

Using Ultrasound to Treat Vowel Disorders: A Single Case Study

Most children acquiring English will have developed their vowel system by age three. However, vowel acquisition can be problematic for some children leading to vowel error patterns, such as lowering and fronting. This can result in a perceptual collapse in vowel contrast; context sensitive processes where surrounding consonants influence the vowel; and more unusual idiosyncratic systems (Reynolds, 2013; Bates, Watson, & Scobbie, 2013). Speake, Stackhouse, and Pascoe (2012) provide encouragement that vowel-focused therapy can increase vowel inventory and accuracy of production.

Ultrasound Visual Bio-Feedback (U-VBF) Therapy has become increasingly popular for the remediation of persistent speech sound disorders (SSDs), however there are few studies investigating the use of U-VBF therapy for the remediation of vowel disorders. Current evidence for the remediation of vowels is within the hearing impairment population, showing limited evidence of improvement (Wein et al., 1991; Bacsfalvi et al., 2007).

This single case study uses a single-subject multiple baseline design with Michael (pseudonym), a Scottish male aged 6;5 years. Michael presents with a vowel disorder, whereby he collapses /ɪ ɛ a ɑ/ into [a]. The target of therapy was /ɛ/. Our research questions were:

1. Does a course of ultrasound visual biofeedback treatment improve accuracy of /ɛ/ in
 - a. Words/pseudo-words and phrases trained during the therapy (treated word lists)?
 - b. Words/pseudo-words and phrases not trained during the therapy (untreated wordlists)?
2. Are listeners able to perceive a difference in the production of /ɛ/ pre- and post-therapy tokens, identified through
 - a. Phonetic transcriptions by phonetically trained listeners?
 - b. Perceptual evaluation of lay listeners?

Repeated measures of the Phonology subtest of the Diagnostic Evaluation of Articulation and Phonology (DEAP) (Dodd et al, 2002) and an untreated wordlist containing 81 tokens of /ɪ ɛ a ɑ/ were recorded across three baseline assessments. Michael received 10 therapy sessions using ultrasound visual biofeedback (U-VBF) targeting /ɛ/. Therapy was based on the principles of motor-based learning. Assessments were repeated mid-therapy and will be repeated post therapy and at a maintenance session three months post-therapy to test for generalisation.

Ultrasound data was acquired using an Ultrasonix® SonixRP machine remotely controlled via Ethernet from a PC running Articulate Assistant Advanced™ (AAA) software (Articulate Instruments 2010). A probe stabilising headset was used, to allow comparison across sessions. A headset-mounted micro-camera was also used to capture lip data. A headset-mounted microphone was used to record audio data.

Therapy is currently on-going. We will present a fine phonetic analysis of Michael's vowel system including perceptual and instrumental findings. Outcome measures are based on auditory judgements by trained and untrained listeners (phonetic transcription and perceptual evaluation of pre- and post-therapy measures), acoustic analysis (formant analysis) and articulatory data (tongue surface shape analysis).

References

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