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A Clinical View of Bell's Palsy and Other Facial Paralysis Conditions for Therapists

A Practical Review of NMR Principles for Therapists

By Todd Henkelmann, PT, MS, CCTT
UPMC Centers for Rehab Services

Introduction

- My Background: Working With Richard Balliet PhD, Jacqueline Diels OTR, Jessie VanSwearingen PhD PT, & Mark May MD
- The Importance Of Being An Autonomous Practitioner – “Work with doctors, not for doctors”
- Not wise to assume the doctor who referred the facial palsy patient to you knows everything about it

01/22/16
Learning Objectives

1. Independently list at least three of the classic symptoms of Bell's palsy.
2. Identify at least three objective facial palsy evaluation and outcome measuring tools that are available for your clinical assessment and documentation.
3. Describe at least three therapeutic exercise methods for reduction and control for the patient with synkinesis.
4. Accurately identify at least three possible red flags that would prompt referral of the patient to a physician for further work-up.

Example of Facial Palsy

- Which is affected side?
- Observe attenuated lips
- Observe shifted philtrum
Example of Facial Palsy

- Which side is effected?

- Wide eye and mouth corner droop gives clue about what?

Example of Facial Palsy

- Which side is effected?

- Why do we see the whites of her eyes?

- Note: Is closing eyes
Example of Facial Palsy

- Effected side?
- What do you notice about the eye?

01/22/16

Example of Facial Palsy

- Effected side?
- Nose & mouth deviate R
- Brow droop
- Gold weight in which eye?

10/27/13
Causes of Facial Paralysis

Etiology

- Many in the medical profession assume that any patient with facial paralysis on one side is automatically Bell’s palsy.

- “All that palsies is not Bell’s”
  - Sir Terrence Cawthorne (1963)

Facial Paralysis: Possible Causes


- Majority of those 113 listed are rare.
Differential Diagnosis in Facial Paralysis Conditions

- **Idiopathic (65%)**
  - Bell’s palsy (BP)

- **Infection (associated with BP)**
  - Herpes simplex,
    - Herpes zoster,
    - Borreliosis (Lyme disease)

- **Trauma (25%)**
  - Temporal bone fracture, penetrating wound, iatrogenic

- **Neoplasms (5%)**
  - Acoustic neuroma,
    - Parotid gland,
    - Metastases (skin, breast, lung, kidney, colon),
    - Cholesteatoma

- **Metabolic and Toxic**
  - Diabetes, Thyroid disease, Alcoholism,
    - Carbon monoxide, “Metallosis”

- **Epstein-Barr, HIV,**
  - Cytomegalovirus virus,
    - Mycoplasma pneumonia,
    - Tuberculosis

- **Acute and chronic otitis media (inner ear infection)**

- **Other Causes**
  - Congenital, CVA,
    - Sarcoidosis, MS,
    - Amyloidosis, Sjogren’s disease, Guillain-Barre syndrome, STD’s,
    - Melkersson-Rosenthal syndrome
Other Facial Disorders
(non-facial palsy)

Trigeminal neuralgia, i.e., “tic douloureux” – compression of Vth cranial nerve inside skull; causes severe pain, not paralysis

Hemifacial spasm – compression of VIIth cranial nerve inside skull; causes intermittent spasms beginning in eyelids and can involve other parts of face

Blepharospasm – bilateral spasmodic eye close; etiology uncertain

Bell’s palsy

Named for Scottish surgeon Sir Charles Bell who in 1821 first described paralysis of the muscles of facial expression following facial trauma

“There is now general agreement that Bell’s palsy is an acute, idiopathic, unilateral, peripheral facial paralysis that should be considered a diagnosis of exclusion” (Petruzzelli et al, 1991)

Barry Schaitkin, an otolaryngology (ENT) specialist, stated that 10% of referrals to him for BP had some other diagnosis as cause
Incidence of Bell’s palsy

- 1 in 3000 per year. Is it increasing? Some think so, but the evidence is not there
- Mean age at onset is between 40-44 years old. Less common before 15 yo or after 60 yo (Gantz et al, 1999)
- Diabetics, pregnant women (3rd trimester), & those who are immunocompromised, are at increased risk

The 3 Cardinal Signs of Bell’s palsy

- Sudden unilateral onset – within 24-48 hours (but some suggest up to 1 week)

- Pain behind or in ear canal that precedes facial muscle weakness, and is not long-lasting (< 1 week)

- Involves all branches of facial nerve, so entire hemi-face
Risk Factors for Incomplete Recovery

- Older age
- Diabetes mellitus
- Hypertension
- Compromised immune system
- No recovery at all (still completely flaccid) seen in first month

Evidence for a viral etiology of Bell’s palsy

- Herpes simplex virus (HSV) identified as causative pathogen in molecular biological investigations (Furuta et al, 1998)
- Detection of HSV genomes in facial nerve fluid of patients with BP (Murakami et al, 1996)
- Better outcome when antiviral med. given within 3 days, rather than 7 days, of onset (Hato et al, 2003)
- Better outcome with valacyclovir with prednisone over prednisone alone (Hato, et al, 2007)
What Triggers Reactivation of HSV to cause Bell’s palsy?

- Etiology considered viral, but different things seem to ‘trigger’ onset:
  - Upper respiratory infection (“a bad cold”)
  - Exposure to cold wind, overactive air conditioner
  - High stress and fatigue
  - Third trimester of pregnancy

The mechanism of Bell’s palsy is unproven but these are 2 theories:

- Inflammation of the VIIth nerve causes entrapment in the canal, causing ischemia & nerve damage

- Viral infection causes direct interference with VIIth nerve function without actual nerve compression
Clinical Implication

Take home message

- If you see an acute BP patient, if not on steroids and an antiviral medication, you should consider recommending it. Discuss with doctor.
- Considered effective within 3-4 weeks of onset
- Dosage: Prednisone – 60-80 mg/day x 7-10 days, tapering. Valacyclovir (Valtrex) – 500mg 2x/day for 7-10 days. Not Acyclovir.

Bell’s palsy vs. Ramsay-Hunt Syndrome

- Bell’s palsy
  - Herpes simplex virus
  - Little to no pain at onset
  - No dizziness or hearing loss
  - No blisters in or around ear
  - Better & faster recovery

- Ramsay-Hunt Synd.
  - Herpes zoster virus
  - aka herpes zoster oticus
  - Severe ear pain, esp. posterior
  - Vestibular symptoms, sensory loss (Vth & VIIIth CN)
  - May have blisters (not required)
Review Article on BP

- This is an excellent clinical review article:

Case Study

- 46 yo female in otherwise good health
- Prescription from neurologist- “PTx1 month - R facial weakness (Bell’s palsy)”
- Time from onset to 1st PT visit: 8 months
- History: chipped R tooth w/ temporary filling – severe pain in ear after. Ear infection ruled in, then out. Filed tooth down and did root canal, no help.
History

- Suffering R jaw and ear pain. Then came down with R facial palsy 2 weeks after the root canal
- Sent to neurologist – Tegretol, Neurontin did not help. Dx’d with trigeminal neuralgia in addition to Bell’s palsy
- Eventually went to John Hopkins at about 5 months post-onset- saw neurosurgeon, MRI (-), Dx’d with “trigeminal neuropathy”

Examination

- Patient stated her BP was slowly improving
- Pain rating 8-10/10 in R mandibular ramus, TMJ, & ear. Tests consistent with Stage 2 disc displacement TMD
- Tone= hypotonic in all R VIIth (facial) nerve branches. Sunnybrook FGS score = 29/100
- Diminished light touch sensation V1-V3, pain V2 dermatomes (this is most important sign!)
Discussion

What may be wrong with this presentation?

Discussion:

Could TMD be interfering with BP recovery?

Possible Vth – VIIth CN connection?

Relevance of Johns Hopkins evaluation?

What course of action would you take?

Result

We referred her to a facial nerve specialist in Pittsburgh

New MRI ordered with focus on mid to lower face, not brain

Diagnosed with advanced parotid cancer

Underwent extensive surgical intervention, including tumor removal, mandibulectomy, reconstruction with ilium bone, nerve grafting

Followed by chemotherapy & RadRx
Natural Course of Recovery

- An estimated 70% of Bell’s palsy patients are fully recovered within 6-8 weeks of onset, regardless of intervention.

- Peitersen’s natural history study of over 1,000 cases showed that after 1 year, 71% had complete recovery, 13% had “slight residual weakness”, and 16% had fair to poor recovery (Peitersen, 1982).

To Treat or Not to Treat The Acute Facial Palsy Patient, that is the Question

- If the doctor orders it, of course, but you may be using up limited insurance dollars at the wrong time!
- 1 visit to educate the patient can be quite valuable
- Psychological effect of providing intervention also should not be underestimated
- However, if nothing is moving yet on the affected side, what are you going to accomplish?
Recent Article on Early Physical Therapy in BP

- Published in “Neurorehabilitation and Neural Repair”, from Rome, Italy in 2013
- A Randomized Controlled clinical Trial: compared early PT + drug therapy (prednisone/valcyclovir) vs. drug therapy alone
- PT involved Facial NMR methods and speech ex’s (not e. stim.)
- Results (summary): PT had a significant effect on grade and time to recovery only in pt’s. with severe facial palsy (HB Grade V/VI), but no effect on outcome of synkinesis. Less severe BP cases (HB Grade IV or less) resulted in complete spontaneous recovery, regardless of PT

What does the Facial Nerve Innervate?

- Muscles of facial expression
- Lacrimal Gland (greater petrosal nerve), salivary glands (chorda tympani), mucous membranes in mouth
- Taste - anterior 2/3 of tongue (chorda tympani)
- Sensation - small area behind ear (posterior auricular nerve)
- Stapedius muscle of middle ear; posterior digastric & stylohyoid muscles
Some things the facial nerve does NOT do

- Open the eyelids - this is done by a) passive rebound, b) levator palpebrae superiorus muscle (CNIII), and c) Mueller’s muscle (CNV) – ptosis often seen in paresis of either of these 2 muscles
- Provide sensation to face (except postauricularly), so pain is not from facial nerve
- Innervate the mastication (chewing) muscles
Facial nerve, CN VII, is a peripheral nerve, as are CN III-XII.

This will apply to any peripheral nerve in body, but the following slides are specific to the facial nerve.

The difference in degree of recovery is based on degree of injury (neuropraxia, axonotmesis, neurotmesis).

### Neuropathology & Regeneration of Peripheral Nerve Injury

<table>
<thead>
<tr>
<th>Degree of Injury</th>
<th>Pathology of Injury</th>
<th>EEMG Response</th>
<th>Neurobiology of Recovery</th>
<th>Clinical Recovery Begins</th>
<th>Spontaneous Recovery-1 Year Postinjury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compression. Daming of axoplasm. No morphologic changes. (Neuropraxia)</td>
<td>Normal</td>
<td>No morphologic changes noted.</td>
<td>1-4 weeks</td>
<td>Grade I: Complete, without evide faulty regeneration.</td>
</tr>
<tr>
<td>2</td>
<td>Compression persists. Increased intraneural pressure. Loss of axons but endoneurial tubes remain intact. (Axonotmesis)</td>
<td>25% of normal</td>
<td>Axons grow into intact empty myelin tubes at a rate of 1 mm/day which accounts for longer period for recovery in 2' injuries compared to 1'. Less than complete recovery is due to some fibers with 3' injury.</td>
<td>1-2 months</td>
<td>Grade II: Fair: Some noticeable di with volitional or oto movement, minimal s of faulty regeneration.</td>
</tr>
<tr>
<td>3</td>
<td>Intraneural pressure increases. Loss of myelin tubes. (Neuromatosis)</td>
<td>0–15% of normal</td>
<td>With loss of myelin tubes the new axons have an opportunity to get mixed up and split causing smooth movement with eye closure referred to as synkinetics.</td>
<td>2-4 months</td>
<td>Grade III-IV: Moderate to poor: Obvi incomplete recovery a crippling deformity w moderate to marked complications of fault regeneration.</td>
</tr>
<tr>
<td>4</td>
<td>Above plus disruption of perineurium. (Partial transection)</td>
<td>No response</td>
<td>In addition to problems caused by 2' and 3' injuries, now the axons are blocked by scar tissue which impairs regeneration.</td>
<td>4-18 months</td>
<td>Grade V: Motion barely perceptible</td>
</tr>
<tr>
<td>5</td>
<td>Above plus disruption of epineurium. (Complete transection)</td>
<td>No response</td>
<td>Complete disruption with a scar-filled gap presents an insurmountable barrier to the growth of axons and neuromuscular reinnervation.</td>
<td>Never</td>
<td>Grade VI: None.</td>
</tr>
</tbody>
</table>
A supranuclear injury is often termed a “central seventh” injury by neurologists, who consider it permanent. Caused by CVA (stroke) or TBI (traumatic brain injury), it can occur anywhere from cortex to pontine nucleus of CN VII (see “Diagram of Facial Nerve Anatomy”).
Stroke-caused Palsy

- A Central VIIth palsy is characterized by the following:
  1. Accompanied by hemiparesis of other body parts (usually, but not always, ipsilateral)
  2. Upper face intact (normal brow raise voluntarily)
  3. Sparing of spontaneous expression – can smile from an emotional cause

Lyme disease as Cause of Facial Palsy

- Symptoms include bull’s eye-shaped rash, headaches, stiff neck, spectrum of neurologic symptoms – ataxia, bilateral facial palsy, motor & sensory radiculoneuritis (May & Schaitkin, 2000)
- Requires attachment of infected tick for over 12 hours to be successfully transmitted
- In areas of the country considered high-risk for Lyme infection (from deer tick bite), patients presenting to the ER are usually started on antibiotics prophylactically
- Now seeing increased incidence in Western PA
Unique Qualities of the Muscles of Facial Expression

- From different embryological source – considered ‘atypical skeletal muscle’, not smooth muscle – do not atrophy for up to 2 years (Moldaver, 1980)

- Have limited proprioceptive feedback
  - A) few, if any, muscle spindles
  - B) absence of joints and joint receptors

- This results in muscle movement and tension not being easily perceived
1st "LAB" SESSION
- Let's all make faces -

These are the basics:

1. Brow raise (frontalis)
2. Brow knit (corrugator, procerus)
3. Eye close (orbic. oculi)
4. Squint (orbic. oculi)
5. Snarl (levator group)
6. Closed lip smile (zygomaticus)
7. Open lip smile (zygomaticus)
8. Pucker (orbic. oris)
9. Smirk (risorius)
10. Lip wraps (orbic. oris)
11. Lip press (orbic. oris)
12. Lower lip depression (depressor labii infer.)
13. Frown (dep. anguli oris)
Review of Facial Symptoms & Impairments Seen in Facial Palsy

- Resting posture changes (asymmetry)
- Decreased facial movement (weakness)
- Co-contracting facial movements (synkinesis)
- Limited tissue mobility (resting tension, contracture)
- Facial twitches or spasms (in chronic cases)

Common symptoms related to Facial Palsy: Ocular Impairments

- Incomplete eye closure (lagophthalmos) causing dryness; sensitivity to outdoor wind & sunlight – can lead to corneal damage
- Inability to wink
- Excessive tearing – can be due to 2 different reasons
  - Weak “windshield wiper” effect & loss of punctal pump
  - "crocodile tears" – excess tear production due to synkinesis
Oral Impairments

- Lip and buccinator weakness results in:
  - Drooling, pocketing of food
  - Difficulty drinking from cup, bottle
  - Difficulty rinsing & spitting (brushing teeth)
  - Biting lip or inner cheek
  - Inability to whistle, blow up balloon, blow out candles
  - Dysarthric speech with labial sounds

Other Symptoms

- Hyperacusis – sensitivity to loud noise
- Loss or change of taste – can lead to weight loss, nutritional problems
- Bell’s phenomenon, a protective eye reflex, can become habituated and prevent full eye close later
- Twitching of cheek or mouth corner, usually caused by ocular to oral synkinesis when blinking (in chronic cases)
- Dry mouth due to decreased saliva production
Bell’s Phenomenon preventing gold weight from fully closing eye

Some Red/Yellow Flags to Consider

- 1. Isolated branch weakness: i.e. weakness of individual facial nerve branches, not entire face (red)
- 2. Slowly progressive > 3 weeks (red)
- 3. No recovery at 3-4 months post-onset (red)
- 4. Sensation loss in 1 or more trigeminal dermatomes (yellow)
- 5. Drainage from ear (red)
- 6. Presence of a mass or swelling near angle of mandible (red)
- 7. Lack of any bells phenomenon during eye close attempt (yellow)
- 8. Loss of lateral eye movement on same side (CN VI) (yellow)
Isolated branch weakness

“Prior to emerging from the temporal bone, the facial nerve is not organized into distinct branches; therefore, any lesion with a distinct branch weakness can only be caused by parotid pathology.”

Sensory loss in any or all of ipsilateral trigeminal dermatomes also may indicate a neoplasm (tumor; benign or malignant) = yellow flag

Psychosocial Aspects of Facial Palsy

“The face is the window of the soul” - Cicero.

We use our faces to communicate, it gives 1st impressions, very important in non-verbal communication

Facial palsy usually results in great personal distress. Degree based upon:

- premorbid self-concept
- support systems
Typical Responses to facial paralysis:
depression, guilt, anger & hostility, anxiety,
rejection, paranoia, poker face (avoiding emotional responses) (Twerski, 1986)

Treatment: Recognition & empathy, referral for counseling/psychotherapy, anti-depressants

What is Synkinesis?

Definition: A specific disorder of facial movement associated with recovery from paralysis, defined as an unwanted movement accompanying a desired motion

\( Syn = \text{together}, \ kinesis = \text{movement} \)

Considered to be caused by aberrant reinnervation or synaptic reorganization in the facial nucleus (Valls-Sole et al, 1992; Montserrat et al, 1988)

Occurs late in recovery, usually >3 months post-onset
Neuromuscular reeducation (NMR): surface EMG biofeedback & mirror-assisted facial muscle reeducation, focusing on reducing synkinesis to improve movement control

Teaches patient how to suppress abnormal muscle activity interfering with facial function

Home exercise program of specific facial movements

Clinical Evaluation Methods

Subjective & Objective Tools To Use

Questions to ask in History

- Onset Date:
  - 0-3 months is considered acute
  - 3-12 months is considered sub-acute
  - >12 months is considered chronic
- Was onset sudden or slow
- How long did it take before improvement was first seen
  - The longer it takes, the less full the recovery
Review systems: ear, eye, and mouth symptoms

What treatment has been received to date

What is main concern, or “If I had a magic wand and could fix one thing in your face, what would it be?” – helps you to focus treatment

Gradual onset over 3 weeks or more may mean tumor

Unilateral hearing loss accompanied by dizziness, imbalance, or mild facial weakness may mean acoustic neuroma

Complaint of “hard” swelling over angle of mandible (not cheek) may mean parotid tumor
Common Evaluation Tools

- House-Brackmann grading scale (1985)
- Grading scales of resting posture, voluntary movement and synkinesis (Sunnybrook FGS)
- Surface Electromyography (sEMG) recordings of facial muscle activity
- Self-report questionnaire of facial function (FDI)

Other Facial Grading & Outcome measures

- May scale (1970)
- Burres-Fisch system (1986)
- Yanagihara Facial Grading Scale
- Dutch Facial Clinimetric Evaluation Scale
- Glasgow Facial Palsy Scale
- Facial Nerve Grading System 2.0 (Upgrade of House-Brackmann Scale)
- Facial Clinimetric Evaluation (FaCE) Scale
- MEEI FACE-Gram software (New)
Clinical Evaluation Tools

Not to Use

- ROM measurement with goniometer
  - No axis's to line up with

- Strength testing using manual muscle testing
  - Unable to effectively apply resistance
  - No joints in the face

- So, how does one objectively measure facial paralysis?

House-Brackmann Grading Scale (House et al, 1985)

- Observational scale
- Well established, used mainly by physicians, researchers
- Utilizes a I to VI scale, where I is normal and VI is total paralysis
- Frequently used & cited in research articles worldwide
- Newer version published in 2009 - “Facial Nerve Grading System 2.0” - takes longer, not widely used
### Table 14-8  House-Brackmann Grading System

<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>
</tbody>
</table>
| II    | Mild dysfunction | Gross: slight weakness noticeable on close inspection; may have very slight synkinesis.  
At rest: normal symmetry and tone.  
Motion:  
Forehead: moderate to good function.  
Eye: complete closure with minimum effort.  
Mouth: slight asymmetry. |
| III   | Moderate dysfunction | Gross: obvious but not disfiguring difference between two sides; noticeable but not severe synkinesis, contracture, and/or hemifacial spasm.  
At rest: normal symmetry and tone.  
Motion:  
Forehead: slight to moderate movement.  
Eye: complete closure with effort.  
Mouth: slightly weak with maximum effort. |
| IV    | Moderately severe dysfunction | Gross: obvious weakness and/or disfiguring asymmetry.  
At rest: normal symmetry and tone.  
Motion:  
Forehead: none.  
Eye: incomplete closure.  
Mouth: asymmetric with maximum effort. |
| V     | Severe dysfunction | Gross: only barely perceptible motion.  
At rest: asymmetry.  
Motion:  
Forehead: none.  
Eye: incomplete closure.  
Mouth: slight movement. |
| VI    | Total paralysis | No movement. |

#### Problems with H-B Scale

- Not sensitive enough
- Mixed Grades due to overlap
- Can be easily manipulated
- Grades I to IV all include normal resting tone & symmetry
Sunnybrook Facial Grading System (FGS) (Ross et al, 1996)

- Observational scale
- 3 sections (resting posture, voluntary movement, synkinesis)
- Composite score 0 – 100 (higher score = less impairment)
- Reliability coefficients ≥ .90 (Brach et al, 1999)
- Construct validity and responsiveness (Ross et al, 1996)

Facial Grading System

<table>
<thead>
<tr>
<th>Resting Symmetry</th>
<th>Symmetry of Voluntary Movement</th>
<th>Synkinesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared to normal side</td>
<td>Degree of muscle EXCURSION compared to normal side</td>
<td>Rate the degree of INVolUNTARY MUSCLE CONTRACTION associated with each expression</td>
</tr>
<tr>
<td>Eye (choose one only)</td>
<td>Normal</td>
<td>Glabellar wrinkle (FRT)</td>
</tr>
<tr>
<td></td>
<td>Narrow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eyelid surgery</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheek (nose-labial fold)</td>
<td>Normal</td>
<td>Fullness of nasolabial folds</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More pronounced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less pronounced</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth</td>
<td>Normal</td>
<td>Upturn of the corner of the mouth</td>
</tr>
<tr>
<td></td>
<td>Corner drooped</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corner pulled up/out</td>
<td></td>
</tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Resting symmetry score Total × 5
Voluntary movement score Total × 4
Synkinesis score Total

Patient’s name
Date
Facial Disability Index (FDI)

- A self-report instrument for the assessment of disability in this patient population developed by Jessie VanSwearingen, Jennifer Brach and others at UPMC
- It has 2 subscales: Physical & Social
- (VanSwearingen et al, 1996)
Scoring the FDI

- **Physical (FDIP) subscale** is Questions 1-5 – score from left to right, 5 down to 0 and sum the five scores. Score using key sheet and is between 0 (worst) and 100 (best)

- **Social (FDIS) subscale** is Questions 6-10 – score first question left to right, 6 down to 1 and the subsequent questions left to right 1 up to 6 and sum the five scores. Score using key sheet and is between 0 (worst) and 100 (best)
A Basic Evaluation will include...

- FDI Questionnaire filled out in waiting room
- History including onset details, treatment to date, review of systems
- FGS test (plus lower lip depression movement)
- Sensory exam – pain and light touch (test V1, V2, V3 – see next slide)
- Functional tests (see separate slide)
- EMG Biofeedback testing: frontalis (brow raise), zygomaticus (smile), orbicularis oris (pucker), or other muscle groups as needed.
### FUNCTIONAL TESTING OF FACIAL PALSY

- **Observe Speech:** Lips opening symmetrically? Is dysarthria present? Does eye shut with labial (M, B, P, W) sound pronunciation?

- **Whistling:** Can they? Could they before?

- **Blowing up Balloon:** Use medium sized balloon. Does air escape from lips? Do not let them use finger to press against lips.

- **Blow out Candle:** Use lighter or matches. Hold at distance of 6" and 12". Do not allow them to move head.

- **Winking:** Try with unaffected eye first. If they can wink affected eye, there is adequate orbicularis oculi strength and no need for gold weight, or it can be removed.

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### Surface EMG Biofeedback & Electrical Stimulation

~The electrical stimulation controversy~
Feedback

- Information about ongoing neuromuscular activity
- Biofeedback, signals from physiologic phenomena
- Learning (or relearning) facial movements requires feedback

Surface EMG Biofeedback

- Signaling about motor output (muscle activity) back to the CNS during progression of the motor event
- Purpose: Patient can use the information to alter involuntary, or usually not perceived, motor events by altering the feedback signal:
  - map facial muscle activity (voluntary and synkinesis)
  - detect facial muscle activity at rest (hyperkinesia)
  - quantify spasms (amplitude and frequency)
Rationale for sEMG Biofeedback in Facial Rehabilitation

- Provides accurate and immediate (extrinsic) feedback about facial movement to a brain uninformed of facial muscle performance.

- Used by the brain in (re-)learning which motor units to recruit and which are inappropriate for an intended expression or task.

Conscious & Unconscious Control

- Think about your own facial expressions, are they planned?
- Most of our facial movements are unplanned, unconscious – we know “movements, not muscles”
- Born with facial expressions (didn’t have to learn)
- Mimicry of parents when infants
- Individuals with facial palsy must relearn by exerting conscious control of the individual facial muscles.
Motor Learning Through Biofeedback (Adapted from Krebs, 1989)

- Surface EMG recording → → →
- Visual / auditory display → → →
- Gives “feedback”
- Individual’s understanding of desired performance → → →
- Individual’s motor performance → →
- Knowledge of results changes (back to top)

Use of sEMG Biofeedback in Facial Rehabilitation

- Establishes the goal of the movement
- Allows for varied movement strategies to meet goals
- Positive reinforcement
- Process oriented
- Can detect small changes in motor performances not seen in mirror
Surface EMG: Equipment

Electrodes:

- 2 active (recording); 1 reference
- Ag-Ag chloride; conductive gel, or disposable with conductive media
- Placed along muscle belly, reference between (or at angle of jaw!)
- In the face, we place reference at angle of mandible

Surface EMG: Equipment

EMG Biofeedback Device:

- Rectifies
- Smooths
- Integrates
  - Usually over a time period (time constant)
- RMS (= square root of the mean voltage)
Integrated EMG Signal (sEMG)

- Full wave rectification
- Real time processing

- Changes with a change in the:
  - Number of firing of motor units
  - Rate of firing of motor units
  - Type of motor unit recruited

(Krebs, 1989)

sEMG: Recording What?

- A recording of the sum of the change in electrical potential (depolarization) of all of the muscle fibers beneath the recording electrodes
- i.e., sum of sarcolemma depolarizations
- Therefore, not reading movement!
Surface EMG: Equipment

- Systems to consider:
  1. Pathway system – The Prometheus Group (system also for urinary incontinence)
  2. NeuroEducator 4 – Therapeutic Alliances, Inc.
  3. Care EMG – Portable unit
  4. Noraxon 4-channel unit

Potential Pitfalls of sEMG Biofeedback

- Patient may become dependent on the feedback
- Not widely available
- Time consuming “fuss” with equipment
- Not covered by insurance unless bundled with neuromuscular reeducation
Early Research in EMG Biofeedback of Facial Palsy

- Balliet, et al, 1982: Successfully used facial neuromuscular retraining on four VA hospital residents with chronic facial palsy.

Additional Research Supporting Facial NMR

- Segal B, et al, 1995
- Brach JS, et al, 1997
- Cronin GW, et al, 2003
- Beurskens CHG, Heymans PG, 2004
- Toffola ED, et al, 2005

- All these references are found in the bibliography handout.
Research that Supports Electrical Stimulation

- Farragher D et al, 1987 and Targan RS et al, 2000:
  - Problems with these 2 studies include:
    - Neither use recognized objective measures
    - Both used a form of e. stim termed “eutrophic” or “trophic”; this is sub-contractile current, not traditional e. stim we are used to using
    - Targan study is considered flawed
    - These are the only two research studies that support e. stim treatment of FP and it is for chronic cases
    - Note: New study published 2015 – see below

01/22/16

What is your experience with electrical stimulation?

- Expect no harm in the 60-70% of BP patients who will recover spontaneously within 1-2 months of onset. Sensory stimulation effect may even be good
- However, can do same thing with massage and vibrator, without the pain.

01/22/16
Electrical Stimulation and Facial Neuromotor Disorders

- Considered to be of little benefit (Waxman, 1984, Diels, 1995)
- Adversely affect recovery of facial neuromotor function (Brown et al, 1979, Cohan et al, 1986)
- Disruptive to reinnervation (Brown et al, 1979, Cohan et al, 1986)
- Results in “mass action” with voluntary facial movement attempts
- Reinforces synkinetic activity and inaccurate patterns of facial expression

Review Article on Electrical stimulation for Bell’s palsy

- This article reviewed all prior research on the use of electrical stimulation in acute Bell’s palsy and concluded there was no evidence to support it’s use

Vital Stim

◨ This is used for dysphagia treatment, not facial paralysis conditions

◨ It does have FDA approval, but only for swallowing problems

◨ I do not recommend any electrical stimulation in the face for the reasons stated above.

Two new research studies published in 2015

◨ Note: supports efficacy of electrical stim. treatment in Bell’s palsy, but has a major flaw

◨ Note: supports use of Botox in combination with facial NMR in a previously overlooked facial muscle
Treatment Techniques

Surface EMG Guidelines, Facial Exercises & Practical Guidelines

Keep in Mind

- You need to know what your patients’ priority or priorities are
  - The ‘magic wand’ question

- Understand what your time & money (insurance) limits are...
  - These are not the good old days

- Treatment is as much an art as it is a science
In Preparation for sEMG Biofeedback

- Instruct women to wear little to no makeup
- Men may need to trim or shave off facial hair
- Instruct to bring eye drops to sessions in case acute irritation occurs
- Do skin prep with alcohol wipes or “One-Step” skin prep by 3M

sEMG Biofeedback Training Suggestions

- After hooking up desired muscle groups, have patient practice voluntary movements using:
  - Mimetic signals from you
  - Verbal “coaching”
  - “Trial and error”
  - Help reduce performance anxiety by occasionally leaving room
Basic Treatment for Flaccid or Hypotonic condition

- No intervention, re-evaluate in 1 month
- Sensory stim. methods: tapping, electric vibrator, brisk massage, moist heat
- Passive and active-assistive movement of involved side during voluntary movement of uninvolved
- Avoid maximum effort to prevent strong-side over activity or jaw muscle substitution

Basic Treatment of Hypertonic Muscles

- Contractures in facial muscles caused by nerve regeneration
- Massage, massage, massage!
- Active stretching, example: pulling lips hard to right, opening mouth wide stretch, anterior neck (platysma) stretch
- Passive stretching - eyelids, pull lips with fingers, buccinator stretch
Basic Treatment of Synkinesis

- Small movement of desired motion while stopping undesired (synkinetic) motion (mirror, sEMG)
- Must begin with small efforts, not big efforts, or it will be impossible to reduce synkinesis
- Two strategies to consider:
  - Make desired movement, hold very steady while relaxing synkinetic muscle(s)
  - At very start of desired movement, try to prevent onset of synkinesis

Standard sEMG Electrode Placements

- Bilateral frontalis mm. – brow raise, brow knit
- B/L orbicularis oris – train pucker, compression of lips, wrapping lips inward, blowing
- B/L Orbicularis oculi mm., top & bottom eyelids in lateral position
- B/L zygomaticus mm. – train smile
- B/L levator mm. – train snarl
- B/L depressor m. group – train lower lip pulldown, frown
Electrode placement for Synkinesis control

- Zygomaticus & Platysma mm.
  - Train to decrease smile to neck synkinesis

- Frontalis & Zygomaticus mm.
  - Train to decrease brow raise to oral synkinesis

- Orbicularis oculi & oris mm.
  - Train to decrease oral to ocular synkinesis or vice versa

Facial Exercises

This is not a comprehensive list of exercises. The exercises can be divided into 3 broad categories:
1. Massage and stretches
2. Strengthening
3. Synkinesis control
Facial Massage & Stretches

- Self-massage to relax: bilateral slow horizontal strokes from forehead to chin for 3-5 minutes
- Self-massage to facilitate: brisk, quick upward strokes on effected side for 3-5 minutes
- Passive cheek stretches - Hold 20-30 secs.
- Passive lip stretches - Hold 20-30 secs
- Buccinator stretch - using 2 fingers to scoop out cheek laterally
- Nasal ala stretch - using little finger
- Platysma stretch - Hold 20-30 secs

Eye close exercise

- Used to control bells phenomenon
  - Look down with eyes, not head, at hands on table edge.
  - Close eyes most of way without losing sight of hands (allow uninvolved side to close all the way). Hold 5 count.
  - Use 1 finger to finish close, keep looking down.
  - Squeeze eye shut a little and take finger away.
  - Hold 10 more count. Reopen & relax.
Lip Strengthening Exercises

- Lip compression or presses
  - Use finger to hold lips centered, if needed
- Pucker
  - May need 2 fingers - 1 on top, 1 on bottom to assist
  - Be careful of jaw protrusion substitutions
- Blowing slowly
  - May work better than pucker - controversial
- Alternate suck in cheeks, puff cheeks out
  - Try to keep the seal
- Finger blows/ balloon blowing

Synkinesiysis Control Exercises

- Oral to ocular: patient begins to pucker, effected eye begins to close – hold pucker, relax eye. Can be done with or without mirror.
- Brow to oral: patient begins to raise brows, effected cheek/mouth corner begins to contract – hold brow raise steady, relax cheek
- Smile to chin or platysma: patient begins to smile, effected chin begins to dimple or platysma bands begin to show – hold smile steady, relax chin or neck
- Begin with 10 count hold, increase to 20 count as tol.
Substitutions to Watch Out For

- Tongue thrusting, esp. when smiling
- Jaw movements and clenching teeth
- Pulling lips over to good side habitually (it is a way to stretch the tight cheek, but can become tic-like)
- Head & neck postural deviations

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Co-Morbidity of TMD

- Seeing more of this recently (or perhaps just recognizing it better)
- Caused by patients substituting jaw muscle activity in place of the paralyzed facial muscles
- Treat with modalities – HP, ultrasound, jaw stretching exercises, education
- Do you know that at rest the teeth should never be touching? Teach that.

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Treatment Strategies for Specific Problems

- When cheek twitches with every blink or voluntary eye close
- When smile will not go up due to synkinesis of chin and neck muscles
- When lips are being pulled hard to uninvolved side due to lack of involved side tone/strength
- When lips are being pulled hard to involved side due to cheek synkinesis
- When snarl is much stronger than smile

Surgical Interventions & Botox usage

Basic Information
Facial Nerve Decompression

- Used to treat acute Bell’s palsy only, not RHS
- Controversial – big operation for questionable result; Dr. May’s contribution
- Has specific criteria that should be met before even considering:
  - Short time frame from onset
  - Percentage of denervation on EMG testing >95%

Facial Reanimation Surgeries

- Primary (direct) facial nerve repair
- Cross facial nerve graft (VII-VII)
  - Takes 6-12 months to regenerate across
  - These require no special type of facial retraining, other than standard
- 1 & 2-stage muscle flap w/ nerve graft procedures
Temporalis tendon transfer or “pulldown”
- Gives strong voluntary smile, not spontaneous one
- Must clench teeth to activate temporalis muscle to lift mouth corner into smile
- Problems include:
  - Bulge over zygomatic arch (unless using newer technique)
  - Smile turns on during mastication repeatedly

XII-VII Anastomosis (“Twelve-Seven”)
- Only done when no return has occurred
- Portion of or whole of hypoglossal nerve is spliced to stump of seventh nerve
- Takes 6-12 months to regenerate
- Must use tongue push against palate to activate smile, may cause “mass action”
- Needs a lot of sEMG training to shape smile, try to eliminate need for tongue push
Problems with nerve graft surgeries

- Derald Brackmann, MD in lecture at XIIth Int’l. Facial Nerve Symposium in June 2013 stated that 10% of all nerve graft surgeries fail

- If done at same time or near when RadRx is done, usually fail

- Can either get not enough “power” or too much, with synkinesis

Eye lid Surgeries:
- Upper lid gold/platinum weight placement
- Lower lid tightening
- Tarsorrhaphy – suturing together of upper and lower eyelids
- Eyelid Spring
Fascial Sling – static procedure

Selective myectomy

Selective neurectomy

Botox Injections

Used to treat synkinesis problems

Should be combined with specific action exercises & facial NMR treatment, otherwise always temporary effect (3-5 months duration)

Is covered by insurance for treatment of synkinesis, not cosmetic use

Problems that can arise: my experience
“Neuromuscular retraining in conjunction with botulinum toxin allows the patient to access the primary expressive musculature with greater accuracy, improving practice patterns, and motor learning, while the botulinum toxin effect is present.”

(Wei LA, et al, 2015)

Practicalities

Suggested rehabilitation schedule:

1 session per week for 4-6 weeks

1 session per 2 weeks for 12 weeks

1 session per month for 4-6 months
Out-of-Town Patients*

Will see 1 visit per month, 3 or 4 hours per day for 1-3 days, depending on need
Decrease to 1 visit per 3-4 months

* The preceding is ideal, but may no longer be practical in today’s current health care environment

ICD-10 Codes

- **G51.0 (351.0)** Bell’s palsy
- **R29.810 (781.94)** Facial weakness
- **S04.50XA (951.4)** Injury to facial nerve
- **G51.8 (351.8)** Facial nerve disorder (not accepted by Medicare)
- **R25.8 (781.0)** Synkinesis (facial)
- **D33.3 (225.1)** Acoustic neuroma
- **I69.392 (438.83)** Facial droop from stroke
Treatment Procedure Codes

These are used in Physical Therapy Rx:
- Neuromuscular reeducation (NMR) (97112)
- Therapeutic exercise (97110)

Biofeedback training is normally bundled with the NMR code due to concurrent use of verbal, mirror and mimicry feedback.

More about Acoustic Neuroma

- An acoustic neuroma, also called a vestibular schwannoma, is a rare benign tumor of the balance and hearing nerves. 95% of acoustic neuroma (AN) are unilateral (occur on one side).
- Initial symptoms include single-sided hearing loss, balance disturbances or vertigo, tinnitus, and a feeling of fullness in the ear (also sensory loss).
- The treatment options are observation, surgical removal or radiation (RadRx).
Post-Treatment A.N. Symptoms

- Balance issues
- Cognitive: fatigue, concentration, memory loss, depression
- Eye issues: inability to close eye, dry eye, diplopia (double vision)
- Facial palsy or paresis (fortunately, less common than when I started 20+ years ago)
- Headaches
- Hearing loss, tinnitus
- Taste and swallowing problems

Three Websites to Know

- Bell’s Palsy Information Site (BPIS)
  - www.bellspalsy.ws

- Acoustic Neuroma Association website
  - www.anausa.org

- Face2Face Healing website (supports those with facial disfigurement)
  - Face2facehealing.org
Sir Charles Bell Society

- www.sircharlesbell.org
- An international multi-disciplinary society devoted to the research and treatment of facial nerve disorders
- Holds scientific meetings every 4 years
- At the 2013 meeting in Boston, there were approximately 45 facial therapists in attendance
- Next meeting in Los Angeles in 2017

Results of Facial NMR
22 years s/p RHS
Pucker

Acute RHS
Open Lip Smile


Acute B/L Bell’s palsy
Open Lip Smile

Nov. 2012  July 2013
Acute R Bell’s palsy

Thanks for Your Attention

“The great thing in this world is not so much where we stand, as in what direction we are moving… We must sail sometimes with the wind and sometimes against it – but we must sail, and not drift, nor lie at anchor.”

Oliver Wendell Holmes
References


References (Continued)


References (Continued)