

# Interdisciplinary Approach to Tinnitus Management

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Neurology / Otoneurology

# Goals

- Overview of The Cleveland Clinic Tinnitus Management Clinic, with focus on the roles of the neurologist and physical therapist
- Appreciate the potential contributions of the cervical spine and temporomandibular region on tinnitus
- Identify patients with tinnitus that may benefit from multidisciplinary management particularly those that demonstrate somatic modulation.
- Demonstration of a bedside cervical spine and jaw exam (time permitting)

# Goals (NC)

- Brief overview of The Cleveland Clinic Tinnitus Management Clinic, with focus on the role of the Neurologist
- Appreciate the potential contributions of the cervical spine and temporomandibular region on tinnitus
- Identify patients with tinnitus that may benefit from multidisciplinary management particularly those that demonstrate somatic modulation
- Identify patients that may benefit from further neurologic evaluation, headache medicine evaluation or otherwise

(Nothing to disclose. No external funding)

# Quote

There's an insect in your ear  
If you scratch it won't disappear.  
It's gonna itch and burn and sting  
Do you wanna see what the scratching brings!

Paul Hewson

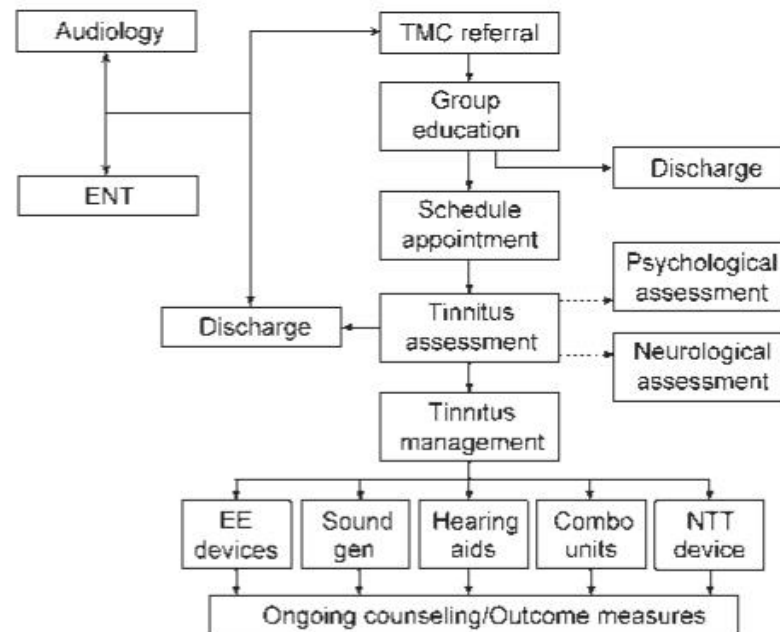
U2 - Staring at the Sun

# CCF Tinnitus Management Clinic

- Started by Craig Newman and Sharon Sandridge
  - 15 years ago (Audiology only)
  - 10 years ago (Full Team)
- Multidisciplinary
- A Shared Medical Appointment – up to 6 patients per session  
(CCF is pro collaboration – IMATCH, CPRP...)



# CCF Tinnitus Management Clinic



**Figure 1** Overview of the Tinnitus Management Clinic (TMC) clinical pathway. Combo, combination; EE, environmental enhancement; ENT, ear, nose, throat physician (otolaryngologist); Gen, generators; NTT, Neuromonics Tinnitus Treatment.

# TMC – Pre-Visit

- Medical Clearance provided by the referral ENT (int or ext)
  - Basic ENT evaluation (at the least)
  - Comprehensive audiometry
  - Possible imaging – head MRI and or temporal bone CT
- Questionnaires completed
  - Tinnitus description, aggravating / alleviating factors, treatments to date
  - Tinnitus Handicap Inventory (THI)
  - Tinnitus Functional Index (TFI)
  - Patient Health Questionnaire (PHQ-9) – for assessing the severity of depression
  - Generalized Anxiety Disorder (GAD-7)
  - Headache Disability Index (HDI)
  - Dizziness Handicap Inventory (DHI)
  - Neck Disability Index (NDI)

# TMC – Visit

- Folder of various materials provided
- Patient self-introduction to the group
- Didactic portion (90 min total)
  - Audiology - prevalence and origins of tinnitus, available options in the treatment/management of tinnitus, and realistic expectations for treatment outcome
  - Auditory Neuroscience (Jim Kaltenbach, PhD)
  - Dentistry (Karyn Kahn, DDS)
  - Physical Therapy (Tod Kokensparger, PT / Kay Cherian, DPT)
  - Psychology (Scott Bea, PsyD)
  - Neurology (Neil Cherian, MD)
- Total time: 3.5 hours (30 min intro, 90 min one on one screens)



# TMC – Individual Screens

- The basic purpose of the screen visit is to ascertain whether a full evaluation is needed
- 15 min with each provider
- Audiology
- Dentistry (Karyn Kahn, DDS)
- Physical Therapy (Tod Kokensparger, PT / Kay Cherian, DPT)
- Psychology (Scott Bea, PsyD)
- Neurology (Neil Cherian, MD)

# TMC – Individual Screens: Neurology

Attempt to ascertain the presence of any pertinent elements:

- Vestibular dysfunction
- Various headache disorders (migraine, tension headache, cervicogenic HA)
- Other pain syndromes (such as fibromyalgia, regional pain syndromes, atypical facial pain)
- Phenomenon of somatic modulation (as described by Robert A. Levine, MD).

# TMC – Individual Screens: Neurology

## History:

- Specific questions about the onset / evolution / character of the tinnitus
- Hearing questions, presence of hyperacusis?
- Ear pain / discomfort
- Jaw pain / discomfort
- Neck pain / discomfort
- Headache
- Dizziness, Imbalance
- Significant past medical history? Head trauma?

# TMC – Individual Screens: Neurology

Examination:

- Cervical spine
- Somatic Modulation

# Office Exam of the Neck (in the seated pos)

- Posture
- Range of Movement (looking for symmetry)
  - Active
    - Extension, Flexion, Total Cervical Rotation
  - Passive
    - Total Cervical Rotation
    - Flexion, Sidebend
    - Upper Cervical Rotation (In flexed position) \*\*\*
- Survey of Pain / Tenderness (Palpation)
  - Suboccipital region
  - Paracervical region / Lateral processes of C1 vertebrae
  - Occipital groove and one vert level below (Occipital nerve region)

# Levine SMTz Protocol

EFFECTS of PRESSURE		
CONDITION	TINNITUS LOUDNESS	TINNITUS PITCH
BASELINE		
CLENCH		
FINGERS LOCKED		
HIP FLEXION L		
HIP FLEXION R		
KNEES APART		
KNEES TOGETHER		
DELTOID L		
DELTOID R		
FOREHEAD		
BACK		
TEMPLE L		
TEMPLE R		
TURN L		
TURN R		
JAW PRESSURE		
VERTEX		
SCM L		
SCM F		
DISTRACTION		
OPEN JAW		
AGAINST RESIST		
PROTRUDE		
AGAINST RESIST		
RETRACT		
LEFT		
AGAINST RESIST		
RIGHT		
AGAINST RESIST		

Levine 2004

# TMC – Takeaways

- The program has been well-received and has a wait list of patients
- Patient feedback has included:
  - Increases in acceptance of a tinnitus diagnosis
  - A deeper understanding of the complexities of tinnitus and the auditory system
  - Diminished feelings of being marginalized by other medical providers

# TMC – Publications

## Papers:

Strategies for Managing Patients with Tinnitus: A Clinical Pathway Model.  
Seminars in Hearing – 2008

Tinnitus: Patients just do not have to live with it.  
Cleveland Clinic Journal of Medicine - 2011

## Posters:

Common Factors of Patients that attend a Multidisciplinary Tinnitus  
Management Clinic - CSM 2014

Characteristics of Patients with Somatic Tinnitus  
American Auditory Society – March 2017

- 70% of patients demonstrated somatic tinnitus. C/w Levine



# TMC – Post-visit

- Team discussion of each patient with screeners providing input / recommendations
- After-visit summary letter with recommendations mailed to patient
- Patient decision of how to move forward





# “Full” Neurology evaluation

- Positive screen from TMC screening
- Patients referred from “friendly” sources
- “Atypical” tinnitus
  - Unilateral, new-onset, no hearing loss
  - No clear anatomic pathology
- Presence of significant headache, facial pain and or dizziness / imbalance
- Somatic tinnitus (not all cases)



# Headache

Cervicogenic HA



# Dizzy

Cervically-mediated  
dizziness



# Tinnitus

Somatic Tinnitus



# My Physical Tools in the Office

- Stethoscope, ophthalmoscope, otoscope
- 256Hz tuning fork – High intensity hit – amplitude, change in weighting of various higher order harmonics?
- Safety pins
- Cotton swab
- Hand held massager

# Office Evaluation

- HPI
  - Evolution of symptoms: Dizzy / Imbalance, Headache, Tinnitus
  - Other otologic symptoms: hearing loss / fluctuation, distortion, pain
- Review of:
  - PMHx: previous dizziness / head trauma, headaches / migraine ?
  - FamHx: vestibular disorders, headache / migraine

## Examination

- Blood Pressure / Pulse
- General Medical
- Otologic exam
  - Tympanic membranes, Tuning fork (Weber / Rinne), Finger rub

# Office Evaluation (cont'd)

- Ophthalmologic exam:
  - Visual fields, pupil size / reactivity
  - Eye movements - Smooth pursuits (vs choppy), presence of nystagmus?  
(Ability to elicit dizziness – can sometimes indicate cervical spine activation)
- General Neurologic Exam
  - Mental Status
  - Motor / Sensory / Reflexes (MSRs)
  - Coordination
- Gait / Balance
  - Romberg / Sharpened Romberg (tandem-modified)
  - Base / Stance
  - Stability, pivots, arm swing
  - Usual gait, tandem (forward / reversed), Stress gait (heels / toes)
- Cervical spine exam

# Otoneurology: My Practice

- Diagnostic Tools:
  - History / Physical exam
  - Videonystagmography(VNG), calorics, rotational chair; VEMP
  - Audiometry
- Advanced-level neck and or jaw physical therapy (McKenzie and beyond). Other mechanical modalities may be helpful (Chiropractic care, Osteopathic manipulation, Medical massage)
- Medication options: (all off-label for tinnitus)
  - Various oral medications (gabapentin, duloxetine, amitriptyline...)
  - IV medications (headache infusion)
  - Occipital nerve blocks / trigger point injections
  - Botox (PREEMPT protocol for chronic migraine)



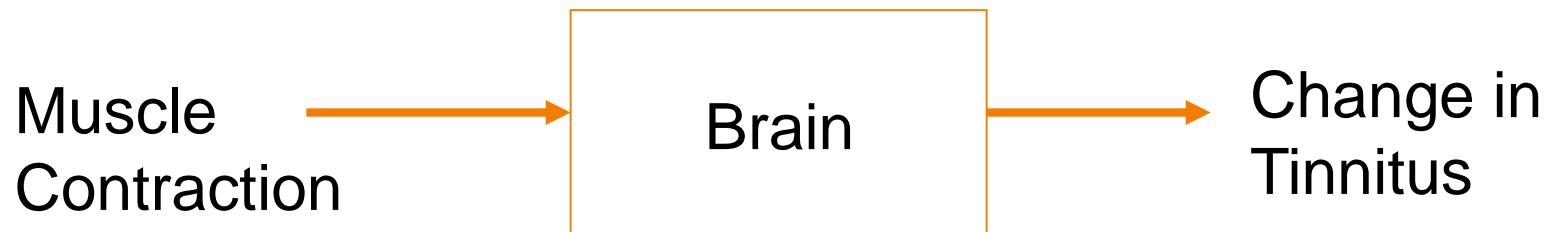
# Somatic Modulation of Tinnitus

- The ability to temporarily change (inc/dec) the loudness or pitch characteristics of tinnitus with neck and/or jaw contractions
- Possible Patterns
  - Chewing / eating-related
  - Activity / Posture-related
  - Temporal patterns of worsening (worse in the evening?)
  - Correlation with headaches and/or dizziness
- Described in the literature (Incompletely studied)
  - Bob Levine, MD, PhD (clinical, related research) – moved to Israel
  - Susan Shore, PhD (basic science) – U of M
  - Tanit Ganz Sanchez, MD, PhD (clinical, related research) – Brazil
  - Sara Michiels, PT, PhD – Belgium

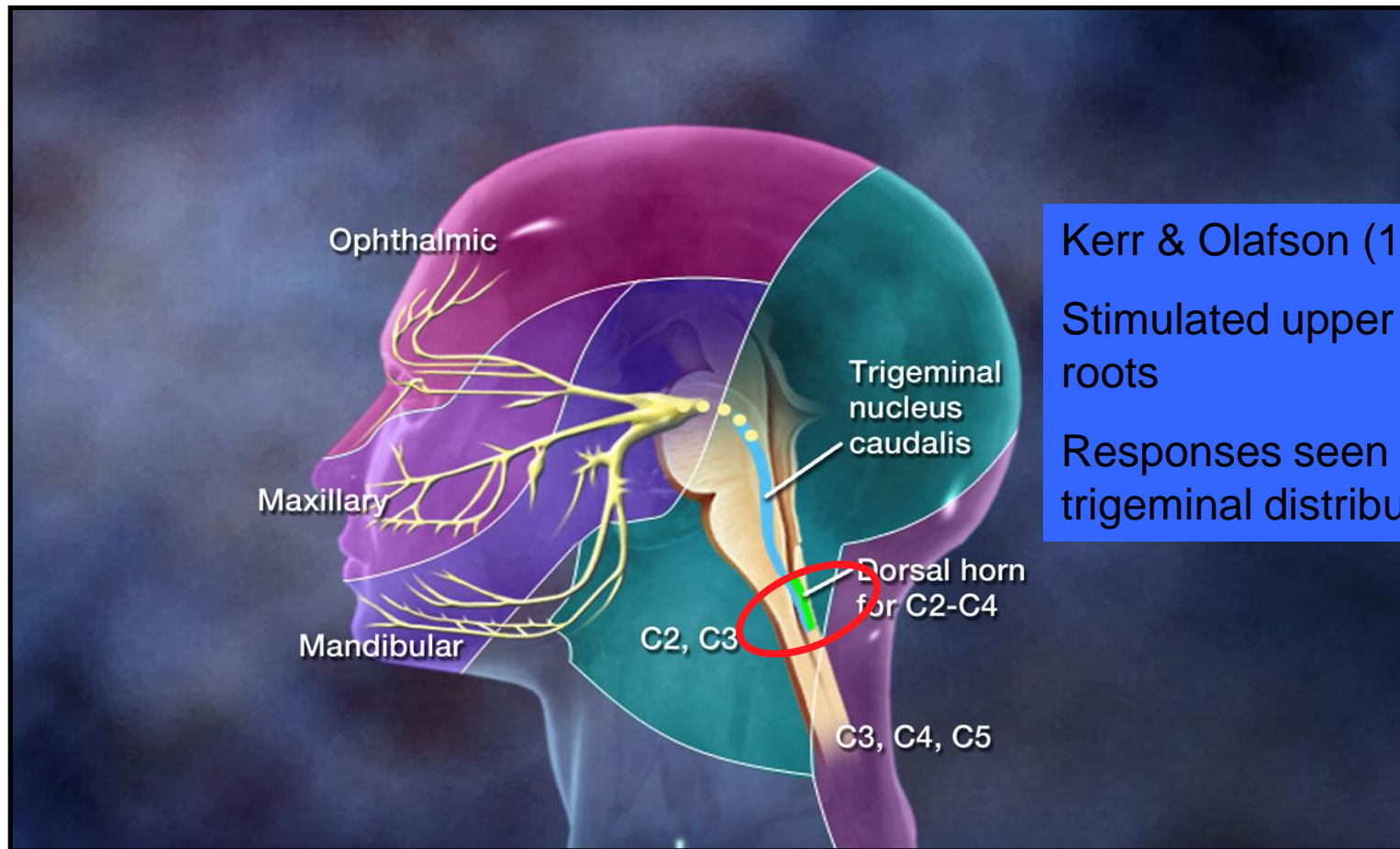
# What Questions does SMTz raise?

- Can/should everyone be able to modulate?
- What is the basis of modulability?
- Is there necessarily a disorder of the cervical spine or TMJ?
- Does the presence of SMTz predict treatability?

# Systems Engineering approach



# Trigeminal Nucleus Caudalis (Spinal Nucleus of the Trigeminal Nerve) / Trigeminothalamic Nucleus



Kerr & Olafson (1961):

Stimulated upper cervical roots

Responses seen in the trigeminal distribution

## Concepts to Consider

- Central sensitization (photophobia, phonophobia, osmophobia)
  - Related phenomena include allodynia to pinprick, windup
- Correlation
  - Temporal (calendar)
  - Temporal (episodic)
- Triangulation (method of anatomic localization)
  - Ipsilateral facial palsy, sensory deficit or hearing symptom?

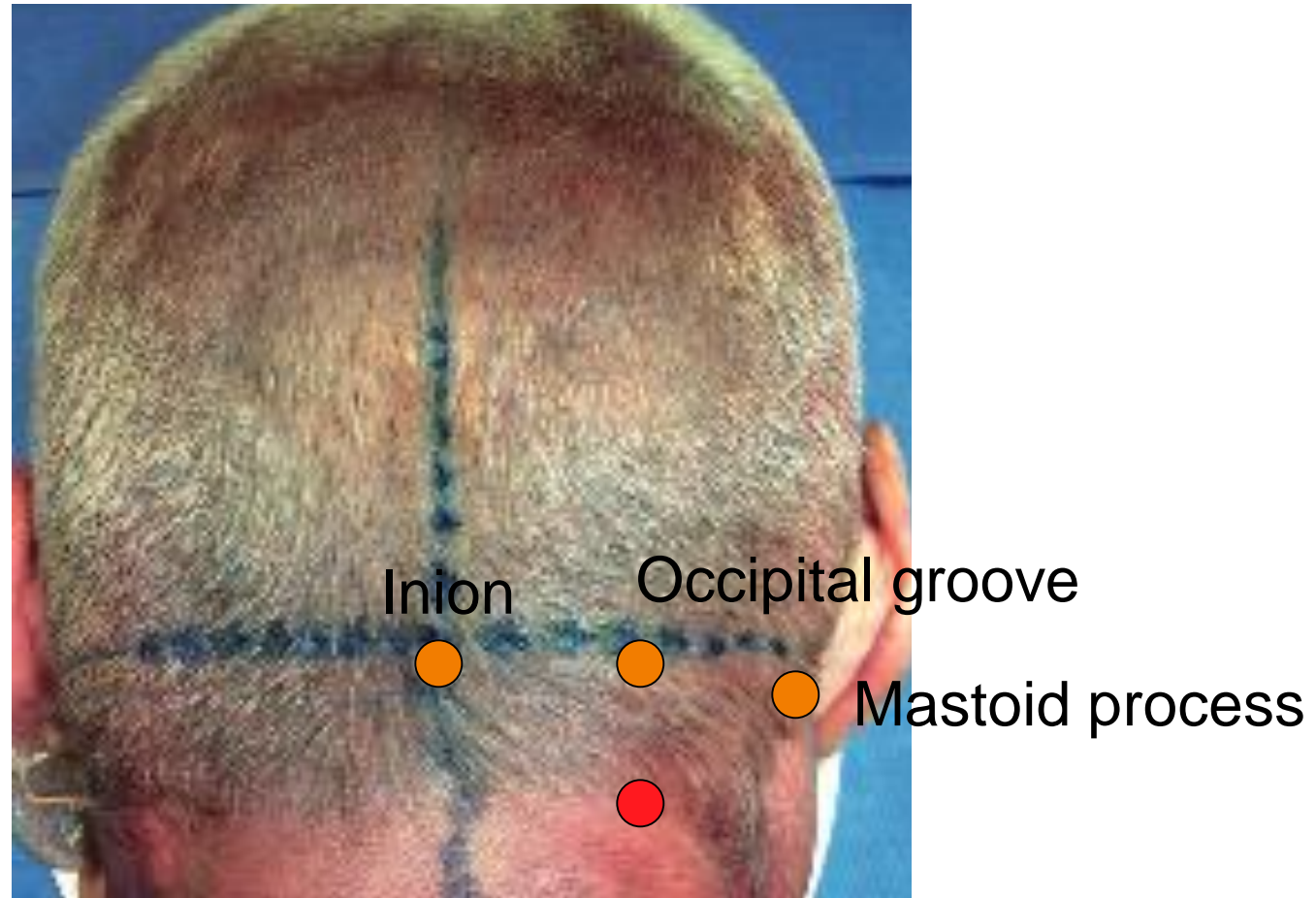
# Pearls

What can a normal medical evaluation miss?

(ENT, Gen medical, Neurology)

- Potential role of migraine / subclinical migraine (no headache)
- Subclinical ear hit (normal VTB, bias of interpretation?)
  - Similar to Hidden hearing loss?
  - Interictal BPPV with normal testing?
- Normal head imaging does not equal no neurologic problem
- The ear is really a nerve / neural process
  - Neuritic involvement of the ear?

# GON Injections



© Dash et al 2004

# Positive responses to Occipital Nerve Injection (published + anecdotal)

- Headache
- Dizziness
- Tinnitus
- Change in posterior vertex sensation
- Improvement in Cervical ROM
- Head pressure / head heaviness
- Change in energy
- Syncope (improvement or triggering)
- Jaw pain / tenderness
- Eye pain
- Diplopia (often monocular)
- Gaze-evoked symptoms:
  - Headache; Eye pain
  - Dizziness
  - Neck pain



# Role of Greater Occipital Nerve (GON) Trigger Point Injections

Baron / Cherian / Tepper - 2011

- Retrospective review of 147 consecutive patients who received GON injections for presumed cervicogenic symptoms (headache, dizziness, tinnitus...)
- Headache / Dizzy (Lightheadedness) symptoms often improved proportionally
- Subjective improvement in Cervical ROM

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Other studies in the literature regarding GON inj:

- Cluster headache / Basilar migraine / Migraine / Tinnitus

# Role of Greater Occipital Nerve (GON) Trigger Point Injections

## Tinnitus

- 33 patients w/ tinnitus
  - 6 w/ tinnitus as presenting complaint
- 10/33 (30%) - improvement following GON inj
- 7/10 responders - Reported a subjective improvement in cervical ROM
- 7/10 responders - Reported a reduction in headache intensity

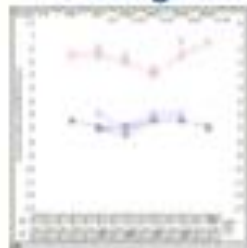
# Improvement in Hearing following GON injections

- Poster I presented at ARO 2008
- 53y/o F
- Clear history of left-sided Meniere's Disease
- Presented to me with left ear fullness and vague dizziness (not her previous vertigo)
- Change in symptoms during neck exam / resisted movements
- Left-sided GON inj performed – resolution of symptoms x 8 months
- Repeat GON w/ pre and post audiometry

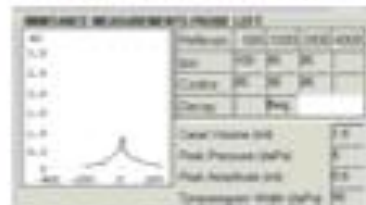
# Improvement in Hearing following GON injections

## Results

Baseline  
Audiogram:

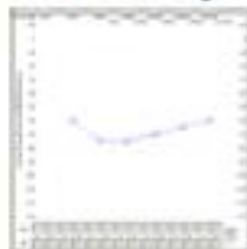


Baseline  
Tympanometry:

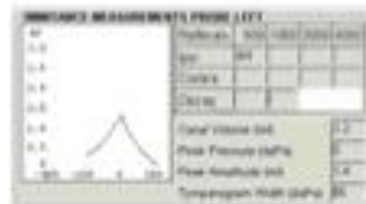


Speech Tests:  
PTA 68  
SRT 70  
WRS 0 %  
@ 80 dB HL

Post-Injection  
Audiometry:



Post-Injection  
Tympanometry:



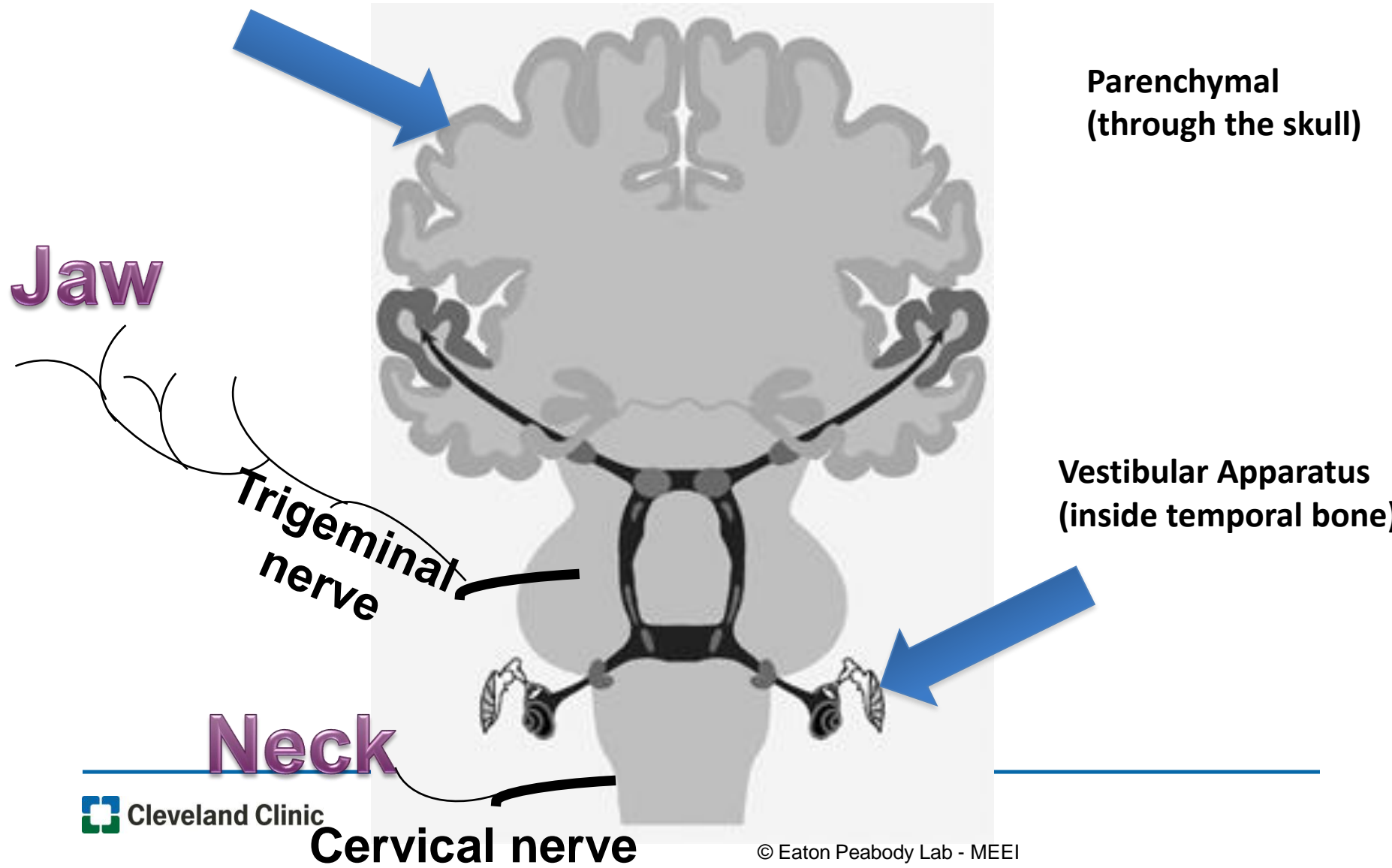
Speech Tests:  
PTA 73  
WRS 36%  
@ 80 dB HL

Patient's report: Significant improvement in left-sided hearing almost immediately following bilateral occipital nerve trigger point injections.

# Thank you!



## Force Transmission



# CROM Device

- 3D Goniometer
- Measures ROM (in degrees)
- Supine testing of FRT
- Magnets
  - Contraindicated w/ pacers

