Ultrax2020: Using Ultrasound Technology in the Assessment and Treatment of Speech Disorders

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Speech sound disorders (SSD) are the most common childhood communication impairment, affecting approximately 8% of children worldwide. Children with SSD have a difficulty producing clear speech, making them difficult to understand and potentially leading to miscommunication and frustration. These children are at a high risk of bullying, literacy difficulties, and poor academic achievement. It is thus imperative that children receive effective treatment to mitigate these negative outcomes. Effective treatment is reliant on an accurate assessment and diagnosis of the child's speech errors. Current assessment methods rely on the auditory skills of the assessing speech and language therapist (SLT) to perceive and correctly identify speech errors. This is problematic, as perception-based assessment and transcription of disordered speech is unreliable and at times inaccurate. Further, children with persistent SSDs may have covert speech errors that can only be identified with instrumental techniques. Incorrect transcription and identification of these errors can result in misdiagnosis, which has severe implications for the effectiveness of treatment and each child's outcomes. One solution to overcoming these barriers is to use ultrasound imaging as an objective assessment measure of children's speech. A growing body of research has provided evidence for the effectiveness of using ultrasound imaging of the tongue for accurate assessment of children's speech, leading to appropriate treatment decision-making and efficient therapy. However, as the technology currently stands, such analysis is time-consuming (and often only able to be completed using specialist software in a university lab) and thus impractical for clinical use. The Ultrax2020 project aims to overcome these barriers by employing novel computational methods to develop an ultrasound-based diagnostic assessment for identifying and categorising speech errors in children with SSD. Over the three-year project, SLTs working across Scotland will assess the speech of 120 children aged 5 to 18 with SSD. Where appropriate, these children will also receive treatment from their NHS SLT using ultrasound visual biofeedback. The efficacy of using ultrasound as a form of visual biofeedback in intervention for persistent and residual SSD in tightly-controlled contexts is well established, but to date no research has explored its effectiveness in everyday clinical contexts. Data collected from assessment and intervention sessions will be sent to the research team for detailed analysis, including phonetic transcription, and qualitative and quantitative ultrasound measures. Changes to the ultrasound software will be made throughout the project to further improve the accuracy of on-line analysis completed by SLTs in the clinic. Additionally, the effectiveness of ultrasound visual biofeedback in the assessment and treatment of SSD will be investigated, to provide preliminary information for large-scale clinical trials in the future. The overall aim of the Ultrax2020 project is to develop and improve ultrasound as a powerful tool for the accurate and differential diagnosis of childhood SSD. By doing this, speech therapy can be optimised to suit each individual child, leading to more efficient outcomes for children with SSD.

Presented at: Sugden, E. (2018). Ultrax2020: Using Ultrasound Technology in the Assessment and Treatment of Speech Disorders. Abstract from the Strathwide Conference, Glasgow, UK.

Ultrax2020 is an EPSRC-funded project (number EP/P02338X/1) awarded to Professor S. Renals, Dr J. Cleland, and Dr K. Richmond.