Diagnosing Speech Errors in Children with Autism using Ultrasound

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Background

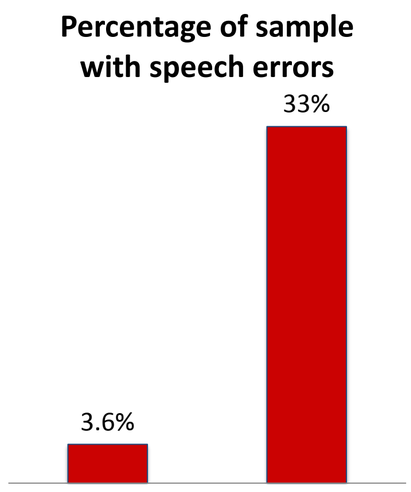
- Speech errors are **significantly** more common in children with autism than those without (Wren et al., 2016, Cleland et al., 2010; Shirberg et al., 2001).
- The cause is not well understood.

Speech requires the intricate control of the tongue.

- Significant evidence that children with autism have movement difficulties, in particular fine movement (hands, fingers, toes etc.) (Fournier et al., 2010)
- Relationship between fine movement of tongue and other parts of body relatively unexplored.

Partly due to the difficulty in measuring speech movements

- The tongue, is largely hidden from view during speech.
- **Ultrasound Tongue Imaging** measures movement of the tongue and compares the *type* of movements (e.g. jerky, smooth) (Cleland et al., 2016).
- The proposed study will use ultrasound to compare tongue movements made by children with autism with typically developing children.



Research Questions

Do children with autism produce inaccurate speech movements that echo those in fine motor skills?

Are clinical speech assessments effectively identifying speech errors in autism?

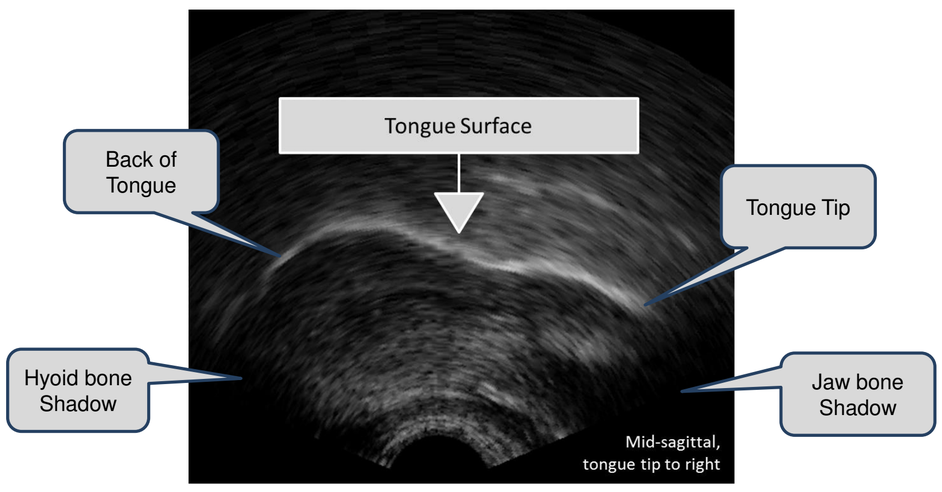
Figure 1: Ultrasound probe and head set

Method

Children will undergo assessments of speech, associated difficulties (e.g. language, non-verbal ability) and movement (general and fine movement). Speech will be measured using perceptual assessment and instrumental analysis (ultrasound tongue imaging).

Participants	20 children with autism 20 controls
Age	6-12 years
Inclusion Criteria	No evidence of hearing difficulty, major learning disability or major physical disability

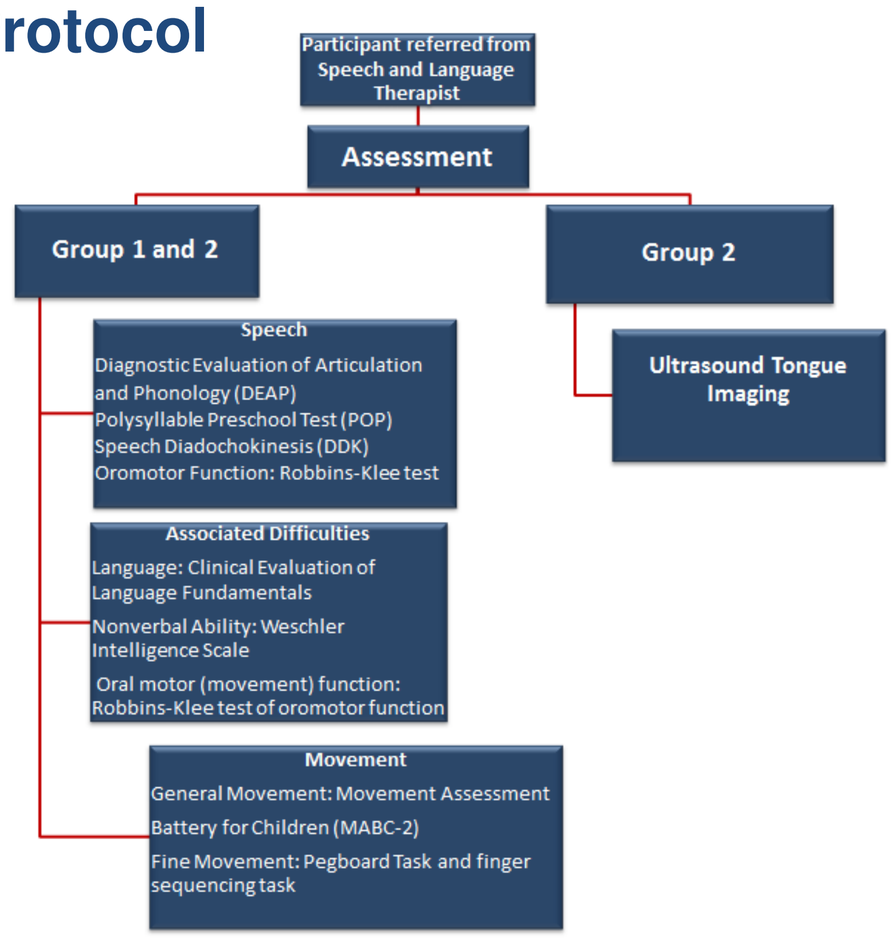
Figure 2: Typical Ultrasound Image showing the Surface of the Tongue



Ultrasound

- Ultrasound Tongue Imaging allows the investigation of tongue movement.
- The ultrasound probe is placed under the child's chin and stabilised using a headset (Figure 1).
- Ultrasonic waves are sent into the mouth and reflected back when they reach the air above the tongue surface.
- The ultrasound image produced is from *mid- sagittal view* (Figure 2)

Protocol



Analysis

All assessments detailed in the protocol will be scored. Results will be used to make within-group and between-group comparisons.

Ultrasound Analysis is carried out on Advanced Articulate Assistant Software (AAA; Articulate Instruments Ltd, 2012; Figure 3) . This software allows automatic tracking of tongue movement to reveal the mathematical attributes of the tongue shape to gain information about the trajectory of the tongue. This is done by plotting points of the tongue surface onto a graph as x-y coordinate (Figure 4).

Figure 3: AAA Analysis

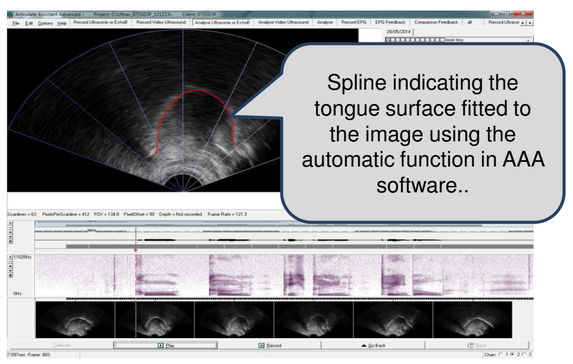
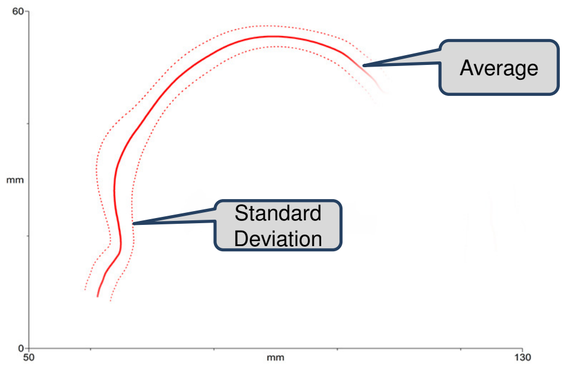


Figure 4: Example of Graph of Average Tongue Curves



Conclusion

- Higher rates of speech errors and their relationship to fine movement difficulties is still relatively unexplored in autism.
- This methodology using ultrasound tongue imaging will produce new information about otherwise unseeable movements of the tongue and types of speech errors produced by children with autism.
- Answering some of these questions will increase our understanding of the difficulties faced by people with autism.
- It will also impact the type of speech therapies some children with autism will receive to help improve their speech intelligibility.

References

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