

Ultrasound Visual Biofeedback in Intervention for Speech Sound Disorders: A Systematic Review of the Evidence

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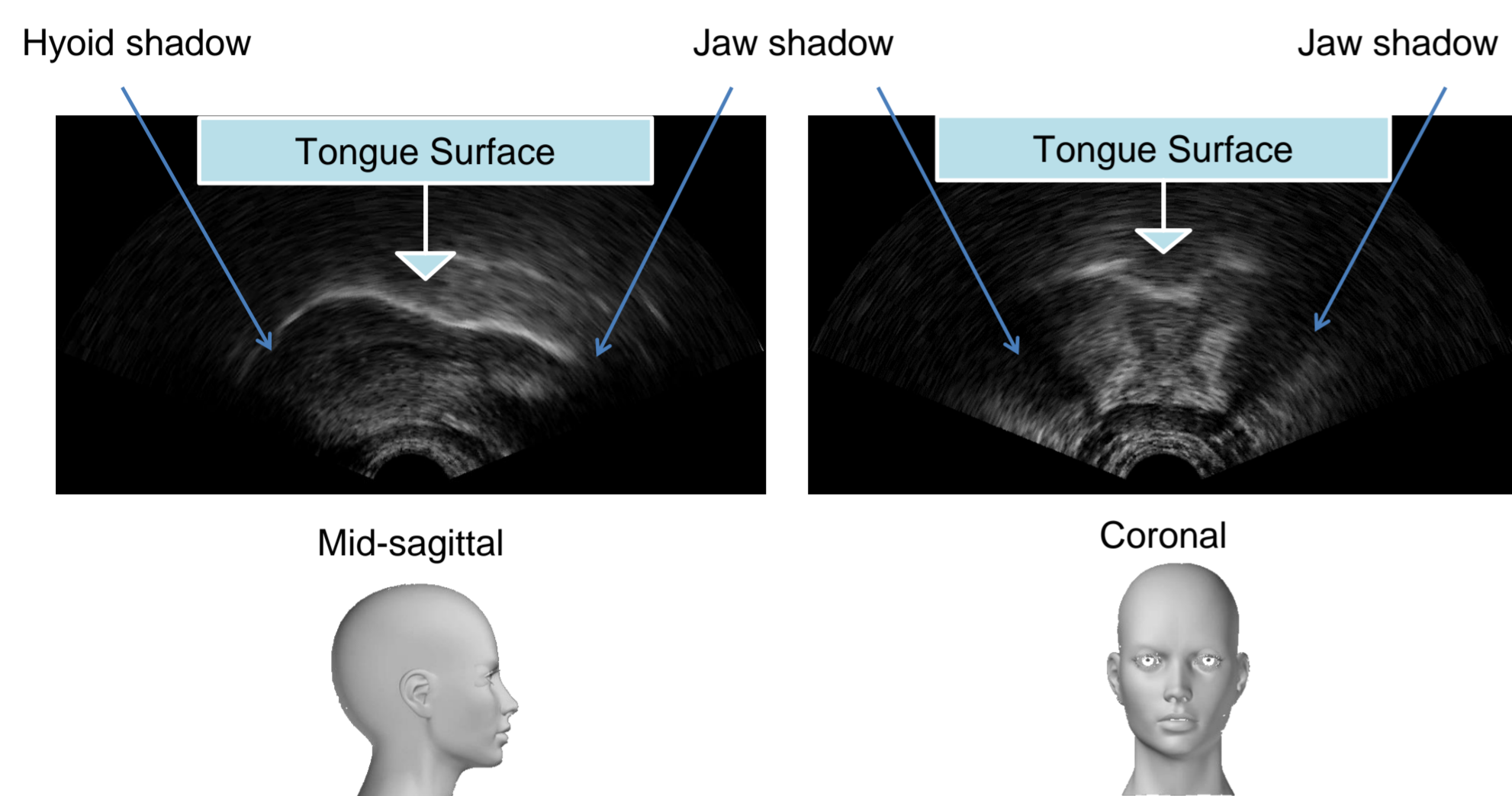
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Speech sound disorders (SSDs) are the most common childhood communication disorder, with prevalence rates of between 2.3% and 24.6%¹.

Treatment typically relies on providing predominately auditory information², but this can be difficult for children as the articulators are largely invisible during speech. Visual biofeedback may hold the answers.

Ultrasound Visual Biofeedback



The image can be used in intervention to provide cues and feedback on the movement/position of the tongue.

Decreases in costs and increases in portability have led to a growing clinical and research interest in U-VBF.

Interpretation of the research is challenging due to diversity in study design, populations, clinical methods, and outcomes. A systematic review is therefore needed.

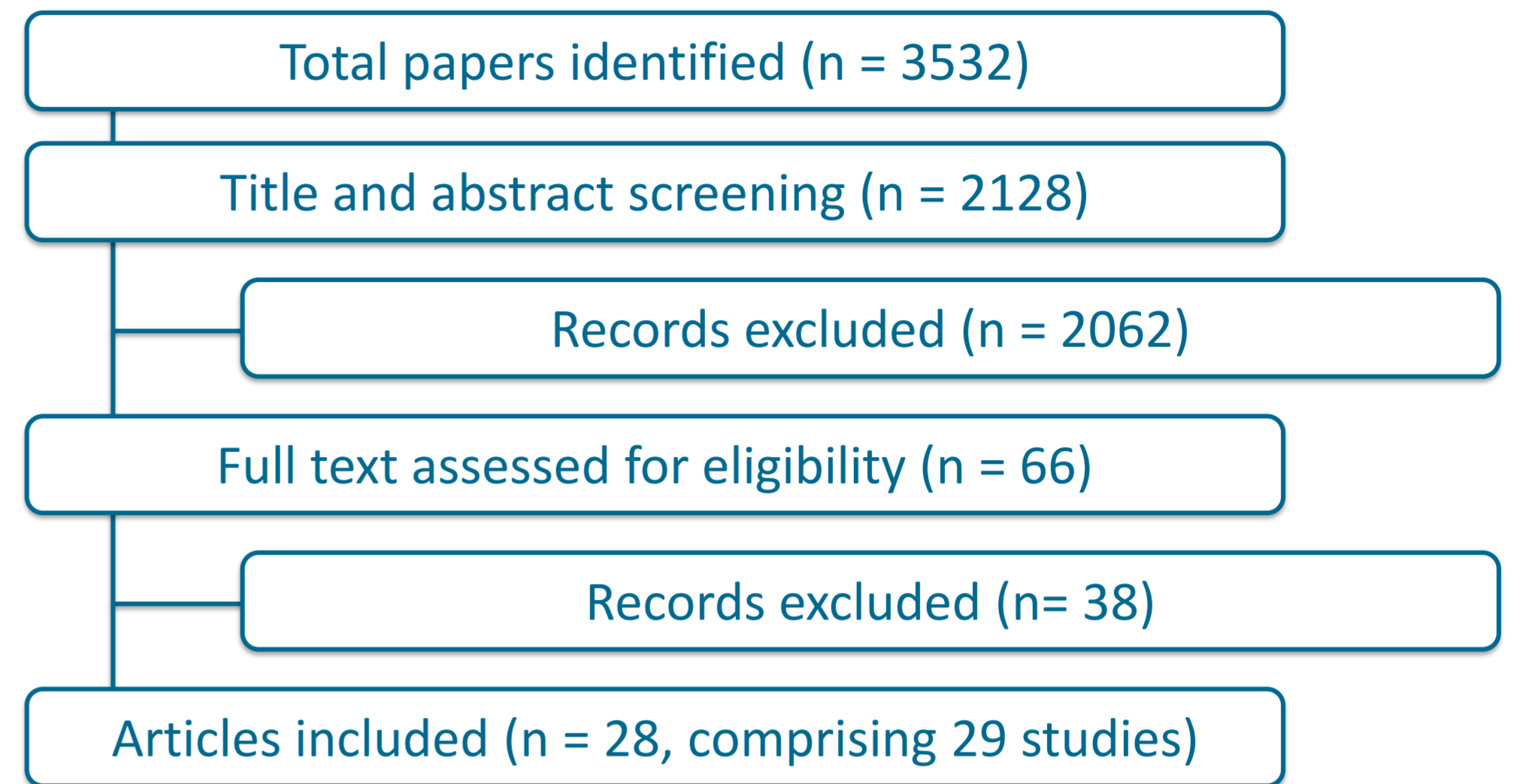
Search Strategy & Identification

Databases searched	Search terms
Medline	intervention OR therapy OR treat*
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	
PROQUEST	ultrasound OR biofeedback
Scopus	
Linguistic and Language Behaviour Abstracts	speech OR articulat* OR phon* OR apraxi* OR dyspraxia*
SpeechBITE	
ASHA's online journal search site	
The Cochrane Library	

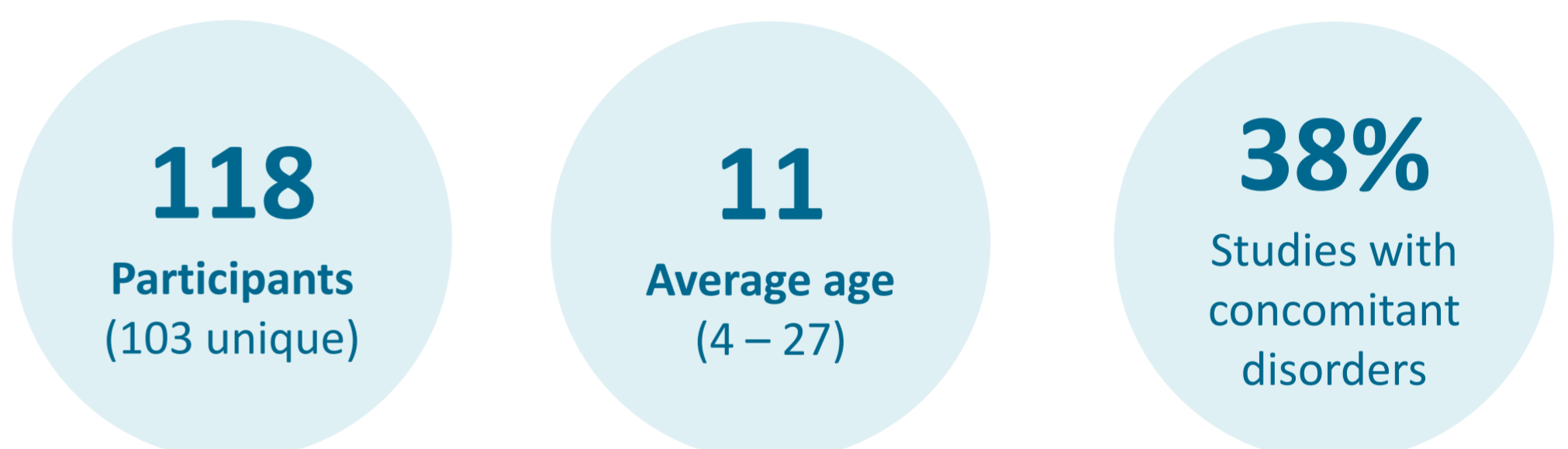
Inclusion criteria

- Peer-reviewed articles published in or before 2017
- Available in English
- Reporting on an investigation of the use of U-VBF in intervention
- Intervention delivered to children or adults identified as having a developmental (i.e., non-acquired) SSD

Results



Study design	n (%)
Randomised controlled trial	1 (3.4%)
Quasi-experimental group design	1 (3.4%)
Single-case experimental design	13 (44.8%)
Case series	8 (27.6%)
Case study	6 (20.7%)



A range of SSDs have been treated³, including: Residual speech sound errors, CAS, dysarthria, persistent SSD, those related to hearing impairment and repaired cleft.



65.5% of studies reported positive results

34.5% of studies reported mixed results

Discussion

- U-VBF can be an effective intervention for a range of SSDs, particularly in the early/acquisition stages of motor learning⁴
- Low generalisation to non-treated words/context⁵
- Predominately low-*n* SCED or case study design, representing lower levels of evidence
- Need for large-scale studies in everyday practice

References

- Wren, Y., Miller, L. L., Peters, T. J., Emond, A., & Roulstone, S. (2016). Prevalence and predictors of persistent speech sound disorder at eight years old: findings from a population cohort study. *Journal of Speech, Language, and Hearing Research*, 59, 647-673
- Baker, E., Williams, A. L., McLeod, S., & McCauley, R. (2018). Elements of phonological interventions for children with speech sound disorders: The development of a taxonomy. *American Journal of Speech-Language Pathology*, 27(3), 906-935.
- Cleland, J., Wrench, A., Lloyd, S., & Sugden, E. (2018). *ULTRAX2020: Ultrasound Technology for Optimising the Treatment of Speech Disorders: Clinicians' Resource Manual*. Glasgow: University of Strathclyde.
- Maas, E., Robin, D. A., Austermann Hula, S. N., Freedman, S. E., Wulf, G., Ballard, K. J., & Schmidt, R. A. (2008). Principles of motor learning in treatment of motor speech disorders. *American Journal of Speech-Language Pathology*, 17(3), 277-298.
- Preston, J. L., Maas, E., Whittle, J., Leece, M. C., & McCabe, P. (2016). Limited acquisition and generalisation of rhotics with ultrasound visual feedback in childhood apraxia. *Clinical Linguistics & Phonetics*, 30(3-5), 363-381.