



CLINICAL BOTTOM LINE: The CAS treatment literature to date tests the effects of one treatment or more than one treatment in combination. No comparisons of treatment versus control groups or comparisons of two or more treatments exist, making it difficult to know which treatment is most efficacious. The literature comprises feasibility and early efficacy studies (Robey, 2004; Fey & Finestack, 2009) that have a level of evidence of III or IV (NHMRC, 2009). The papers were not systematically rated using a known methodological quality scale in this CAT.

There are some preliminary guidelines as to which treatment has evidence for treating different aspects of CAS. At this stage, the best evidence for treating articulation is for DTTC or Integrated Phonological Awareness intervention due to replication across cases, larger sample sizes and demonstration of generalisation and maintenance. Phonological awareness skills also could be improved using Integrated Phonological Awareness intervention. The best evidence for prosodic accuracy is DTTC or ReST. AAC may be beneficial as a supplement or alternative to verbal communication in those with intellectual disability or poor speech outcomes and those experiencing frustration or behavioural impairment. The combined Stimulability and modified core vocabulary also demonstrates feasibility for some with CAS with a primary concern of inconsistency. Participants across studies varied and at this stage the results are best generalised to clients who are similar to the participants studies with caution. Clinical data collection on treatment, generalisation and control items is recommended.

Much further research is required. Areas of potential future research recommended by this group include to compare treatment to a control condition, compare treatments to determine which may work more efficiently and effectively, compare treatment intensity, test more principles of motor learning to determine the best combination for prompting transfer / generalisation of skills, to test the use of parent involvement in therapy and determine the best treatments for differing ages, severity and child with a range of comorbid disorders.

Clinical [PICO] Question [Patient/problem, Intervention, (Comparison), Outcome]:

In children with childhood apraxia of speech (CAS/ verbal dyspraxia) does intervention (e.g., DTTC, Integrated Phonological Awareness Approach, AAC, Combined Melodic Intonation Therapy + Multimodal approach, +/- PML principles) improve speech (+/- literacy, overall communication skill) when compared to no intervention?

Search terms/ systems:

Terms: child* AND apraxia or dyspraxia AND speech or articulation or prosody or reading or spelling or communica*, AND treat* or interven* or therapy

Systems: PubMed, Medline, PsycINFO, EMBASE, Scopus, CINAHL, CIAP links, Cochrane library

Selection criteria:

Must treat a child between 0-18 years of age with reported CAS or dyspraxia, be an article in a peer-reviewed journal and have data on at least one communication outcome as a result of therapy.

Results:

No studies were found that compared treatment to no treatment. The group therefore investigated treatments to determine if any had promising outcomes for CAS. Readers are encouraged to read the Critically Appraised Papers for more details on each of these articles and the article itself for more details.

Integral Stimulation / Dynamic Temporal and Tactile Cueing (DTTC)

1. Strand, E., and Debertine, A. (2000) The Efficacy of Integral Stimulation Intervention with Developmental Apraxia of Speech. *Journal of Medical Speech-language Pathology*, 8(4), 295-300.

Study type: Single subject multiple baseline design across behaviours.

Participant: 1, 5 year old female with reported CAS and no other comorbid disorders.

The study examined an integral stimulation approach that used of principles of motor learning (PML) including large, intensive practice, distributed practice, and reducing feedback as treatment progressed. This paper indicated that a treatment approach maximising the principles of motor learning and using temporal (simultaneous, delayed and no imitation) and tactile cues improve treated functional phrases in a child with severe developmental apraxia of speech beyond the gains seen in control words. No generalisation data was taken. No statistics were reported.

2. Strand, E.A, Stoeckel, R., Baas, B. (2006). Treatment of severe Childhood Apraxia of Speech: A treatment efficacy study. *Journal of Medical Speech-Language Pathology*, 14, 297

Study type: Single subject multiple baseline design.

Participant: 4, 5;5-61 year old males with reported CAS acted as their own control. 2 had comorbid dysarthria, 1 had intellectual impairment and 3 had fine motor deficits.

DTTC was shown to be an effective treatment for teaching specific functional utterances for 3 out of 4 children with severe CAS who attended intensive intervention sessions (2 x 30 minute sessions a day for 5 days a week). No statistics were reported.

Critically Appraised Topic (CAT) *continued....*

Results (cont.):

3. Baas, B., Strand, E.A., Elmer, & Barbaresi (2008). Treatment of Severe Childhood Apraxia in a 12 –Year-Old Male with CHARGE Association. *Journal of Medical Speech-Language Pathology*, 16(4), 181-190

Study type: retrospective, longitudinal single case design

Participant: 1, 12 year old male who was nonverbal, had moderate intellectual disability and CAS. The study follows D from 12;8 to 14;11 years.

This study provides some emerging evidence that some improvements in verbal, functional communication can occur for children over 12 years with severe childhood apraxia of speech and mild-moderate intellectual disability. No statistics were reported, data is mostly subjective regarding the participants communicative competence.

4. Maas, E. & Farinella, K. (2012) Random Versus Blocked Practice in Treatment for Childhood Apraxia of Speech. *Journal of Speech, Language, and Hearing Research*, 55, 561-578.

Study type: Single case multiple baseline design, with each participant acting as their own control

Participants: 4, 5;0 – 7;9 year olds with moderate-severe CAS diagnosed using the ASHA (2007) consensus-based characteristics. 2 participants had comorbid dysarthria and language abilities varied.

Blocked and random practice are aspects of PML, with random practice previously suggested to facilitate greater transfer/ generalisation. Integral stimulation treatment improved speech production and/or prosody for 3/4 participants. Overall transfer/ generalisation to untrained items was limited. It is unclear whether a random practice (each stimulus presented at random) or blocked practice (multiple trials on the one stimulus before moving to another) schedule is more effective for children with CAS as there was variability across participant response.

5. Maas, E., Butalla, C. E. and Farinella, K. A. (2012) Feedback Frequency in Treatment for Childhood Apraxia of Speech. *American Journal of Speech Language Pathology*, 21; 239-257.

Study type: Single case multiple baseline design, with each participant acting as their own control

Participants: 4, 5;0 – 7;9 year olds with moderate-severe CAS diagnosed using the ASHA (2007) consensus-based characteristics. 2 participants had comorbid dysarthria and language abilities varied. 3 participants in common with Maas and Farinella (2012).

Integral stimulation treatment improved speech production and/or prosody for 3/4 participants. Overall transfer/ generalisation to untrained items was varied. There was a mixed response to high (100) and low (60) frequency feedback with 2 children responding more favourably to low frequency, 1 to high frequency and one showing no improvement.

6. Edeal, D.M. & Gildersleeve-Neumann, C.E. (2011). The importance of production frequency in therapy for childhood apraxia of speech. *American Journal of Speech-Language Pathology*, 20, 95-110.

Study type: Single case experimental design (AB alternating design)

Participants: 2, 6;2 and 3;4 year old males with CAS, language disorder. The 6;2 year old had a cleft palate repair. For both participants, high dose (i.e. frequency of 100 trials per session) practice of consonant targets may result in more accurate in-session productions and greater generalisation than could be achieved with moderate dose (frequency) practice.

Rapid Syllable Transition Treatment (ReST)

7. Ballard, K.J., Robin, D.A., McCabe, P., and McDonald, J. (2010) A Treatment for Dysprosody in Childhood Apraxia of Speech. *Journal of Speech, Language, and Hearing Research*, 53; 1227-1245

Study type: Single case multiple baseline design.

Participants: 3 siblings all with CAS (diagnosed using ASHA, 2007 consensus-based characteristics) 2 male, 1 female aged 10;10, 9;2 and 7;8 respectively. All had previous artic. therapy and current primary issue affecting intelligibility was dysprosody.

All participants in the study were perceived to improve in their ability to produce the two stress contrasts of SW and WS in three-syllable nonword treatment stimuli over the course of 12 sessions and all 3 demonstrated generalisation to untreated stimuli. 2/3 maintained treatment effects up to 4 weeks posttreatment.

Melodic Intonation Therapy (MIT) and Touch Cue Method (TCM)

8. Martikainen, A. & Korpilahti, P. (2011). Intervention for childhood apraxia of speech: A single-case study. *Child Language Teaching and Therapy*, 27, 9-20.

Study type: Single case experimental design (ABACA) with MIT delivered in block B and TCM in block C. Each block was 6 weeks in duration.

Participant: 1, 4;7 year old girl whose met the Thoonen et al (1997) and Davis et al (1998) criteria of CAS. She spoke Finnish and had no other known disorders.

At phoneme level, there was a significant change in vowel accuracy immediately after MIT yet a significant decrease in consonant accuracy. Immediately after TCM, there was significant differences in vowel, consonant and phonological MLU. Greater changes were made after withdrawal of treatments that the authors attributed to the treatments but may have been due to maturation or other factors. It was unclear which treatment promoted more change due to accumulation effects. No generalisation data was reported.

Results (cont.)

Combined stimulability and modified core vocabulary treatment

9. Iuzzini, J & Forrest K: (2010). Evaluation of a combined treatment approach for childhood apraxia of speech. *Clinical Linguistics & Phonetics*; 24(4-5); 335-345.

Study type: Single subject multiple baseline design across subjects.

Participants: 4, 2 males and 2 aged 3;7 and 6;10. Diagnosed with CAS (inconsistency and disordered speech).

Stimulability Training Protocol (STP) in combination with a phonologically focused modified core vocabulary treatment (MCVT) has been shown to be effective in increasing the percent consonants correct of 4/4 participants and 3/4 increased their consistency of productions. Generalisation data and effect sizes were not reported.

Integrated Phonological Awareness intervention

10. Moriarty, B.C. & Gillon, G. (2006) Phonological awareness intervention for children with childhood apraxia of speech. *International Journal of Language Communication Disorders*, 41(6), 713-734.

Study type: Multiple single subject design with repeated measures, participants were their own control.

Participants: 3, 2 males and 1 female aged 7;3, 6;10 and 6;3 years. Children met Ozanne's (2005) criteria for CAS, all had language impairment and 1 (the 6;10 year old) had low nonverbal intelligence.

The results suggest 2/3 participants improved their speech production, phonological awareness and decoding when speech production and phonological awareness intervention was delivered simultaneously.

11. McNeill, B. C., Gillon, G. T., Dodd, B. (2009a) A longitudinal case study of the effects of an integrated phonological awareness program for identical twin boys with childhood apraxia of speech (CAS).

International Journal of Speech-Language Pathology, 11(6) 482-495.

Study type: Controlled multiple single-subject design / case series with repeated measures, using an AB (baseline-intervention) format for each treatment goal.

Participants: 12, 9 male, 3 female aged 4-7 years diagnosed with CAS using Ozanne's (2005) criteria. The twins in McNeill et al (2009b) were included.

Integrated Phonological Awareness was effective for 9/12 children with CAS in their production of target speech sounds with generalisation to connected speech noted. 8/12 children showed significant gains in at least one target phoneme awareness skills, these children demonstrated transfer of skills to novel phoneme awareness tasks. As a group the children with CAS demonstrated improvements in phonological awareness, letter knowledge, word decoding and spelling ability. The results suggest speech and early literacy skills can be addressed simultaneously for some participants.

12. McNeill, B. C., Gillon, G. T., Dodd, B. (2009b) A longitudinal case study of the effects of an integrated phonological awareness program for identical twin boys with childhood apraxia of speech (CAS).

International Journal of Speech-Language Pathology, 11(6) 482-495.

Study type: Single subject design, longitudinal study.

Participants: 2 male twins, aged 4;5 at the start of treatment and followed until 5;9 years of age. Both diagnosed with CAS using Ozanne's (2005) criteria and both have a rare chromosomal deletion (10q21.2.222.1).

An integrated phonological awareness program can promote age appropriate early literacy development as well as gains in speech skills (suppression of phonological processes). The authors recommend literacy difficulties should be targeted specifically during intervention for CAS as they do not resolve as speech difficulties improve.

13. Cumley G. & Swanson, S. (1999). Augmentative and Alternative Communication Options for Children with Developmental Apraxia of Speech: Three Case Studies. *AAC Augmentative and Alternative Communication* (15), 110-125.

Study type: Descriptive case studies.

Participants: 3, 2 female, 2 male aged 3;7, 8 and 12 years. 2 had intellectual disability and 3 had language delays. All used AAC primarily to communicate.

This study suggests that for children with CAS and other cognitive difficulties who have received previous speech intervention with minimal success, implementing high and low tech AAC options greatly improved functional communication. This included initiating and maintaining conversations, repairing communication breakdowns, facilitating language development and improving academic success. Improvement in the children's' behaviour was also reported. No defined measures or statistics were used, improvement mainly judged by participant/ parent report.

Practice factors:

Constraining factors that may affect implementation in practice are treatment intensity and the lack of a validated CAS diagnosis tool. Re: intensity, these treatments offered therapy from multiple times a day to at least once a week. The majority had a treatment intensity of 2-3 times a week. At present, this intensity of therapy is not catered for in the health service however treatment outcomes have only been demonstrated with higher intensity treatment.

Appraised By: EBP Paediatric Speech Group

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