

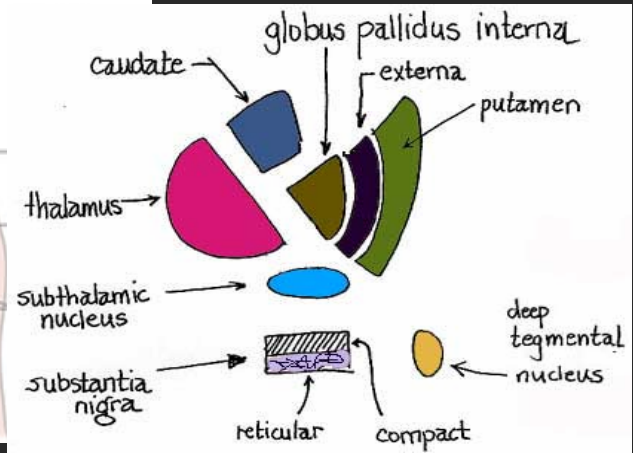
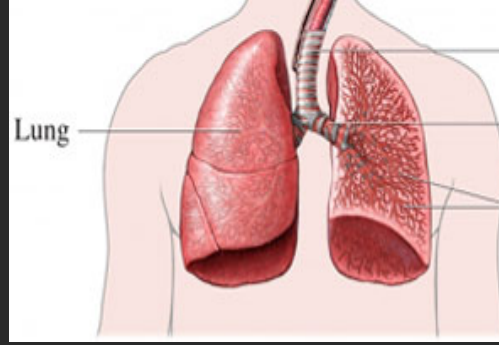
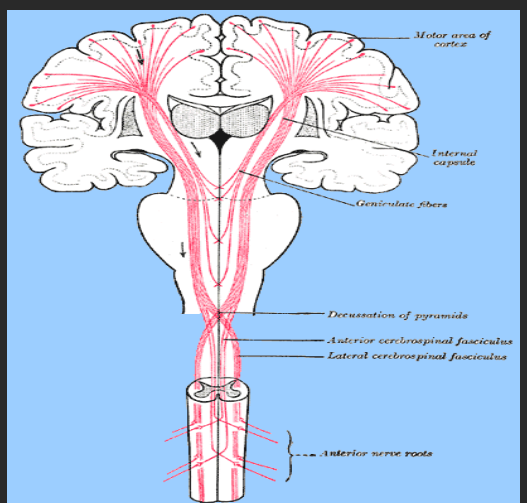
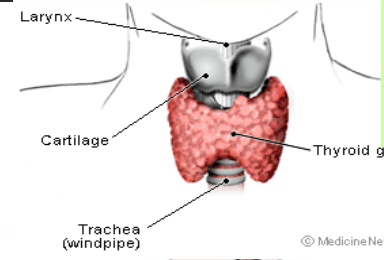
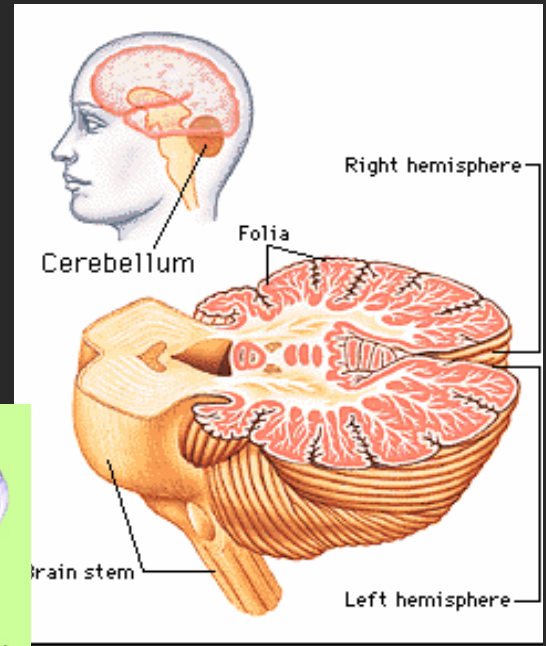
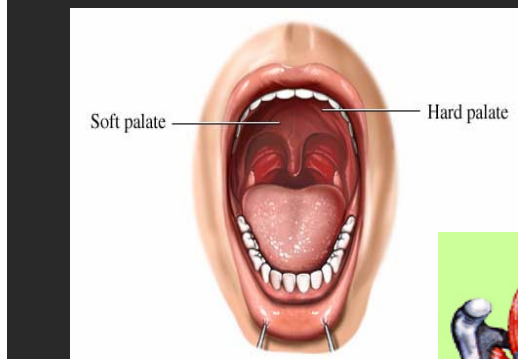
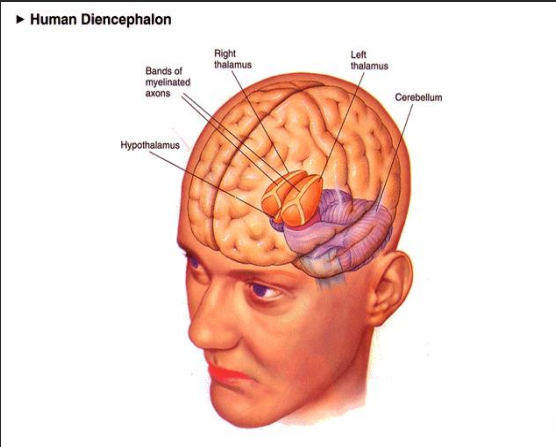


# ***Voice Therapy for Neuropathological Voices***

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# Phonation involves an interplay between.....



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***There is an integration, perfect timing and coordination between intellectual + physiological processes***

Cognition →	Language semantics + syntax + phonology
Motor Speech Programmer	Programmer + Planner selection + sequencing
Articulation → shaping of sounds	motor speech motor speech precision
Resonation → exhalation Supra-glottic + sub-glottic air flow	shapes acoustic signal via nasal + vocal + oral cavities
Phonation → vibration of vocal folds	voice + sound production
Respiration → juice!	sets air flow in motion + sets vocal folds into vibration

# *Neuropathological Voices*

Dysarthria = neuromotor speech/voice disorder

- Resonation
- Articulation
- Phonation
- Respiration

Dysphonia ≠ Dysarthria

- Non-neurologic voice problem (vocal nodules, etc.)

# *Dysarthrias with Dysphonias*

## Spastic → bilateral UMN

- Strained-strangled
- Hypernasality
- Regular, Slow rate

## Hypokinetic → BG circuits

- Monoloudness. Monopitch
- Reduced volume (< drive)
- +/- Co-existing Tremor

## Hyperkinetic → BG circuits

- Fast vs. slow movement
- Regular vs. irregular
- Phonation, Respiration

## Flaccid → LMN (Cranial + cervical nerves)

- Nasal resonance
- Breathiness, hoarseness
- Reduced loudness
- Diplophonia

## Ataxic → Cerebellar circuits

- Incoordination, timing issues
- Irregular bursts, silent periods

# *Dysarthrias also affect breathing*

## **Dyspnea: Neurologic effects → Respiration**

### **Spastic**

#### **Spastic Dyspnea**

Rigidity, slowness  
Central weakness

### **Hypokinetic**

#### **Hypokinetic Dyspnea**

↓ volume, ↓ initiation/drive

### **Hyperkinetic**

#### **Respiratory Dystonia**

Other Hyperkinetic Dyspneas  
Superimposed involuntary movements

### **Flaccid**

#### **Flaccid dyspnea**

Peripheral weakness

“flaccidity”

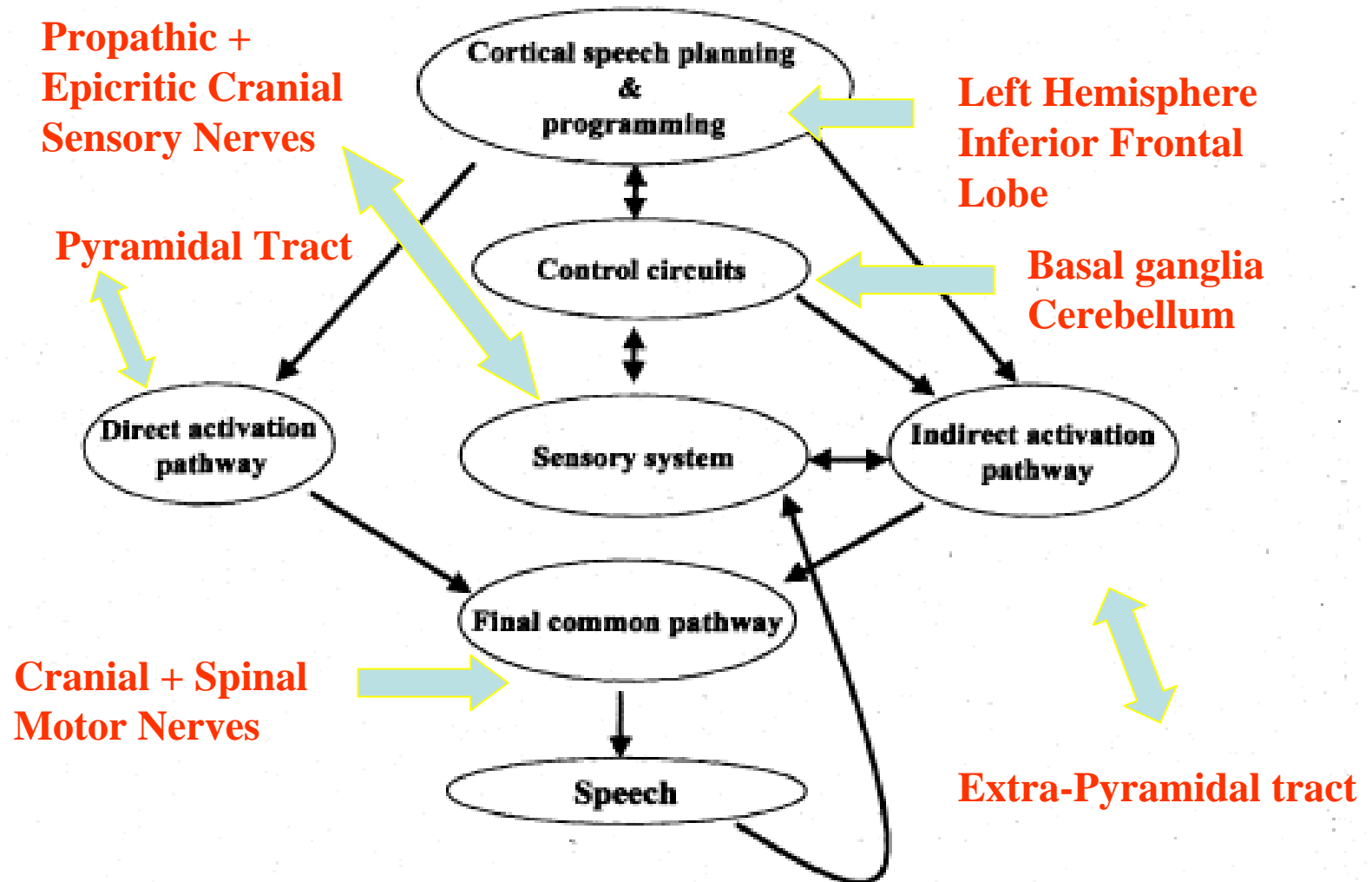
MG, ALS,  
VF paralysis

### **Ataxic**

#### **Ataxic dyspnea**

Incoordination/timing

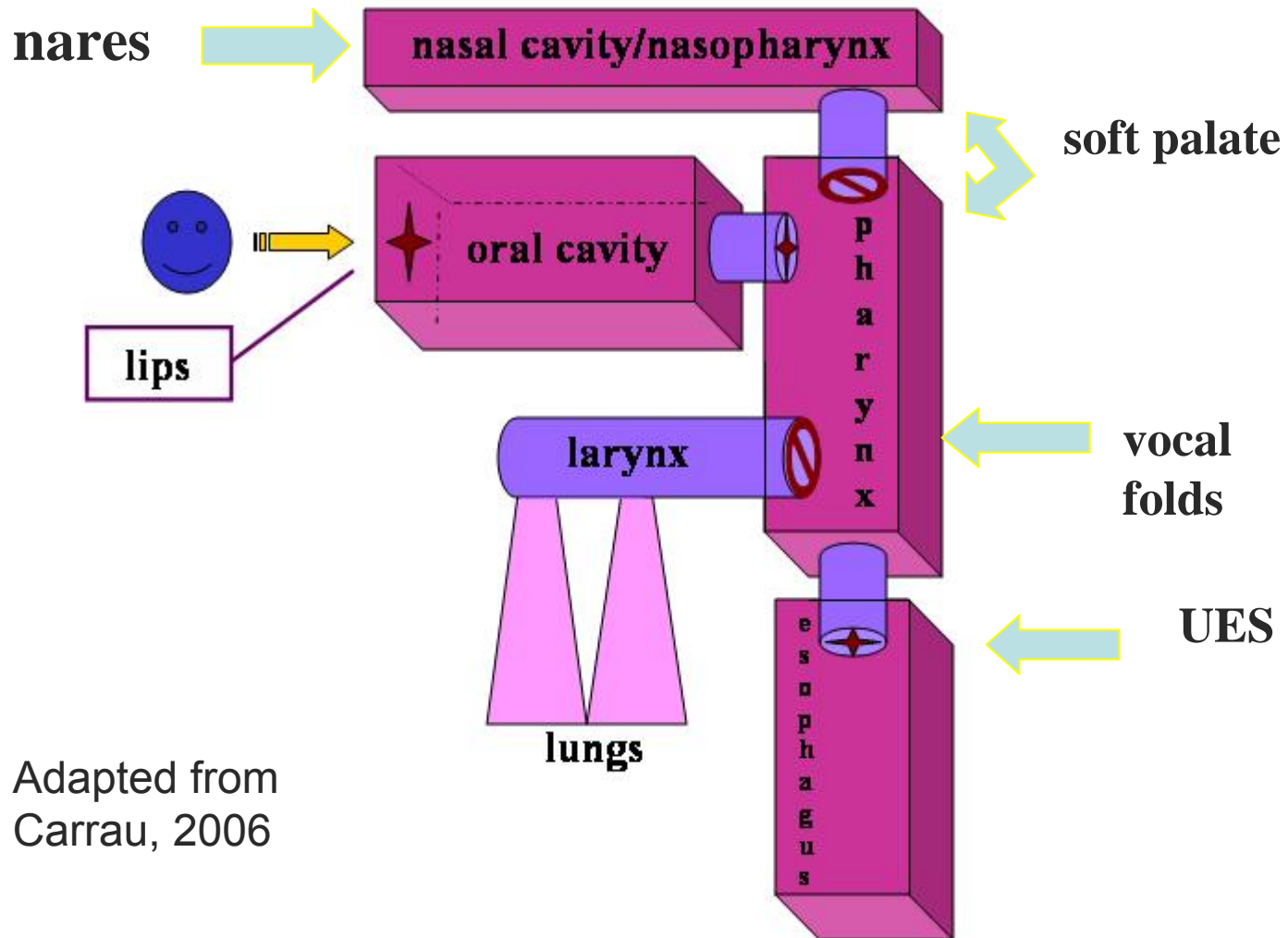
Respiration → Phonation



JRE 2-11 Relationships among the major divisions of the motor system, the sensory system, the motor speech program-

# The Final Common Pathway of Speech and Voice

A system of tubes + valves  
With Sensory + Motor networks



Adapted from  
Carrau, 2006



# *Therapeutic Pre-requisites*

## 1) Differential Diagnosis

- Multidisciplinary team approach
  - Medical assessments (ENT, Neurology, etc.)
  - Voice assessment (ENT, SLP-Vocologist)

## 2) Scope of Practice

- Preferred Practice Patterns

## 3) Amass Baseline Data

- Pre-Tx, Per-session, Post-Tx, Follow-up

# *Regarding Tx for Neuropathological Voices*

What are the beneficial effects of Tx?

What level of evidence is available?

Consider + Contribute to:

- Evidence Based Medicine (EBM)
- Evidence Based Practices (EBP)

## *Empirical Studies Reviewed for EBP + levels of Evidence*

Total # published studies	N = 55 (1996-2007) ~ 50 eliminated
Breakdown of Studies	69.0% Behavioral TX 16.3% Biofeedback TX 14.3% Instrumentation TX
Reasons for elimination	No SLP TX administered Medical- Surgical TX, Hypnosis, Acupuncture, Chiropractic, etc.

# Group Design

(Andrianopoulos, Whitmal, & Astin, 2007)

Criterion	Response	%	Number studies
Subject selection criteria	Inclusion	67%	33
	Inclusion exclusion	33%	16
Randomization	Yes	29%	14
	No	71%	35
Blinding	Yes	10%	15
	No	90%	44

# Conclusions

(Andrianopoulos, Whitmal & Astin, 2007)

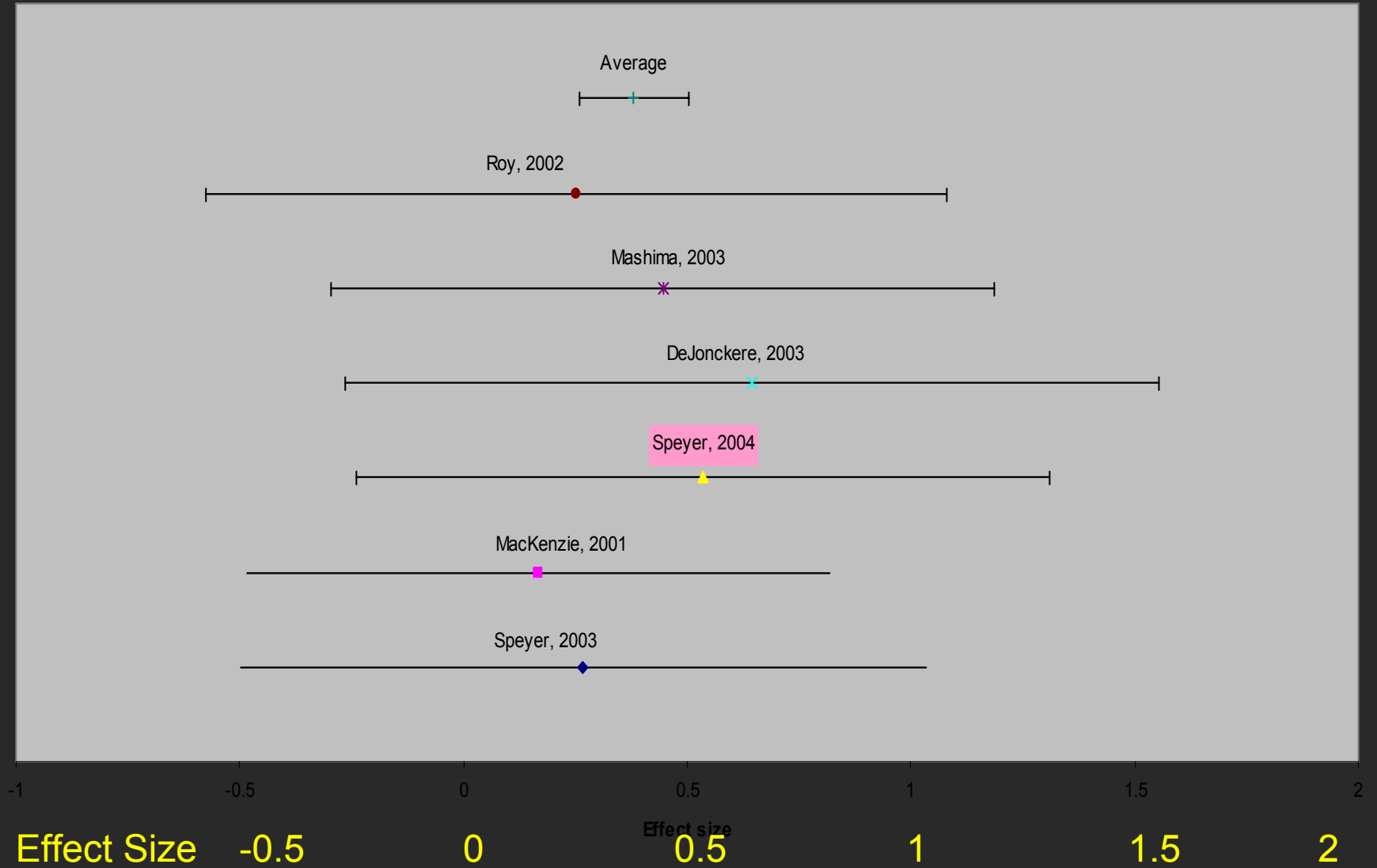
We found that:

- Prospective studies: 95% (52/55)
- Retrospective studies : 4% (2/55)
- 94% of studies reported change 2° TX
  - Pre-TX → Post-TX studies (94.5%)
- 62% of the studies were type Ib + IIa
- 71% reported statistical significance, yet
- 12% reported Effect size
- 6% reported Confidence Intervals
- 29% reported Reliability, 0% Validity

Effect Size	% Subjects in Control group below average subject in treated group.	% overlap	Chance of guessing group membership from a single score
0.0	50	100	50%
0.2	58	85	54%
0.4	66	73	58%
0.6	73	62	62%
0.8	79	53	66%
1.0	84	45	69%
1.2	88	38	73%
1.4	92	32	76%
1.6	95	27	79%
1.8	96	23	82%
2.0	98	19	84%

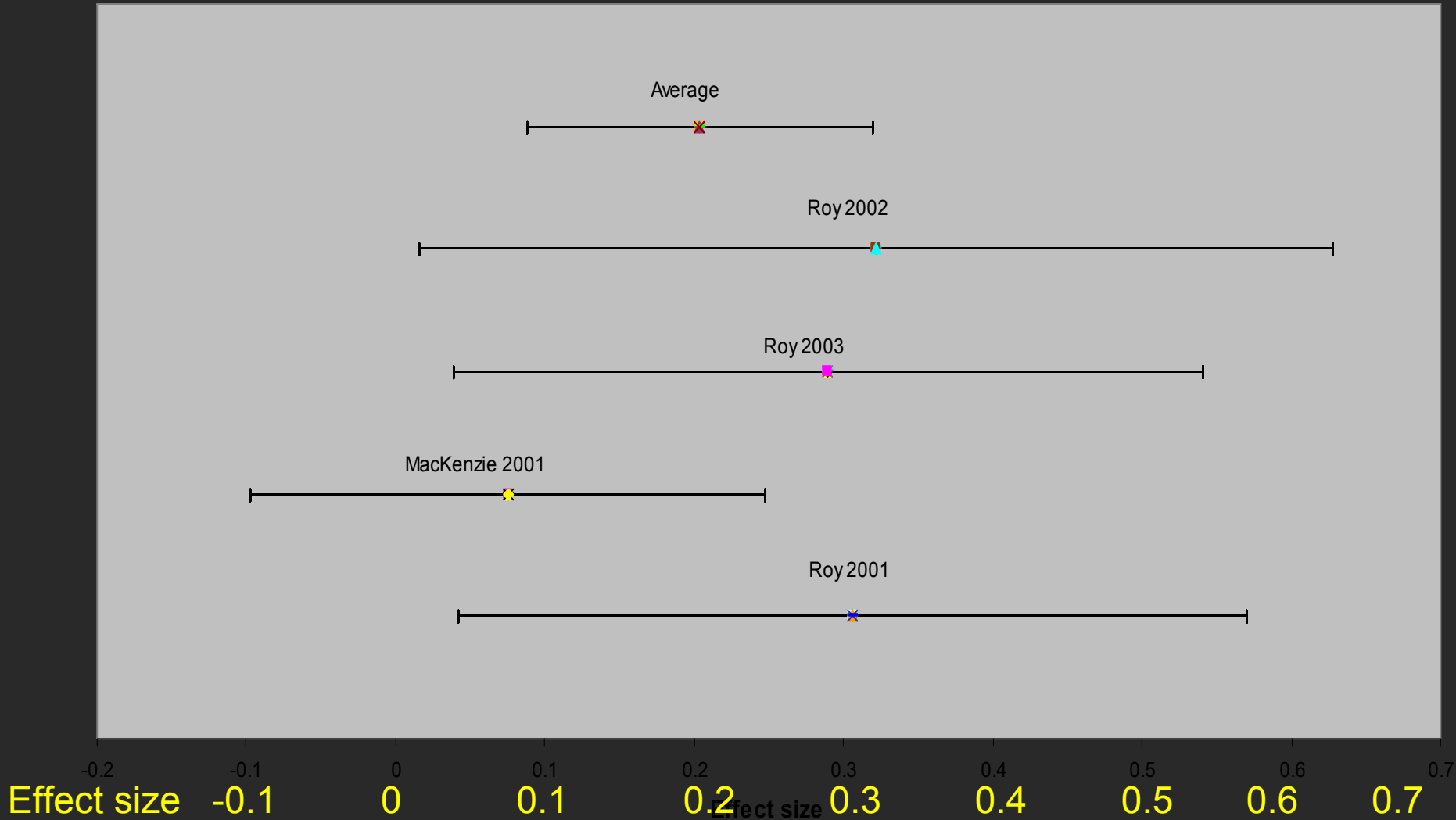
# Treatment Effects Acoustic Changes in Dysphonic Patients

Treatment effects on acoustic parameters in dysphonic subjects



# Effects of Voice Tx using Rating Scales of Dysphonic Patients

Effects of voice therapy on self-rating scales for dysphonic patients





# Conclusion...

Although a study demonstrates ***statistical significance***, it does not demonstrate ***practical significance*** unless it determines its Effect Size (ES).

So, a study can have statistical significance and may not be practically significant. An ES size of 1.0 has an overlap of 45%. The smaller the ES, the more overlap, the less difference between groups as a result of TX.

# General Principles

- Many patients with neuromuscular problems affecting phonation develop bad habits (valves + tubes)
- Many of these habits do not always go away once you repair lost function.

*(Wan-Fu Su; Yu-Che Hsiao; Chung-Ching Hung, 2007)*

# General Treatment Principles

## Objective:

- To Improve effectiveness, efficiency and naturalness of phonation for its intended purpose
  - Restore lost function
    - i.e., ENT surgery for VF paralysis, etc.
  - Compensate, pleasant as possible
  - Adjust with least effort as possible

# Neuropathologies with Hypophonia

Increase volume → louder

Greater prosodic range

Examples: LSVT (Ramig et al.)

- Parkinson's Disease
- Aging Effects: Presbylaryngeus
- Ataxia
- VF paralysis, Cerebral Palsy, Downs
- Swallowing

# Neuropathologies with Hyperphonia

Strained, harsh, tight →

Relaxation, alter pitch + intonation, stretch,  
flow, laryngeal massage

Examples:

- Spastic Dysarthria
- Rigidity

# Vagus Nerve Lesions

- Pharyngeal nerve → Soft palate
  - Hypernasality
  - Prosthetic Devices → LMN weakness
  - Possible for UMN weakness ? results

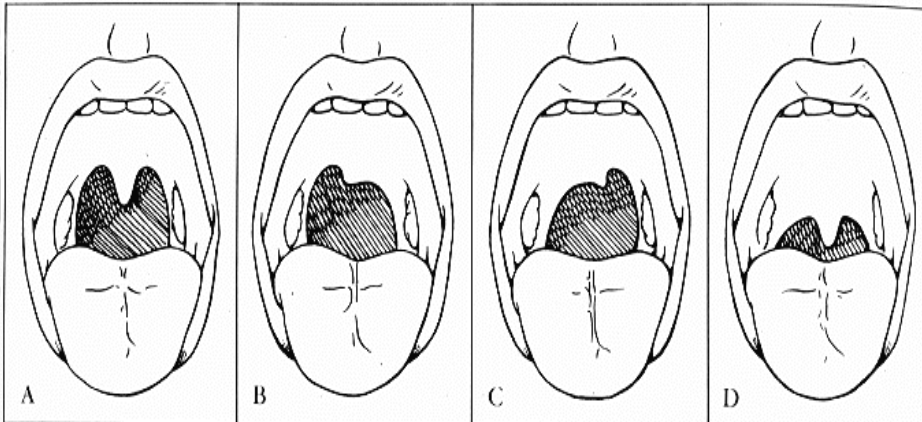
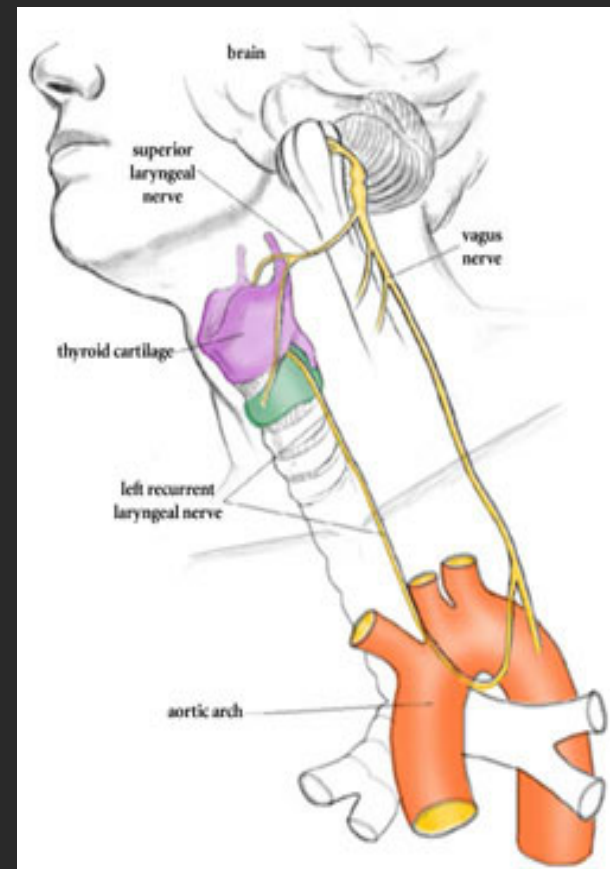


FIGURE 18-10 Tests of uvular deviation (cranial nerves IX and X). A. Normal. B. Left IX and X palsy. C. Right IX and X palsy. D. Bulbar palsy.



# Spasmodic Dysphonia

- SD → abnormal involuntary movements:
  - are action induced and task specific
- Movement during vocalization:
  - Involuntary co-contraction of muscles used to produce sound.
- Yet, patient has normal structure

# Patient Complaints, Other Symptoms

- **Spastic Dysarthria**
  - “Speech is slower, it tires me”
  - “My speech is nasal”
  - Swallowing difficulty
  - Drooling
  - Difficult to control laughter or crying (pseudobulbar affect)
  - Pathologic reflexes
  - Weakness
- **Spasmodic Dysphonia**
  - Negative impact on job, social life, and emotions
  - Vocal fatigue caused by increased effort in speech
  - Body motions or tenseness may be present secondary to spasms (AD type)
  - Frustration getting accurate DX



# Differential Diagnosis

## ADSD vs. MTD

Currently there are no definitive diagnostic criteria used to differentiate between these two very different voice disorders!

But, we are getting better:

(Andrianopoulos, 2008; Duffy, 2005; Roy, 2001)

# Differential Dx: MTD vs. ADSD

- **Phonatory air flow** (*Higgins et al., 1999*)
  - ADSD vs. MTD vs. Normals
  - ADSD > Phonatory airflow + Air Flow Perturbation
- **Task specific phonation** (*Roy et al., 2005; 2007*)
  - During speech + sustained vowel [ah]
  - Spastic Dysarthria → continuous speech, vowels
  - ADSDs > severity → connected speech vs. vowels
  - MTD → no difference, speech vs. vowels

# Compensation

## Use of residual function

- Modifications in rate + prosody
- Prosthetic devices to amplify voice/speech
- Reduce nasal airflow (palatal lift, CPAP)
- Pace rate of speech to increase precision
- Alternative means of communication
- Modify physical environment

# Factors that Influence Voice Treatment

- Stability of medical and neurological condition



# Factors that Influence Voice Treatment

- Do you defer voice treatment after surgery or the therapeutic effects of medications?



# Factors that Influence Voice Treatment PD; ALS, MS, other neuropathologies

- For degenerative cases,
- Stepwise management counseling
- Maintain intelligibility
- Counsel patients
- Prepare for AAC
- Quality of Life



# Individual considerations

- Major + Minor voice impairments have Major + Minor effects on the patient



# Focus of treatment

- Work on systems or components:
  - From which the greatest benefit will be derived rapidly
  - that will provide the greatest support for voice improvement
  - More Bang for your Buck!!
- For example: improve respiration
  - to improve loudness, voice + intelligibility
  - Lee Silverman Voice Treatment (LSVT→ PD)



# Management Approaches

- Prosthetic
  - Voice amplifiers
  - Palatal lift prosthesis/bite blocks
  - Pacing tools: metronomes, DAF, biofeedback
  - Augmentative + Alternative Communication

# Behavioral Management

Goal is to maximize communication

- **Speaker-oriented:**
  - improve voice, resonance, intelligibility
  - reduce impairment
- **Communication-oriented:**
  - environmental manipulations

# Use Principles of Motor Learning

- It is a process of acquiring the capability for producing skilled actions
  - (Schmidt, 1988; 1998, 2000)
  - (Clark, 2005; Duffy 2005, Robbins, 2007; Seminars in SLP, Nov. 2008)
- Sensori-Motor (vocal) learning is a result of:
  - Experience: Proprioceptive → learned
  - Practice (systematic, frequent, shorter sessions)
  - Feedback
  - Change

# Conditions of Practice

## 1. Prepractice

- Vocal Warm-up exercises

## 2. Repetitive practice

## 3. Mass vs. distributed practice

## 4. Low force → high velocity

## 5. Recovery period

muscle overload → strength → power → endurance

# Practice

- Consistent: repetitions on a single task
  - reduce the *df*
  - increases immediate learning of skill
  - facilitates speed + automaticity of response
- Variable practice:
  - range of related activities that target same objective and muscle groups
  - better retention + generalization
- Systematic routines + practice

# More on Feedback

- Instrumental feedback:
  - Biofeedback, Visual Feedback-strobe, EMG
  - Mirror, VU meter
- Quantity and quality of feedback
  - Knowledge of Results
  - Knowledge of Performance
  - Journal, data, regression/improvement

# Specificity of Training

- Important to match the contraction characteristics of the exercise to the desired movement outcome.
- You treat voice with voice specifically for
  - Communication
  - Singing
- Work with functional groups of muscles as treatment targets

# Are non-verbal oral motor speech and exercises beneficial for speech??

- For swallowing, there is evidence (some)
- For speech/voice, controversial for neuropathological dysarthrias + dysphonias
- Seminars in SLP (November 1988)



# Hypotonia: Increasing Strength

- Overloading muscle → increase strength
  - Low-resistance, high-repetition exercises\*\* voice
  - High-resistance, low-repetition exercises (swallowing)
- Isotonic exercises vs. Isometric exercises
  - Isometric → muscle stays the same length, but changes tension (Relaxation, massage)
  - Isotonic → muscle changes length, maintains the same tension (using voice with less effort, no MTD, good PTP → Resonant Voice TX)

# Voice Therapy Approaches

- **Direct** → Patient Oriented
  - improve voice, resonance, intelligibility
  - Increase loudness
    - LSVT-Ramig et al
    - Expiratory Muscle Strengthening (Sapienza, Murdoch, etc.)
- **Indirect** → Adjustments + Education
  - Use amplification

# Behavioral Treatment: Flaccid Dysarthria

## Unilateral Vocal Fold involvement

Objective: To improve vocal fold adduction and vibration without strain and muscle tension

- Inhalation Phonation
- Head turning to left or right (Casper + Colton)
- Lateral digital manipulation
- Vocal Function Exercises
- Glottal Gap Reduction Techniques (MTD)

# Treatment: Flaccid Dysarthria

## Soft palate weakness

Objective: To reduce nasal resonance for speech purposes

- Velopharynx:
  - Sensory, mechanical or electrical stimulation (?)
- Muscle strengthening:
  - Continuous Positive Airflow Pressure
  - (Kuehn, 1991; 1994; 2004)
- Feedback: nasometer
- Frontal Focus → tongue adjustments
- Palatal lift (prosthetic, best candidates)

# Treatment: Spastic Dysarthria

- Avoid exercises that increase hypertonicity
- LSVT
  - (1 patient with Hypokinetic Spastic, Solomon, 2004)
- Be cautious of Treatments that increase weakness →
  - Team Decision → Botox in Spastic Dysarthria to decrease rigidity → aspiration + dysphagia

# Treatment: Hypokinetic Dysarthria

- **Surgical Treatments:**
  - thalamotomy, pallidotomy, deep brain stimulation.
- **Pharmacotherapy (L-Dopa, Clonazepam)**
- **Behavioral Tx:**
  - LSVT (Greatest empirical significance, 20 studies)
    - ( Ramig et al.1993-2006)
  - Volume lip/jaw stability (Kleinow, 2001)
  - For rate: pacing boards, metronome → pacing
  - For volume: intensity monitors
    - feedback devices, amplification, postural adjustments (Laukkanen, 2004)

# Treatment: Hyperkinetic Dysarthria

- Spasmodic Dysphonia
  - Medical Management → Botox Injection
  - Voice Monitoring →
    - Behavioral Tx alone contraindicated
    - Pre-op + Post-op monitoring
- Palatal pharyngeal myoclonus
  - Pharmacological + medical Tx (some positive results)
  - Behavioral Symptomatic Tx → poor carry over
- Behavioral Tx:
  - bite-block or pipe → mandibular dystonia/dyskinesia
  - Compensatory Techniques (efficacy?)
- Tremor: (?)

# Treatment: Ataxic Dysarthria

- Behavioral Tx:
  - Metronome pacing w/ speech, singing
    - (Pilon et al., 1998)
  - Metered pacing
    - (Yorkston et al., 1990)
  - LSVT on a case study with ataxic dysarthric
    - (Sapir, 2004)