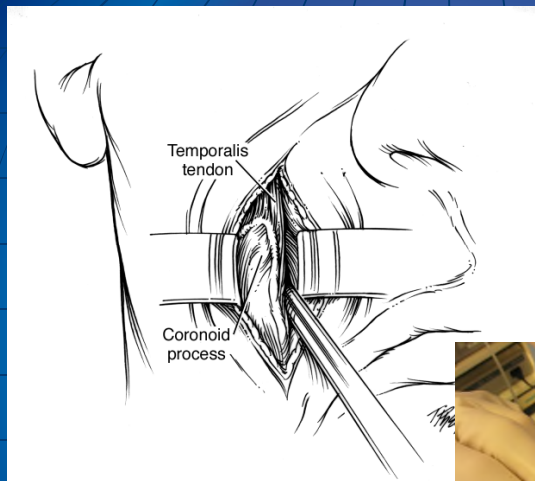
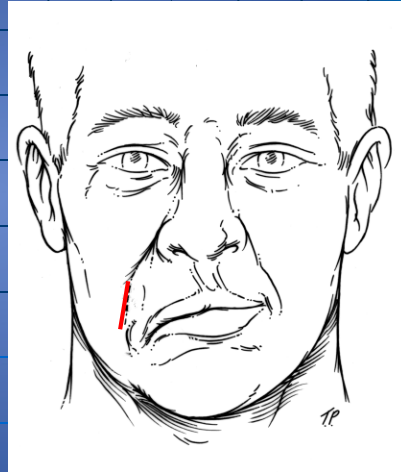
Methods: We report a case series of 17 consecutive patients with facial paralysis who underwent minimally invasive temporalis tendon transposition surgery for dynamic facial reanimation between January 1, 2006, and December 31, 2008. The minimally invasive technique is described. Preoperative and postoperative records, photographs, and videos were

the patients achieved improved symmetry at rest and voluntary motion of the oral commissure. In all the patients, the temporalis tendon was transposed to the malar region without the need for fascial extension or lengthening myoplasty.

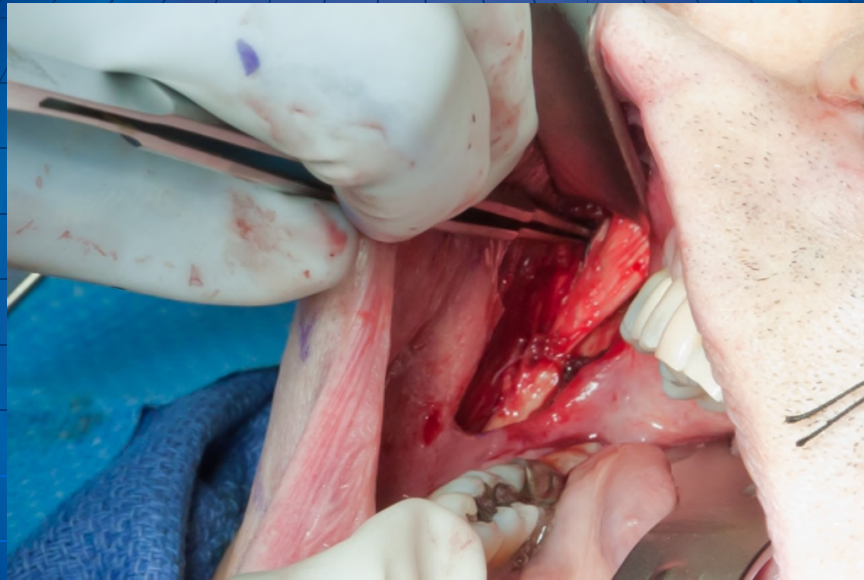
Conclusions: The temporalis tendon can be transposed for immediate dynamic reanimation of the paralyzed lower face using a minimally invasive approach. This procedure involves a single small incision and minimal dissection, with positive outcomes. Limitations of the

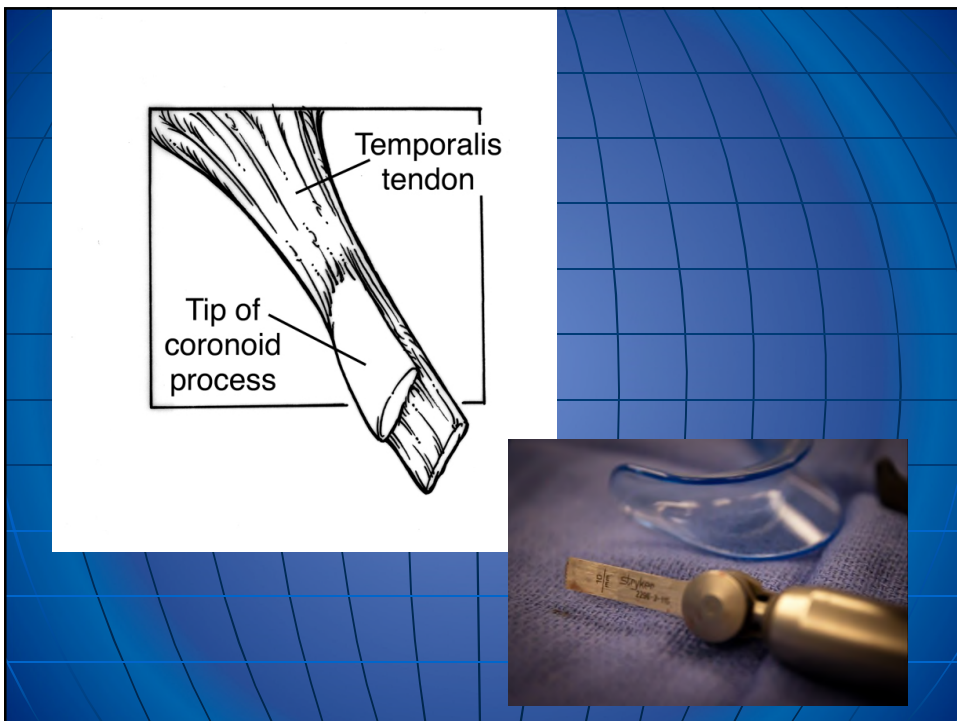
The Minimally Invasive Temporalis Tendon Transfer (MIT3)

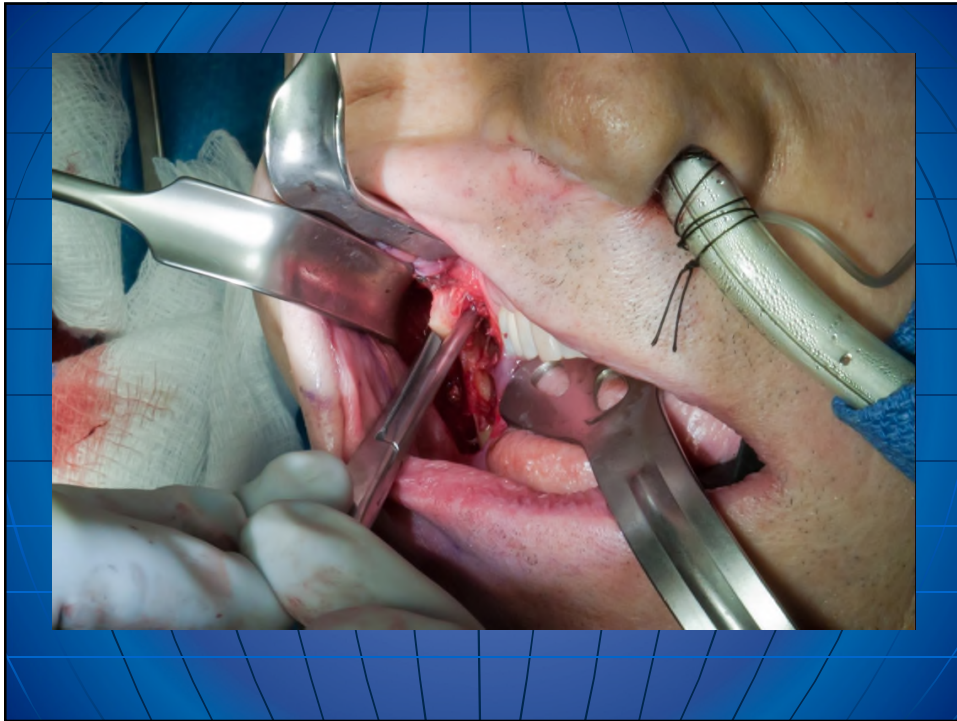
- Options for approaches:
 - Transcutaneous (Melolabial)
 - Transoral

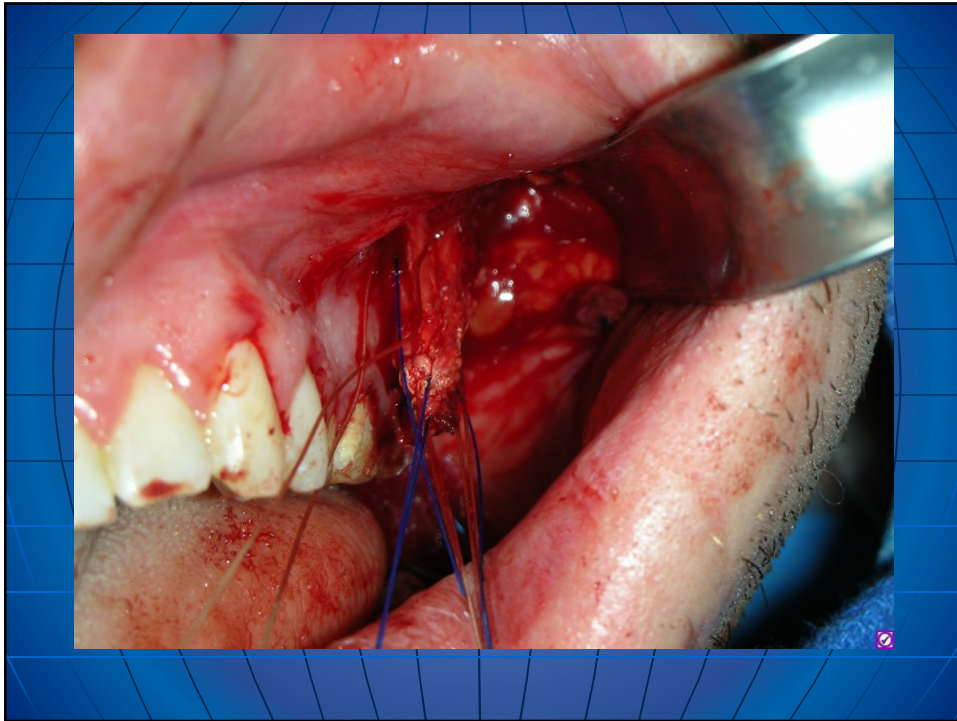


Transoral Approach







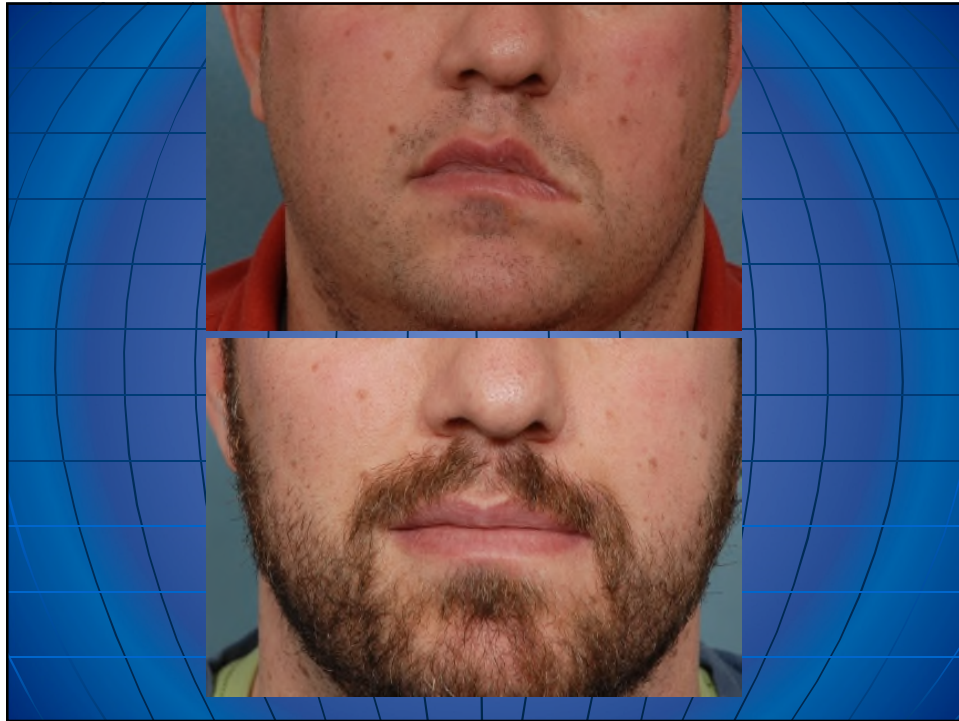


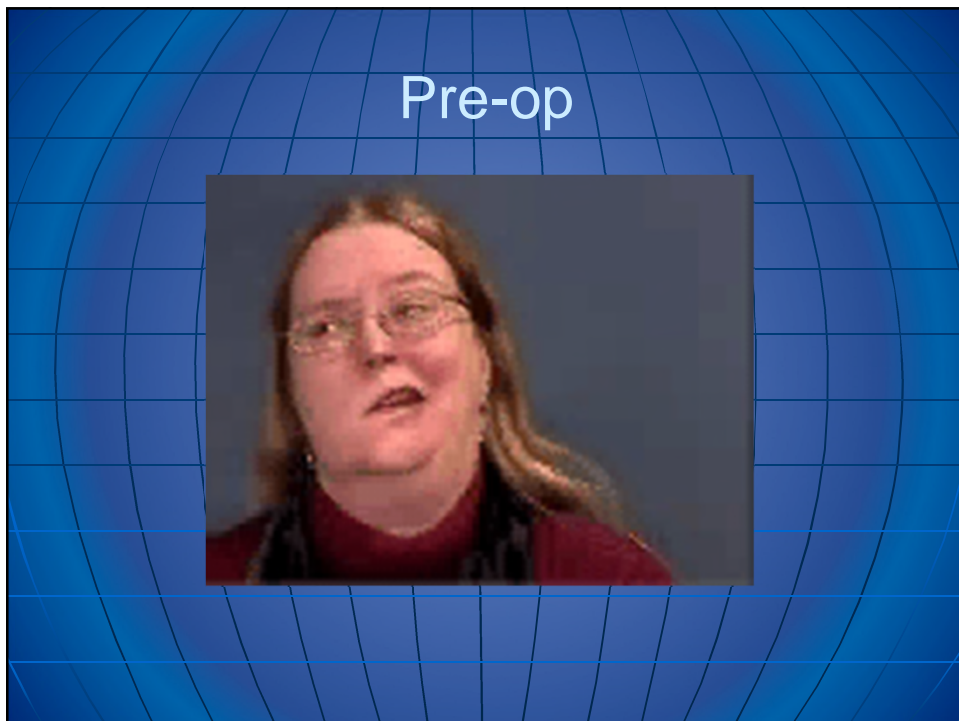
Intraop



Results







Post-Op



Adjunctive Measures



- **Upper Facial Third**
 - Brow ptosis
 - Asymmetric Rhytids
 - Inability to close the eye
 - Lower eyelid laxity
- **Middle Third**
 - Nasal valve collapse
 - Malar sagging
- **Lower Third**
 - Asymmetric smile or at rest
 - Sagging skin
 - Drooling
 - Difficulty with eating or speaking

Upper Third: Treatment Options

Dynamic

- Reinnervation procedures
 - 12/7
 - Cross face grafts
- Temporalis (mini) transfers
- chemodeneration

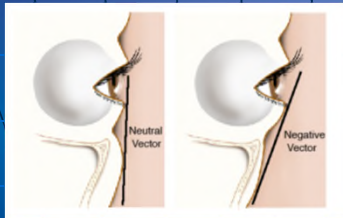
Static

- Browlift
- Upper lid loading
 - Platinum chain
- Lower lid procedures
 - Tarsal strip
 - Lateral transorbital canthopexy
 - Space grafts
 - Medial canthopexy



“**BAD** / Negative vector” = at risk patients for exposure keratitis

- **B**ells phenomenon
- **A**nesthesia
- **D**ry eye history
- Negative vector



Lower Lid Options

- Lateral tarsal strip
- Lateral transorbital canthopexy
- Medial canthopexy
- Space grafts
- Midface lift
- Fat transfer
- Injectable filler

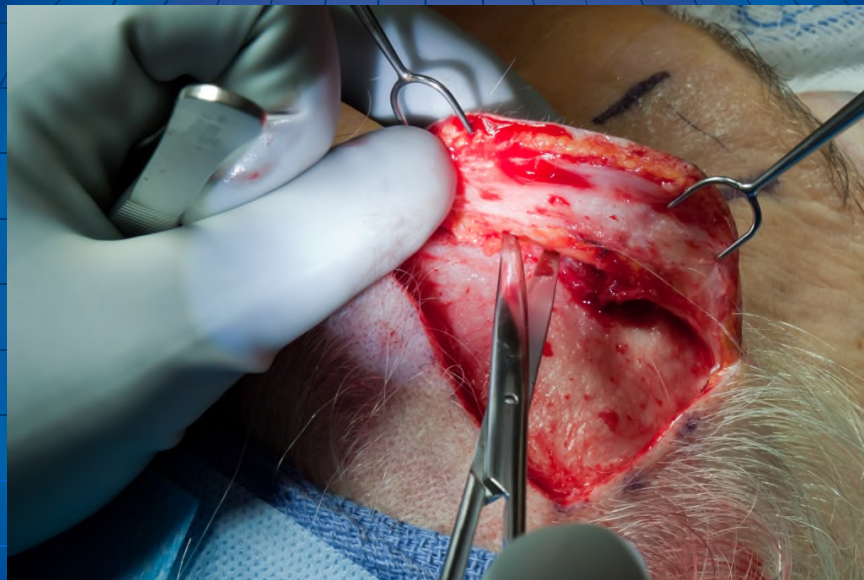


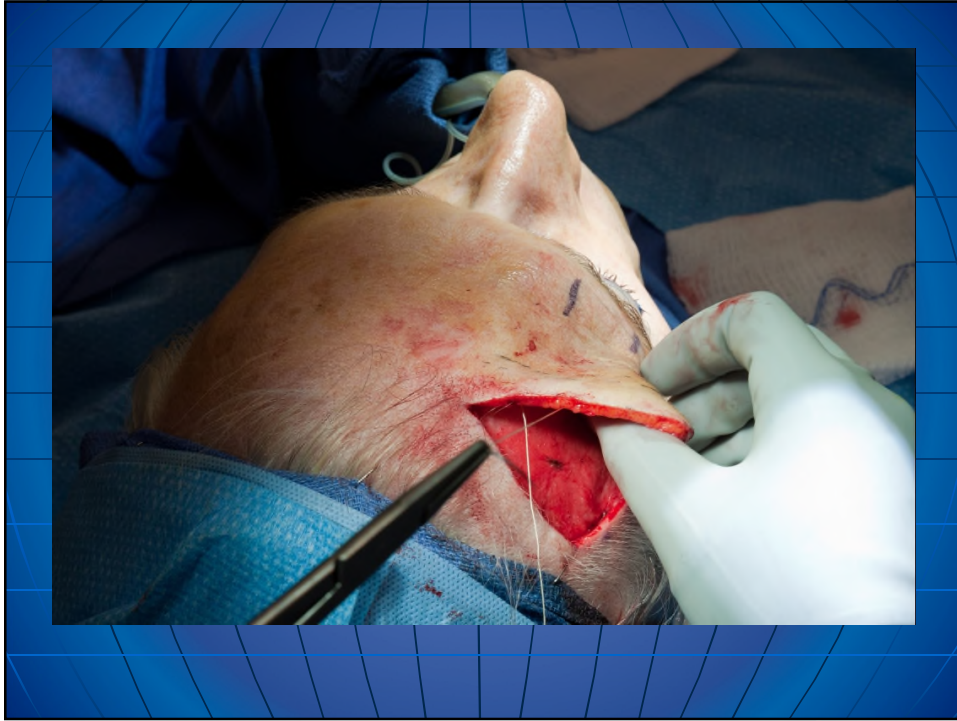
Temporal Brow Lift



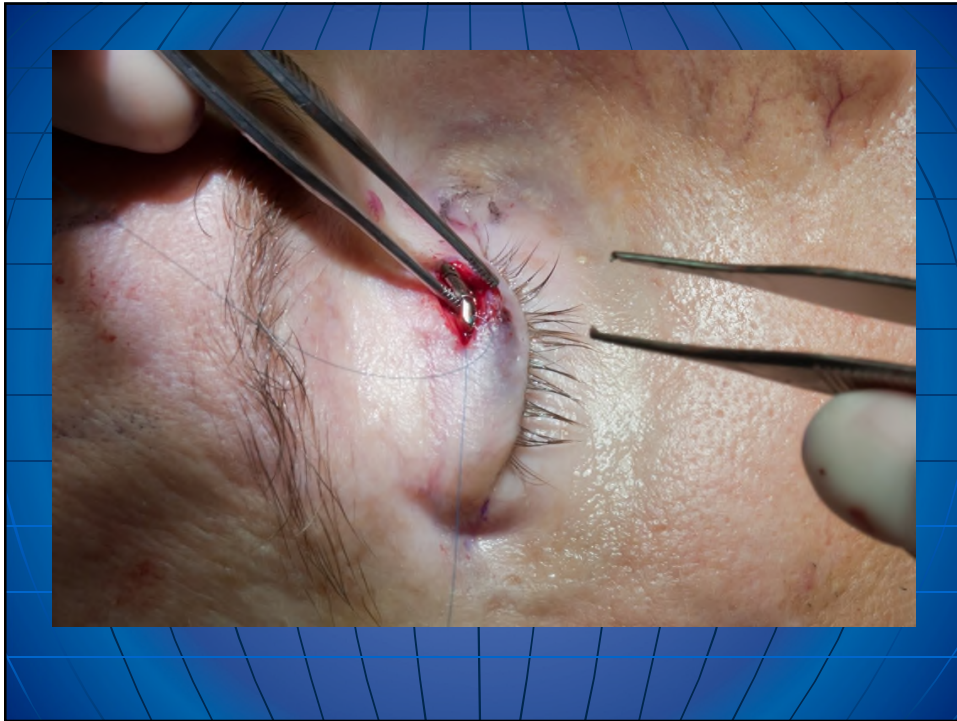


Subgaleal for 2 cm then transition to subcutaneous









Midface Treatment Options

Static

- Slings
- Nasal valve surgery
- Autologous fat transfer
- Lower lid bleph
- Midface techniques
- Injectable filler

Dynamic

- Reinnervation procedures
- Free tissue transfer
- Dynamic regional muscle transfer
- Contralateral chemo-denervation*

Lower Third Treatment Options

Static

- Slings
- Commissuroplasty
- Injectable fillers
- Facelift
- Necklift

Dynamic

- Reinnervation techniques
- Free tissue transfer
- Dynamic muscle transfer
- Contralateral chemodenervation

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Thank you