Rate of Production of Individual Phonemes of the Diadochokinetic Rate in PwMS With and Without Complaints of Speech Production or Swallowing Difficulty

Lori Ann Kostich M.S. CCC-SLP, MSCS

Mount Sinai Rehabilitation Hospital
Hartford, Connecticut

Mandell Center for Multiple Sclerosis Treatment and Research
Hartford, Connecticut

Disclosures

For the purposes of this presentation:

I am a paid employee of Mount Sinai Rehabilitation Hospital

– I have a personal connection with the National MS Society, my spouse is the Director of Corporate Grants

Background:

Patients with MS present for SLP evaluation

- Complaints of difficulty with speech production
  - "Tripping over words" or "Words come out slurred"
- Complaints of difficulty swallowing
  - "Goes down the wrong pipe" or "Swallow gets stuck"

Because of the variability of the disease process these symptoms are often not evident on the day of the evaluation

It was noticed that patients with reports of difficulty with speech production or swallowing appeared to complete repetitive motor speech tasks at a slower rate

- even though there was no perceptual impairment in their speech production at the evaluation

Trinity Health | Saint Francis Hospital and Medical Center | Mount Sinai Rehabilitation Hospital

- **Diadochokinetic rate** is measured by asking the patient say the sounds /p/,/t/ and /k/

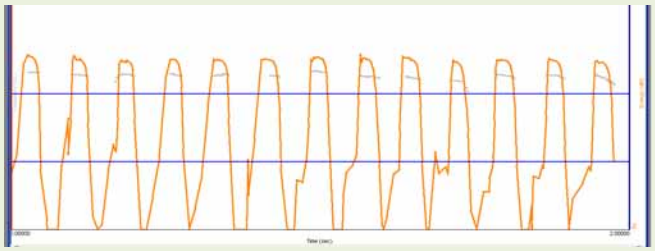
- Repeated individually as fast as they can - "pa, pa, pa, pa, pa"
  - "Normal Rate" /p/ and /t/ is considered to be 6-7 productions /second
  - "Normal Rate" /k/ is considered to be 5 productions / second

- Usually this is measured by listening and timing productions with a stopwatch.

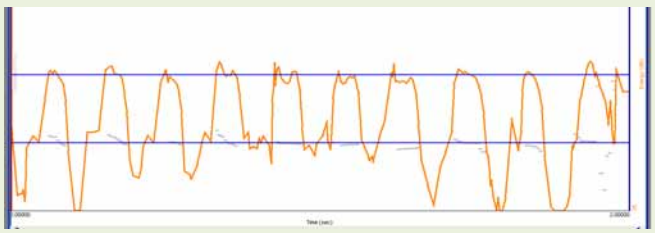
- I have a Visi-Pitch – a computer which will give visual representation of the production

Observation:

Objective measurement appeared to show a difference in rate of production of individual phonemes in the diadochokinetic rate



/k/ 6.5 per second



/k/ 5.0 per second

Limited Literature:

- Visi Pitch IV Manual (p.272) – "Dr. Daniel Boone…described a technique…"
  - "normal speakers produce /p/ and /t/ 6-7 productions per second"
  - "normal" /k/ 5-6 productions per second
- Consistent with Kent, Kent, & Rosenbeck (1987).
- Prevalence of dysphagia three times greater for those patients with score of 3 or greater brainstem functional system (Calgano et al, 2002)
- There is a decline in tongue strength which coincides with a decline in intelligibility. (Stierwalt et al, 2007. Convention Handouts)

Goal:

- ***In order improve the quality of patient care…***
- determine if pwMS who report difficulty with speech production or difficulty with swallowing produce the individual phonemes of the diadochokinetic rate slower than those pwMS who do not have those complaints.

Method:

- One year medical record review of 232 consecutive evaluations
- 161 included objective measurement of the repetitive rates of each of the individual phonemes of the diadochokinetic rate .
  - Visi-Pitch IV model 3950B, manufactured by KayPentax and the SM48 – LC Unidirectional Vocal Microphone manufactured by Shure
  - Real Time Pitch Module / Diadochokinetic Rate Protocol
- Data were organized into 4 groups
  - Report of no difficulty with speech production
  - Report of difficulty with speech production
  - Report of no difficulty swallowing
  - Report of difficulty swallowing
- 4.5 phonemes per second was set as the cut-off
- 5.0 phonemes per second is the lowest rate within the "typical" range for an adult.
- Percentages of the patients that produced the phonemes at or greater than the 4.5 per second cut-off were then calculated for all four groups for comparison.

Results: Speech Production (n=160)

Produce phoneme at 4.5 or greater per second

Phoneme	No Difficulty with Speech Production (n=102)	Difficulty with Speech Production (n=58)	Significance*
/p/	91.18%	65.52%	p<.0001
/t/	90.2%	70.69%	p=.0015
/k/	73.53%	41.38%	p<.0001

*chi-square analysis

Trinity Health | Saint Francis Hospital and Medical Center | Mount Sinai Rehabilitation Hospital

Results: Swallow (n=161)

Can produce phoneme at 4.5 or greater per second

Phoneme	No Difficulty with Swallow (n=97)	Difficulty with Swallow (n=64)	Significance*
/p/	85.57%	75.0%	p=0.092
/t/	86.60%	48.44%	p<.0001
/k/	73.20%	45.31%	p=0.0004

*chi- square analysis

Trinity Health | Saint Francis Hospital and Medical Center | Mount Sinai Rehabilitation Hospital

Conclusions:

1. PwMS who report difficulty with swallowing:
   - produce the phoneme labial /p/ slower than pwMS who have no complaints of difficulty swallowing (near significance).
   - lingual phonemes /t/ and /k/ at a significantly slower rate than pwMS reporting no difficulty swallowing.

2. PwMS who report difficulty with speech production:
   - produce labial phoneme /p/ and lingual phonemes /t/ and /k/ all at a significantly slower rate than pwMS without report of difficulty with speech production.

Trinity Health | Saint Francis Hospital and Medical Center | Mount Sinai Rehabilitation Hospital

Limitations:

- Single investigator reviewing evaluations completed by the single investigator.
- Single investigator was motivated.

- **However:**
- Training in oral motor/breathing exercises reduces patient reported difficulty with speech production and swallowing.
  - Masako maneuver (tongue hold)
  - Lingual coordination exercises
  - Shaker (chin lift)
  - Tongue Press/Swallow
  - Repeated effortful swallow
  - Breath/ speech coordination exercises
  - Loudness training.

Trinity Health | Saint Francis Hospital and Medical Center | Mount Sinai Rehabilitation Hospital

- ***Thank you***
  - Dorothy Wakefield
  - Alexa Detynecki M.S. CCC- SLP

References

- Calcagno, R., Grasso, M., DeVincentiis, M., and Paolucci, S. (2002). Dysphagia in multiple sclerosis-prevalence and prognostic factors. *Acta Neurol Scand, 2002,* 40-43.
- Kent. R. D., Kent, J. F., & Rosenbek, J. C. (1987). Maximum Performance tests of speech production. *Journal of Speech and Hearing Disorders, 52,* 367-387.
- Stierwalt, J., Hancock, A., Lapointe, L., Apel, L., and Maitland, C., (2007). A longitudinal analysis of tongue function: Parkinson disease and multiple sclerosis. ASHA Convention Handouts 2007.
- Visi Pitch Instruction Manual: KayPENTAX, (2009).