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Structured Abstract

Clinical Question: Would preschool children with SSD demonstrate similar or greater improvement in speech sound production during interventions including phonemic awareness goals and procedures than during speech sound interventions without those elements?

Method: EBP Intervention Comparison Review

Sources: Google Scholar, ASHA publications

Search Terms: phonemic awareness, speech sound disorder, phonological disorder, articulation disorder AND intervention, treatment, therapy.

Number of Included Studies: 3

Primary Results:

1. All children demonstrated significantly improved PCC following both phonemic awareness and speech sound production interventions.
2. Both intervention methods were effective at improving speech outcomes, as measured by changes in PCC.
3. Significant differences in favor of the articulation approach were found in one study as measured by outcomes on an individualized articulation probe.

Conclusions:

1. Although both intervention techniques are effective at increasing preschool children's speech sound accuracy, there is insufficient evidence to suggest that an SSD intervention that includes a phonemic awareness approach will offer greater benefit than other speech sound disorder interventions with respect to improving speech.
2. SLPs should continue to assess phonemic awareness in children with speech sound disorders and incorporate some phonemic awareness goals when appropriate with these children as an adjunct rather than a replacement for interventions directly targeting speech production.

Do Phonemic Awareness Interventions Improve Speech in Preschool Children with Speech Sound Disorders?

Sherine R. Tambyraja
Rebecca J. McCauley

Clinical Scenario

Anne is a seasoned speech-language pathologist (SLP) working with preschool children in a suburban public school system. Several children on her caseload have moderate to severe speech sound disorders (SSD), which Anne usually treats using the cycles approach (Prezas & Hodson, 2010). At a recent conference, Anne learned about the value of addressing phonemic awareness in the context of speech interventions as a means of reducing the reading difficulties and poor phonemic awareness skills often seen in children with SSD. This information led Anne to speculate that increasing children's awareness of the sound structures of spoken language might also help them improve their speech production.

Based on her new information and her own clinical hunch, Anne suggested to the district's SLP director that she and other SLPs in the district try including a phonemic awareness approach as they treat children with SSD to see if it improved their speech production. Boosting the communication skills of children with SSD and reducing their potential risk for reading problems seemed like an unbeatable "two for the price of one" opportunity. Although the SLP director agreed that Anne's idea was intriguing, she cautioned Anne that any new methods would need to be efficient and at least as effective in improving speech production as those currently in use. To further explore Anne's idea, the SLP director encouraged Anne to develop a solid research question, search the literature for relevant research, and share what she found with district SLPs at their next meeting.

Background

The term *speech sound disorder* refers to problems that are often described as levels of accuracy in the production of speech sounds that fall below normative expectations. SSDs can range from mild articulation difficulties with a few sounds to severe phonological problems that significantly reduce a child's intelligibility. SSDs may co-occur with other disorders, such as Down syndrome or autism, but very often present in the absence of concomitant hearing, cognitive, or neurological disorders (Dodd, 2005). Prevalence studies have found that up to 14% of preschoolers may be affected with SSDs (Law, Boyle, Harris, Harkness, & Nye, 2000), and a recent survey (ASHA, 2010) found that 91% of school speech-language pathologists provide services to children with this common communication problem.

Numerous intervention techniques are currently available to help improve speech sound production in young children with SSDs (Williams, McLeod, & McCauley, 2010). For example, minimal pair intervention (Weiner, 1981) and the cycles approach (Hodson, 2007) have been among the most frequently studied (Baker & McLeod, 2011). Minimal pair intervention is a popular technique (Joffe & Pring, 2008) designed to help children understand the meaningful contrasts in their language and the correct contexts for producing those different sounds. The cycles approach is another frequently utilized intervention in which clinicians provide primarily production practice and more limited auditory stimulation on a targeted sound pattern (e.g., clusters) affecting specific sounds or sound sequences (e.g., /ts#, ps#/). Although recent versions of this approach (Prezas & Hodson, 2010) recommend inclusion of phonological awareness activities such as rhyming and syllable segmentation, phonemic awareness activities (i.e., those drawing on explicit awareness of individual segments) are not included.

Phonemic Awareness Intervention

Many children resolve their speech difficulties through speech sound interventions; however, accumulating evidence shows that children whose problems are severe and/or persist into the school age years are at risk for eventual reading difficulties (Bird, Bishop, & Freeman, 1995; Nathan, Stackhouse, Goulandris, & Snowling, 2004). One reason for this increased risk is the consistent finding that many children with SSDs exhibit poorer phonological awareness than their typically developing peers (Broomfield & Dodd, 2005; Rvachew, Ohberg, & Grawburg, 2004), particularly for phonemic awareness tasks, that is, tasks requiring the manipulation of small sound structures, or phonemes (Hesketh, Adams, & Nightingale, 2000a). Numerous studies have shown phonemic awareness to be a significant predictor of reading ability (Hulme, Hatcher, Nation, Brown, Adams, & Stuart, 2002; Lonigan, Burgess and Anthony, 2000).

Because of the connection between phonemic awareness and reading and the increased risk of poor phonemic awareness among children with SSDs, researchers have begun to consider specific strategies for addressing these risks in children with SSDs (Gillon, 2005; Hesketh, Adams, Nightingale, & Hall, 2000b). Gillon (2005), for example, found that combining phonemic awareness tasks such as phoneme matching and categorization (i.e., *Show me all the pictures that start with the /k/ sound*) with activities based on letter sound learning significantly increased the phonemic awareness and early reading skills of preschool children with SSD—and also resulted in significantly improved speech accuracy. Other researchers (Denne, Langdown, Pring, & Roy, 2005) compared a group of 5 to 7-year-olds with SSDs receiving phonemic awareness intervention employing the same techniques used by Gillon (2005) with a control group receiving no therapy. The authors reported increased general phonological awareness in the intervention group; however, unlike Gillon's findings, no significant improvements in speech production were obtained. Although these two studies were tantalizing, the Denne et al. (2005) study used older children than Anne was interested in and the study by Gillon (2005) did not compare the phonological awareness intervention with another intervention.

Anne needed to look further and hoped that her review of the evidence would clarify the potential value of SSD interventions for preschoolers that included elements addressing phonemic awareness. Depending on her findings, she and her colleagues could work to streamline the delivery of services to the young children with SSDs in their district by simultaneously addressing the children's speech impairments and helping to avoid or mitigate possible reading deficits as they approached elementary school.

Clinical Question

Anne used the PICO framework (Richardson, Wilson, Nishikawa, & Hayward, 1995) to develop a focused and clinically relevant question that defined (P) the patient group or population, (I) the intervention, (C) the comparison intervention, and (O) the intended outcome. She used the following parameters:

P – preschool children with moderate to severe SSDs

I – incorporation of phonemic awareness intervention

C – other speech sound intervention

O – improvements in speech sound production

So, Anne's question was: Would preschool children with SSDs demonstrate similar or greater improvement in speech sound production during interventions including phonemic awareness goals and procedures than during speech sound interventions without those elements?

Search for Evidence

Inclusion Criteria

To begin her search, Anne considered which inclusion and exclusion criteria she should use to obtain the most useful and relevant articles. Because she wanted concise and sound evidence to present to the group, she decided that all included articles should meet the following criteria: (1) use an experimental, quasi-experimental, or single-participant experimental design, (2) include preschool age children (3 to 5 years) diagnosed with speech sound, articulation, and/or phonological disorders, (3) compare the incorporation of phonemic awareness intervention to an alternative method of speech sound intervention, and (4) include at least one measure of speech sound production as a post-treatment outcome.

Search Strategy

Anne used the two largest research sources that were available to her: the ASHA journal search (www.asha.org/publications), which is accessible to all ASHA members and the Google Scholar search engine. In order to retrieve the greatest number of possible studies, she conducted nine separate searches, using combinations of the search key words *phonemic awareness, speech sound disorder, phonological disorder,* and *articulation disorder* with *intervention, treatment* and *therapy.* Altogether, these searches resulted in 808 articles; however, Anne quickly realized that because she had run multiple searches, the results included numerous duplicates. After removing these, she was able to read through the remaining abstracts to determine which met her four criteria, and then excluded nine more studies after reading the entire document. The following figure shows the selection process and criteria for including or not including articles. Anne was able to complete her search for relevant articles in less than two hours.

Evaluating the Evidence

Description of Included Studies

Three studies that were included in Anne's review (see Table 1) were conducted between 1998 and 2011, and had a total of 110 children with SSDs and 59 children with typical development between the ages of 3:0 and 5:2 years. In the first study, Major and Bernhardt (1998) studied 18 participants with SSDs (ages 3:0 to 4:11 years), who received treatment in three blocks, two blocks of phonological intervention (18 sessions each) and a third (12 sessions) that focused on metaphonological training including phonemic awareness activities combined with phonological intervention. Sessions were conducted, on average, three times per week by community SLPs during a 5- to 10-month period, depending on the child. Within-participant comparisons of speech production and phonological awareness skills were made prior to intervention, following phonological intervention only (block 2), and following phonological plus metaphonological intervention (block 3). Data from an additional child consisted of only two 8-week treatment blocks with one session per week.

In Hesketh et al. (2000b) 61 children with SSDs (ages 3:6 to 5:0 years) were semirandomly assigned to either a metaphonological therapy (n = 31) or articulation-based therapy (n = 30), with performance compared between groups before and after 10 weekly sessions, and then three months later. Comparisons were also made between treated children and a group with typical development (n = 59) before and after treatment of the children with SSDs.

In Tyler, Gillon, Macrae, and Johnson (2011), 30 children (ages 3:10 to 5:2 years) were matched by age and severity of speech disorder. One member of each pair was randomly assigned to an integrated phoneme awareness/speech sound production intervention and the other was assigned to an intervention in which speech production and morphosyntactic interventions alternated weekly. Interventions were administered in small groups of two to three children and consisted of 24 sessions conducted in two 1-hour sessions per week. The 24 sessions were presented in two 6-week blocks separated by a 6- or 7-week break. Group comparisons were made pretreatment then after each of the two treatment blocks on a variety of skills, including speech sound production.

Eligibility requirements for impaired speech was determined based on a score of at least one *SD* below the mean on a standardized test of articulation in the Hesketh et al. (2000b) and Tyler et al. (2011) studies; whereas in the Major & Bernhardt (1998) study, children in the disordered group were chosen based on a pattern of "restricted phonetic inventories, reduced word and syllable shapes" (p. 418) and uncommon substitutions. None of the children in that study had percent consonant correct (PCC) scores that were greater than 53%. In all three studies, children demonstrated age-appropriate receptive language abilities; however, those in Tyler et al. (2011) had concomitant expressive language impairment, as did approximately half the children (N = 9) who participated in the study by Major and Bernhardt.

The duration of phonemic awareness interventions ranged considerably but was based on a predetermined number of sessions rather than children's performance data. Hesketh et al., (2000b) provided 10 weekly sessions, for a total of 10 hours; Tyler et al. (2011) provided two 6-week blocks of therapy, with two sessions per week, for a total of 24 hours; Major and Bernhardt (1998) administered three sessions per week for 16 weeks, but the total amount of therapy time could not be calculated because session duration was not stated. Outcome measures for all three studies included PCC along with measures particular to each study. In addition, Tyler et al. (2011) measured change in the accuracy of cluster productions; Hesketh et al. (2000b)) examined scores on an articulation probe that was individual to each child's intervention goals; and Major and Bernhardt (1998) evaluated changes in the percentage of vowels correct (PVC).

Quality of Evidence

In order to guide her evaluation of the studies, Anne used the Critical Appraisal of Treatment Evidence (CATE;

Dollaghan, 2007). This framework provided a list of questions she could use to consider important elements about the three articles, and assess the overall quality index of each. Examining that list, she chose 10 questions (see the Appendix) that assessed aspects of the research design and how it was implemented. For example, one question considered whether the design asked the research question clearly and another examined treatment fidelity, whether there was evidence that the treatment had been administered as intended. Finally, Anne examined the results section of each article to determine the size of the effects of each phonemic awareness intervention. This information adds important detail to how big a difference an intervention might make to a treated child (Bothe & Richardson, 2011). Anne included those calculations in a table (see Table 1), in order to summarize information for her colleagues concerning the participant characteristics, treatments, and outcomes from each of the three articles. She also enlisted a colleague to repeat her evaluation of evidence quality using the CATE and was pleased when she found that they agreed on 97% of their ratings. The single disagreement between them was rectified by discussion.

Treatment Effectiveness

Upon reviewing the results from the three studies in chronological order, Anne noted that Major and Bernhardt (1998) descriptively reported a larger change in PCC when their participants' interventions included phonological awareness goals, as compared to the change seen after a block of phonological therapy. However, because they did not statistically compare those differences and did not report the mean score differences and standard deviations, an effect size for this difference could not be calculated. So, it was not possible to determine whether the phonemic awareness intervention had similar or greater effects on speech sound production compared to the phonological intervention.

Hesketh et al. (2000b) reported that children receiving traditional articulation condition exhibited similar improvement in speech output as measured by PCC when compared to children receiving a phonemic awareness intervention. However, Hesketh et al. (2000b) reported a significant group difference favoring the traditional approach for the articulation probe, which was tailored to each child's specific therapy targets ($p < .001$, $d = -.516$, CI = -1.03–.006). This finding suggests that traditional articulation therapy was particularly effective for reducing targeted errors.

Finally, the 2011 study by Tyler et al. yielded findings similar to those of the other studies Anne examined. Like those two earlier studies, Tyler et al. found that children receiving phonemic awareness training did not demonstrate significantly different levels of improvement from those children receiving an alternative speech sound intervention. Because the standard deviations were not reported, effect sizes for the posttest outcomes could not be derived.

The Evidence-Based Decision

Anne undertook her review to determine whether the inclusion of phonemic awareness interventions would be as or more effective than current methods she and her colleagues were using to optimize speech sound development in children with concomitant speech and phonological awareness delays. The three studies Anne reviewed offered evidence that was of moderate to high methodological quality, so Anne felt confident that she had sound data to use in answering her clinical research question. Although only one study reported treatment fidelity, all had high interrater reliability and used the same outcome measure (PCC) to assess change in speech production. The results from these articles were similar in that no study reported statistically significantly greater speech output outcomes for children with SSD who received a phonemic awareness intervention. Major and Bernhardt (1998) indicated that children made greater improvements from the phonemic awareness intervention than from the purely phonological intervention; however, the lack of statistical analyses prevented drawing firm conclusions about that difference. Because the same group of children experienced both interventions, a clear comparison of the two methods of therapy was not possible. Specifically, it was not clear if the larger change in speech output was due to the phonemic awareness intervention alone, or due to the addition of those goals to their previous phonological therapy. Finally, this study had only a moderate quality index rating, so Anne felt the authors should be more cautious in how they interpreted these results.

Outcomes from the other two studies showed no significant difference in PCC between groups of children receiving interventions that combined speech sound therapy with either phonemic awareness goals or morphosyntactic goals (Tyler et al., 2011), and groups of children receiving phonemic awareness intervention or traditional articulation therapy (Hesketh et al., 2000b). In fact, findings from Hesketh and colleagues showed that children receiving articulation therapy tended to have better outcomes on specifically targeted sounds than those in the phonemic awareness condition.

Anne did note that all studies reported significant improvements in PCC for children receiving phonemic awareness therapy, suggesting that these activities and goals would be at least somewhat effective for improving speech sound production. However, based on the limited amount of research evidence, Anne was not sure whether there was sufficient support for adopting a phonemic awareness approach for treating the preschool children with SSDs in their district. The only significant group difference on speech outcomes in these three studies was in favor of the traditional articulation approach (Hesketh et al., 2000b) as measured by an individualized articulation probe, which the authors argued "had the potential to be more sensitive to change than an overall PCC score" (p. 341).

At the next meeting with her colleagues and the district SLP director, Anne presented information about her search and review. She talked about the three articles she had found, and argued that although the phonemic awareness interventions appeared to provide some benefits for improving speech as other phonological approaches, there was not yet enough evidence to support changing their current methods. The other SLPs appreciated her efforts and were grateful that she had taken time to assess the evidence for this question. In the end, the director agreed with Anne's conclusions to maintain their present programs, and use SSD interventions as the primary method of addressing SSDs along with phonological awareness interventions in the case of children who also showed impairments in phonemic awareness, placing them at risk for future written language difficulties. Finally, the director, Anne, and the assembled group agreed to revisit a similar literature review in the future because any SSD intervention incorporating phonemic awareness that showed superlative efficacy for speech sound outcomes as well as phonemic awareness and literacy outcomes would represent a giant step forward in efficiency for both children and SLPs.

Author Note

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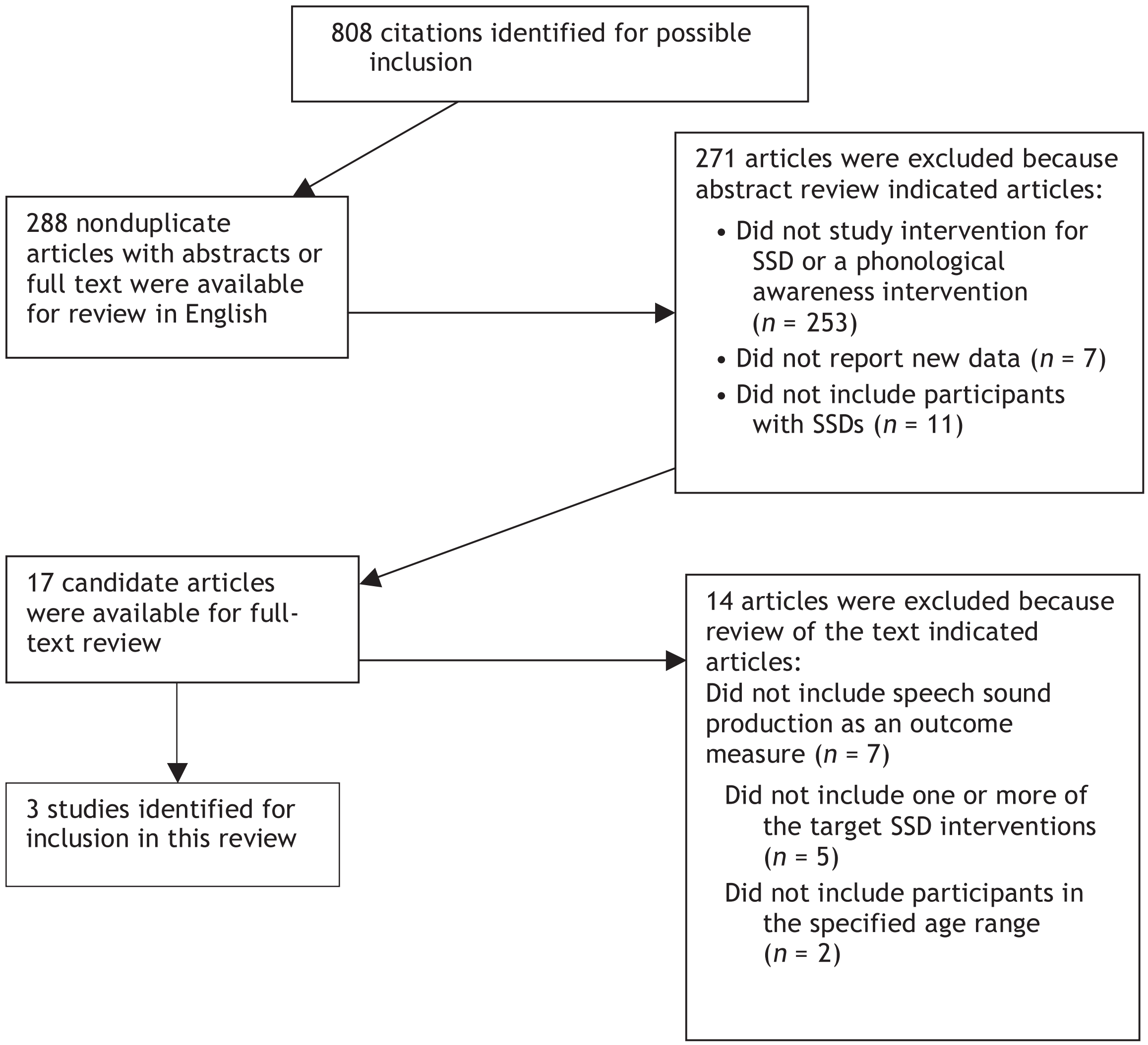

Figure. Study search and selection process

Table 1. Articles included for review

Reference	Design	Population	PA intervention activities	Comparison intervention	Outcomes	Result	Effect sizes
Major & Bernhardt, 1998	Experimental prepost; *N* = 19	Children with moderate to severe SSDs. Age range = 3:0–4:11	Activities focused on awareness to onsets, rimes, and phonemes were incorporated into ongoing phonological therapy.	Phonological therapy.	PCC and PVC	Improvements in both speech outcomes and PA were made from Block 1 to 2 to 3, but no comparisons on whether greater improvements were made with PA activities.	Ms and *SD*s not provided; effect sizes could not be calculated.
Hesketh, Adams, Nightingale, & Hall, 2000	Experimental prepost design; 3 groups *N* = 120	Children with SSDs (*N* = 61) receiving articulation therapy (*n* = 30) or a metaphonological intervention that included PA intervention activities (*n* = 31). A group of typically developing controls (*N* = 59) was also included. Age range = 3:6–5:0.	Rhyming, syllable clasping, alliteration, blending, and segmenting. Activities focused on child's specific speech targets.	Traditional articulation therapy.	PCC from the Metaphon Screening Assessment and speech probes of target words.	Traditional articulation therapy resulted in greater speech sound improvement on articulation probe. No group differences on PA measures.	–.006
Tyler, Gillon, Macrae, & Johnson, 2011	Experimental; *N* = 30	Children with concomitant SSD and language impairment receiving phoneme awareness treatment (*n* = 15) or morphosyntax treatment (*N* = 15). Mean age = 4.5 years.	Phoneme detection, phoneme categorization, initial phoneme matching, and phoneme isolation – all focused on the child's speech targets. Incorporated phoneme awareness and letter knowledge into their regular speech therapy.	Activities developing morphosyntax incorporated into regular speech therapy, auditory awareness and production of forms of to be, third person singular, and past tense, as well as child's speech targets.	PCC and cluster accuracy.	Both groups improved on speech measures and phoneme awareness, but there were no significant group differences.	*SD*s not provided; effect sizes could not be calculated.

Note. PA = phonemic awareness, SSD = speech sound disorder, PCC = percent consonant correct, PVC = percent vowel correct, M = mean, *SD* = standard deviation