Algorithm in the Treatment of Facial Nerve Paralysis

Krista Rodriguez-Bruno, MD
Otolaryngology, Head and Neck Surgery
Facial Plastic and Reconstructive Surgery
Kaiser Permanente Southern Medical Group
San Diego

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.radsource.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

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

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

Keywords: Facial palsy, nerve transfers, "kissing" procedure, circumferential...
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)
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
Branch of adductor a. and v
Anterior obturator nerve

Review
Nerve Renervation Timeline

Nerve transected
- Repair >72 hours
- Primary Repair -> sooner is better

<6 months
- CFNG alone
- XII-VII transfer

6 months to 2 years
- CFNG with babysitting procedure
- XII-VII transfer

>2 years
- CFNG with free flap

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?
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

Regional Muscle Slings

- Temporalis
- Masseter

- They remain innervated by their native CN V, and if connected to the oral commisure, 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 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 as Part of a Comprehensive Approach to Facial Reanimation

Patrick J. Byrne, MD; Michael Kim, MD; Kofi Boahene, MD; Jennifer Millar, MSPT; Kris Moe, MD
Temporalis Tendon Transfer

- Transfer the insertion rather than the origin

Fig. 3. Elevation of the muscle in the temporal fossa passing through the synovium of the condylar bursae.
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
The Minimally invasive Temporalis Tendon Transfer (MIT3)

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

**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

- Bells phenomenon
- Anesthesia
- Dry 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 chemodenervation*

Lower Third Treatment Options

Static
- Slings
- Commissuroplasty
- Injectable fillers
- Facelift
- Necklift

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


Thank you