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Facial Rehabilitation
Part 1: Evaluation of the patient with facial palsy

Mara Wernick Robinson, PT, MS
Massachusetts Eye and Ear Infirmary
Facial Nerve Center
Boston, MA

Outline

Webinar 1
- Anatomy and Physiology of the Facial Nerve
- Causes of Facial Palsy
  - Peripheral
    - Bell’s Palsy
  - Central
- Impairments, Functional Limitations, and Disability
- Evaluation

Webinar 2
- Assessment
- Treatment
  - Physical Therapy, Medications/Botox, Surgical Interventions
- Case Studies
- Research
Learning Outcomes

After this course, participants will be able to:

- Identify the course of the facial nerve in relationship to the etiology of facial palsy.
- Evaluate a patient with peripheral unilateral facial palsy using the House Brackman Scale and the Sunnybrook Facial Grading System.
- Identify the stage of rehabilitation and use at least thee strategies in the management of facial palsy.

The face is the image of the soul
Anatomy of the Facial Nerve

*Cranial Nerve VII*
Intracranial vs. Extracranial

Intracranial: Facial Nerve

- The motor nucleus of the FN arises in the pons, as both a motor and sensory root. It then traverses through the internal acoustic meatus
- Enters the S shaped canal: pontine, meatal, labyrinthine, tympanic, mastoid
- When the motor and sensory roots come together at the geniculate ganglion, they then give rise to the
  - greater petrosal nerve
  - stapedius nerve
  - chorda tympani nerve
- Exits the canal at the stylomastoid foramen, just below the mastoid process to form the extracranial branches of the facial nerve
Intracranial branches: Facial Nerve

Greater petrosal nerve:
(parasympathetic fibers)
- lacrimal gland
  Sx: Lack of tears

Chorda Tympani nerve:
(sensory and parasympathetic fibers)
- anterior 2/3 of the tongue
- Salivary glands: Submandibular and sublingual
  Sx: Loss of taste

Stapedius nerve
(motor fibers)
- Stapedius muscles of the middle ear
  Sx: Hyperacusis

Extracranial: Facial Nerve

Patrick J. Lynch, medical illustrator [CC BY (https://creativecommons.org/licenses/by/2.5)]
<table>
<thead>
<tr>
<th>Branch of CN VII</th>
<th>Muscle</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior auricular</td>
<td>Posterior auricular</td>
<td>Pulls ear backward</td>
</tr>
<tr>
<td></td>
<td>Occipitofrontalis, occipital belly</td>
<td>Moves scalp backward</td>
</tr>
<tr>
<td>Temporal</td>
<td>Anterior auricular</td>
<td>Pulls ear forward</td>
</tr>
<tr>
<td></td>
<td>Superior auricular</td>
<td>Raises ear</td>
</tr>
<tr>
<td></td>
<td>Occipitofrontalis, occipital belly</td>
<td>Moves scalp forward</td>
</tr>
<tr>
<td></td>
<td>Corrugator supercilii</td>
<td>Pulls eyebrow medially and downward</td>
</tr>
<tr>
<td></td>
<td>Procerus</td>
<td>Pulls medial eyebrow downward</td>
</tr>
<tr>
<td>Temporal and zygomatic</td>
<td>Orbicularis oculi</td>
<td>Closes eyelids and contracts skin around eye</td>
</tr>
<tr>
<td>Zygomatic and buccal</td>
<td>Zygomaticus major</td>
<td>Elevates corners of mouth</td>
</tr>
<tr>
<td>Buccal</td>
<td>Zygomaticus minor</td>
<td>Elevates upper lip</td>
</tr>
<tr>
<td></td>
<td>Levator labii superioris</td>
<td>Elevates upper lip and midportion nasolabial fold</td>
</tr>
<tr>
<td></td>
<td>Levator labii superioris alaeque nasi</td>
<td>Elevates medial nasolabial fold and nasal ala</td>
</tr>
<tr>
<td></td>
<td>Risorius</td>
<td>Aids smile with lateral pull</td>
</tr>
<tr>
<td></td>
<td>Buccinator</td>
<td>Pulls corner of mouth backward and compresses cheek</td>
</tr>
<tr>
<td></td>
<td>Levator anguli oris</td>
<td>Pulls angles of mouth upward and toward midline</td>
</tr>
<tr>
<td></td>
<td>Orbicularis</td>
<td>Closes and compresses lips</td>
</tr>
<tr>
<td></td>
<td>Nasalis, dilator naris</td>
<td>Flares nostrils</td>
</tr>
<tr>
<td></td>
<td>Nasalis, compressor naris</td>
<td>Compresses nostrils</td>
</tr>
<tr>
<td>Buccal and marginal mandibular</td>
<td>Depressor anguli oris</td>
<td>Pulls corner of mouth downward</td>
</tr>
<tr>
<td></td>
<td>Depressor labii inferiors</td>
<td>Pulls lower lip downward</td>
</tr>
<tr>
<td>Marginal mandibular</td>
<td>Mentalis</td>
<td>Pulls skin of chin upward</td>
</tr>
<tr>
<td>Cervical</td>
<td>Platysma</td>
<td>Pulls down corners of mouth</td>
</tr>
</tbody>
</table>
Video:
Left facial palsy

Causes of Facial Palsy
Bell’s Palsy

- Acute inflammation of the facial nerve, resulting in facial unilateral muscle weakness, and loss of taste

- Virus: Herpes Simplex Virus (HSV Type 1) reactivated by stress when immune system is compromised

- Risk factors
  - Diabetes
  - Weak immune system (URI)
  - Family history
  - Migraines
  - 3x greater in third trimester pregnancy

- Most common between ages 15 and 50, but can occur at any age

Bell’s Palsy

- The onset of facial weakness occurs over the course of 24-72 hours
  - Facial muscle weakness can be partial or complete

- Treated with steroids and anti-virals
  - Prednisolone and valacyclovir in Bell’s Palsy: a randomized double blind placebo controlled multicenter trial. Lancet Neurol 2008 7(11) 993-1000
Prognosis of Bell’s Palsy

- ~70-80% complete recovery
  - 3 weeks - 6 months
- Prognosis is more favorable
  - Steroids and Antivirals
  - Recovery began within 3 months of onset
  - < 60 year

- Recurrence of 4–14%.

Facial Palsy and Bell’s Palsy: Stages of recovery

- Flaccid
  - 70-80% recover
- Paresis
- Synkinesis
  - Aberrant nerve regeneration following nerve injury, resulting in a misrouting of nerve fibers
  - Results in unwanted or involuntary movement, during intended movement;
    - e.g. (involuntary) eye closure when you (intend to) smile
**Synkinesis**

Results in misrouting of nerve fibers as the fibers grow back.

Flaccid

Synkinesis
Synkinesis with smiling

Synkinesis with puckering
Video of synkinesis: left

Synkinesis

- Typically occurs 4-6 months after onset of BP in the patients that do not make a full recovery
- Can be the most disfiguring and discouraging sequela
- Synkinesis is often what brings the patient in to the facial nerve center
Causes of Facial Palsy

Ramsey Hunt Syndrome
- Acute inflammatory process caused by the Herpes Zoster Virus (HZV)
  - blisters on the pinna/canal
  - cranial nerve VIII (vertigo, imbalance, and hearing loss), and pain
  - Unilateral

Lyme Disease
- Infectious disease caused by the Borrelia bacteria, that is carried by a deer tic
- Unilateral, but can be bilateral

Causes of Facial Palsy: Benign Tumors
- Facial nerve schwannomas
- Facial nerve hemangiomas
Acoustic Neuroma

- Clinical signs:
  - Asymmetric hearing loss; tinnitus
  - Headaches
  - Imbalance/Dizziness
  - Abnormal facial sensation...less often facial weakness
- Diagnosed:
  - Hearing test/audiogram
  - CT with contrast, MRI
- Treated:
  - Surgical removal
  - XRT
  - Watchful waiting
- Risks of surgery
  - Imbalance/dizziness, hearing loss, headaches,
  - Facial Paralysis, 10%

Less common causes of facial paralysis

- Parotid Gland Tumors (extracranial)
  - When the bell tolls on Bell's palsy: finding occult malignancy in acute-onset facial paralysis. American Journal of Otolaryngology (31)5 2010
  - Acute facial palsy, that did not recovery
- Temporal bone fractures (trauma)
  - Immediate paralysis: nerve transection
  - Delayed paralysis: stretched or inflamed
- Autoimmune Diseases
  - Sarcoidosis, Melkerson Rosenthal, Guillain Barre
    - Usually bilateral facial palsy
### Congenital Facial Palsy

<table>
<thead>
<tr>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial nerve trauma related to delivery; synkinesis</td>
<td>Moebius Syndrome</td>
</tr>
<tr>
<td>Lack of development of the facial nerve in utero</td>
<td>Neurofibromatosis Type 2</td>
</tr>
</tbody>
</table>

Facial Palsy due to a stroke looks different due to central connections

Voluntary facial expressions arise from efferent discharge from the motor face of the cerebral cortex. Signals from the cortex travel through the corticobulbar tract to the internal capsule, through the upper midbrain to the lower brainstem, where they synapse in the pontine facial nuclei. Lower facial muscle fibers then cross over to the contralateral side, whereas the fibers of the upper facial muscles receive bilateral cortical input.
Stroke vs Bell’s Palsy

The differentiating factor is that a stroke patient can raise their forehead and close their eyes. These patients will typically have other signs of stroke (speech and weakness of the arm/leg). Patients with facial weakness from a cortical stroke do not get synkinesis.

Evaluation of Facial Palsy

- Radiographic Tests: CT and MRI to identify stroke or skull based tumors
- Laboratory/Blood Tests: Lyme, autoimmune disease
- Hearing and Balance tests: Audiogram and Vestibular Lab for acoustic neuromas
- Electrophysiological Tests: ENoG, EMG
Diagnostic testing: Electrophysiology

- **Electroneuronography (ENoG)**
  - When greater than 90% degeneration of the nerve is present, the prognosis for return of function is quite poor
  - Must be done within 3-7 days
  - May be candidate for Facial Nerve Decompression

- **Electromyogram (EMG)**
  - Used to determine any residual function or prognosis. Fibrillations indicate poor prognosis and will not be observed before 2 weeks has elapsed from the time of the original insult

Impairments

**Acute** (onset to 6 months): Paralysis and Paresis
- Motor Loss of the facial muscles, unilateral/bilateral
- Impaired taste sensation (anterior 2/3 of tongue)
- Impaired vision due to inability to blink
- Sensitivity to sound
- Pre- or post- auricular pain

**Chronic** (> 6 months): No Recovery from complete FN injury or Synkinesis;
- Hypotonic (no recovery)
- Muscle atrophy
- Muscle stiffness due to synkinesis and hypertonicity
- Pain
Functional Limitations

- Incomplete eye closure: dry or teary, corneal abrasion
- Inability to move the corner of mouth: smile, laugh
- Inability to pucker lips
- Impaired articulation
- Limited expression of emotions:
  - Perceived by others to have negative affect (Ishii and colleagues 2012)
  - Observed by others as less normal, more distressed, less intelligent (Li and colleagues 2016)

Disability

- Social isolation, Anxiety and Depression
  - Studies show between 30-60% have anxiety and depression
  - Higher grades of facial dysfunction had higher depression scores, lower quality of life; higher in females
- Unable to eat in public, in restaurants
- Unable to work due to articulation difficulties, visual dysfunction, pain, cosmesis
- Avoid being in photos
## House-Brackmann Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal</td>
<td>Normal facial function in all areas</td>
</tr>
<tr>
<td>II</td>
<td>Mild dysfunction</td>
<td>Slight weakness noticeable on close inspection; may have very slight synkinesis</td>
</tr>
<tr>
<td>III</td>
<td>Moderate dysfunction</td>
<td>Obvious, but not disfiguring, difference between 2 sides, noticeable, but not severe, synkinesis, contracture, or hemifacial spasm; complete eye closure with effort</td>
</tr>
<tr>
<td>IV</td>
<td>Moderately severe dysfunction</td>
<td>Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure</td>
</tr>
<tr>
<td>V</td>
<td>Severe dysfunction</td>
<td>Only barely perceptible motion; asymmetry at rest</td>
</tr>
<tr>
<td>VI</td>
<td>Total paralysis</td>
<td>No movement</td>
</tr>
</tbody>
</table>
### Sunnybrook Facial Grading System

<table>
<thead>
<tr>
<th>Resting Symmetry</th>
<th>Symmetry of Voluntary Movement</th>
<th>Synkinesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison to normal side</strong></td>
<td><strong>Degree of muscle excursion compared to normal side</strong></td>
<td><strong>Rate the degree of involuntary muscle contraction associated with each expression</strong></td>
</tr>
<tr>
<td>Eye (choose one only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>normal 0</td>
<td>Normal</td>
<td>Complete</td>
</tr>
<tr>
<td>narrow 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wide 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eyelid surgery 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheek (naso-labial fold)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>normal 0</td>
<td>Normal</td>
<td>Complete</td>
</tr>
<tr>
<td>absent 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less pronounced 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>more pronounced 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>normal 0</td>
<td>Normal</td>
<td>Complete</td>
</tr>
<tr>
<td>corner dropped 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>corner pulled up/not 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resting symmetry score</strong></td>
<td>Total</td>
<td>5</td>
</tr>
<tr>
<td><strong>Voluntary movement score</strong></td>
<td>Total</td>
<td>4</td>
</tr>
<tr>
<td><strong>Synkinesis score</strong></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Patient's name:

Do:

Date:

---

**Right sided Bell's palsy**

---

**continued**
Right sided bell’s palsy

Voluntary movement:
Forehead wrinkle

Voluntary movement:
Gentle eye closure
Right sided Bell’s palsy
Voluntary movement:
Open mouth smile

Right sided Bell’s palsy
Voluntary movement:
Snarl
Right sided bell’s palsy

Voluntary movement

Lip pucker

<table>
<thead>
<tr>
<th>Sunnybrook Facial Grading System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting Symmetry</strong></td>
</tr>
<tr>
<td>Compared to normal side</td>
</tr>
<tr>
<td>Eye (cheek movement only)</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Narrow</td>
</tr>
<tr>
<td>Wide</td>
</tr>
<tr>
<td>Eyelid surgery</td>
</tr>
<tr>
<td>Cheek (naso-oral line)</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Absent</td>
</tr>
<tr>
<td>Less pronounced</td>
</tr>
<tr>
<td>Mouth</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Corner dropped</td>
</tr>
<tr>
<td>Corner pulled superior</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Resting symmetry score</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Symmetry of Voluntary Movement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees of muscle excursion</td>
</tr>
<tr>
<td>Compared to normal side</td>
</tr>
<tr>
<td>Standard</td>
</tr>
<tr>
<td>Forehead</td>
</tr>
<tr>
<td>Wink at (Phs)</td>
</tr>
<tr>
<td>Gaze at eye (OCE)</td>
</tr>
<tr>
<td>Open mouth (EVE, RVE)</td>
</tr>
<tr>
<td>Smirk</td>
</tr>
<tr>
<td>Lip Pucker (DVS, DRS)</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| **Syknosis**                       |
| Rate the degree of involuntary muscle contraction associated with each expression |
| Dinner                             | 5 |
| Walking                            | 3 |
| Standing                           | 0 |
| Talking                            | 0 |
| Total                             | 12 |

Voluntary movement score: 17
Syknosis score: 12
Composite score: 29
Summary of Facial Palsy

- **Flaccid**
  - Acute BP
  - Parotid Tumor

- **Paresis**
  - Subacute BP
  - Congenital

- **Synkinesis**
  - Chronic BP
  - Or incomplete recovery following FN injury

- **Bilateral**
  - Lyme Disease
  - Moebius Syndrome