

Critical Review: The effect of phonological awareness intervention on the speech output of children with expressive phonological disorders

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This critical review examines the effects of phonological awareness intervention on the speech output of children with expressive phonological disorders. Study designs include: a randomized controlled trial and quasi-experimental designs. Overall, research suggests that PA intervention has an advantageous effect on the phonological speech output of children with expressive phonological disorders. At least, it appears that when phonological awareness intervention is used to enhance the phonological awareness skills of these children, it would not be conducted at the expense of the children's expressive phonological skill development.

Introduction

Children with expressive phonological disorders have difficulties acquiring the sound system of their native language and show a disorganization of their speech sounds in the absence of gross neurological or structural abnormalities (Hesketh, Adams, & Nightingale, 2000a). Children who experience these difficulties form a heterogeneous population. Their expressive phonological disorders (PD) may exist as a relatively isolated problem or occur in combination with other language difficulties which may include delays in acquiring phonological awareness (Hesketh et al., 2000a).

Phonological awareness (PA) refers to the explicit knowledge of the units that make up spoken words including syllables, onset and rime units and individual phonemes (Rvachew, Ohberg, Grawburg, & Heyding, 2003). Awareness of these units is widely accepted as a precursor to the acquisition of reading (Bird & Bishop, 1995; Rvachew et al., 2003; Stackhouse, Wells, Pasce, & Rees, 2002). Children with PD present with a wide range of PA skills. Several studies show that children with PD are at risk for concomitant delays in the development of their PA and literacy skills (Bird & Bishop, 1995; Stackhouse & Wells, 1997). At the same time, other studies report mixed results in which a number of children with PD presented with age appropriate PA skills and learned to read without difficulty (Bird et al., 1995; Hesketh et al., 2000a; Larivee & Catts, 1999; Leitao, Hogben & Fletcher, 1997; Major & Bernhardt, 1998).

When a delay in PA has been identified in children with PD, it may be possible to assist in the prevention of reading difficulties by providing PA intervention (Hesketh, Adams, Nightingale & Hall, 2000b). Typically, however, SLPs working with children with PD focus on enhancing their speech intelligibility using phonological or articulatory approaches to treatment (Hodson, 2004; Stackhouse et al., 2002). These intervention strategies may indirectly target PA

knowledge by having the child focus on a target sound in a word; however, the ability to consciously access information about the sound structure of spoken words is not made explicit (Hodson, 2004). This element, which helps reduce the risk of reading difficulties, is not addressed in more traditional speech therapies but can be directly addressed through PA intervention in order to improve PA abilities (Gillon, 2000).

The dilemma of applying PA intervention when working with children with PD is that it seems to help develop their PA skills (Adams, Nightingale, Hesketh & Hall, 2000; Denne, Langdown, Pring & Roy, 2005; Gillon, 2000) but it does not specifically target their expressive phonological deficits. It is proposed, however, that children with PD have inadequate phonological representations which may contribute to some of their speech production deficits (Gillon, 2000; Sutherland & Gillon, 2005; Sutherland & Gillon, 2007).

Phonological representation is a term used to describe the storage of a word's phonological information in a person's long term memory. Accurate speech production depends on phonological representations being specific and easily accessible (Sutherland & Gillon, 2007). Subsequently, it is thought that the phonological speech output of children with PD may improve when they are provided with intervention designed to enhance their phonological representations. PA intervention may assist in the development of these underlying phonological representations by stimulating a cognitive reorganization of the child's phonological system through the improvement of his/her awareness of the structure of words (Gillon, 2000). What remains unclear is to what extent direct PA intervention promotes phonological output improvement in children with PD. The following paper will examine the research in order to determine whether or not children with PD can benefit from PA intervention to improve their speech production abilities. This could be an important finding, as clinically, it is important to know

that when providing direct PA intervention for reading development with this population, it is not being done at the expense of improving expressive phonology.

Objectives

The primary objective of this paper is to critically evaluate the existing literature regarding the impact of PA intervention on the phonological speech output of children with PD. The secondary objective is to propose evidence based recommendations about the use of PA intervention to improve the phonological output in this population and areas for future research.

Methods

Search Strategy

Computerized databases, including CINAHL, PsychInfo, Medline – OVID, PubMed and Cochrane Library, were searched using the following search strategy:

((phonological awareness intervention)
OR (metaphonological)) AND
((articulation disorder) OR
(phonological disorder)).

The search was limited to articles written in English between 1980 and 2007.

Selection Criteria

Studies selected for inclusion in this critical review paper were required to investigate the impact of phonological awareness intervention on the speech output abilities of children with expressive phonological disorders. No limits were set on the demographics of research participants.

Data Collection

Results of the literature search yielded the following types of articles congruent with the aforementioned selection criteria: randomized controlled trial (RCT) (1), and quasi-experimental designs (4).

Results

Adams et al. (2000) conducted a study to examine the effects of a program targeted at improving PA skills. Participants included 31 children between the ages of 3; 6 and 5; 0 (years; months) with isolated phonological output difficulties and a control group of 34 children with typical speech and language development to control for maturational effects. Changes in phonological output as a result of PA

intervention were measured using the percentage consonants correct (PCC) calculated on 241 consonants on the Metaphon Screening Assessment (MSA) (Dean, Howell, Hill & Water, 1990). Results from a paired t-test indicated that the therapy and control groups both made significant improvements on the phonological output measure during the intervention period ($p < 0.05$). A comparison of the two groups' mean PCC change indicated that the therapy group improved significantly ($p = 0.001$) more than the control group. This suggests that the therapy group's improvements were due to the PA therapy they received. A one-way ANOVA was also used to determine if there was a difference in the mean change in PCC for children with good PA skills at the start of therapy (GPA), children with poor PA skills at the start of therapy (PPA), and the control group. Results demonstrated a significant between-group effect. Tukey's comparison suggested that the GPA group made significantly more progress than the control group ($p < 0.05$), while the PPA group did not show a significant difference compared to the control group ($p = 0.188$). It was also noted that the GPA group appeared to make better progress on the phonological output measure compared to the PPA group but the difference was not significant. Overall, the results of this study suggest a beneficial effect of PA-based intervention on the phonological output of children with PD beyond what would be expected due to maturation. The results from this study also suggest that children with GPA at the start of PA therapy tend to be more successful compared to children with PPA. It cannot be concluded, however, that children with PPA at the start of therapy could not still benefit from PA intervention; however, in this study the PPA group did not improve beyond what was expected from maturation.

Despite positive conclusions and appropriate statistical analysis, the findings from Adams et al. (2000) should be interpreted with caution. The non-equivalent pre/post test control group design of this study is limited by its lack of randomization. The results must also be interpreted with caution as with a pre/post test design it is assumed that the two groups being compared are similar. The present study does not include any details about whether or not the pre-test scores of the children with PD were significantly different. Further limitations consist of the inclusion of a control group consisting of children with normal speech and language development in order to control for maturational effects. This implies that children with speech disorders who are not receiving treatment exhibit spontaneous change at a similar rate to children without disorders. This is not necessarily a correct assumption as some children with speech disorders spontaneously resolve and others show no change over extended periods of time (Dodd & Bradford, 2000). Another weakness in the study's methodology is in the

content of the PA intervention in which the last two sessions incorporated production practice. The authors, however, stated that the children were not corrected on their production of sounds. It was also unclear who implemented the therapy and administered the pre/post testing. The level of blinding is therefore uncertain. The administrators of the pre and post tests may have been aware of group assignments and experimenter bias may have affected the scores. The results must also be interpreted with caution as there is a small sample size and the effect size and power calculations were not included. Due to these weaknesses, the positive outcomes from Adams et al. (2000) should be interpreted and applied with caution.

Gillon (2000) used a pre-post test controlled group design to investigate the effects of PA intervention on the expressive phonology of children with spoken language impairments. The study recruited 91 children between the ages of 5; 6 and 7; 6. Of the 91 children, 61 had spoken language impairments in which they all presented with expressive phonological difficulties in the absence of severe receptive language or cognitive delays. The remaining 30 children had typically developing speech and language skills. The children with spoken language impairments participated in one of the following three intervention programs; a) phonological awareness intervention, b) traditional speech and language intervention or c) a minimal intervention program consisting of home and school recommendations provided by a SLP. PCC for single word elicitation tasks was used to examine the effects of intervention on the children's phonological production ability. The difference scores for phonological production for the three intervention groups were compared using an ANOVA. The results indicated a significant group effect ($p < 0.01$) in which all three groups improved over the intervention period. Tukey's comparison indicated that the PA intervention group's improvement in phonological production was better than the improvement made by the other two intervention groups. A significant difference, however, was not noted. The overall findings from this study suggest that PA intervention can have a positive effect on improving the phonological production skills of children with spoken language impairments while targeting the skills required for literacy. The effectiveness of PA intervention, compared to the other intervention approaches examined, on the expressive phonology of children with spoken language impairments remains uncertain based on the results from this study.

A follow-up study (Gillon, 2002) of the participants in the previously summarized intervention study (Gillon, 2000) was conducted to examine the long term effects of PA intervention on the speech output of children with spoken language impairments.

The performance of 20 children with spoken language impairments who received PA treatment was compared with the progress made by 20 children who participated in the traditional or minimal treatment programs approximately 11 months post-intervention. The change in PCC of the two spoken language impairment groups was analyzed using a two-way repeated measure ANOVA with one factor repetition (group by time, 1, 2, 3 scores). A significant time effect ($p < 0.001$) and a significant group x time interaction ($p < 0.0001$) were reported. Both groups improved at the post-intervention assessment (Gillon, 2000) and the follow-up assessment (Gillon, 2002), however, the PA intervention group made more progress over time (Gillon, 2002). The overall results suggest that, over time, structured PA intervention may result in a positive significant difference in phonological production of children with spoken language impairment.

Though a quasi experimental design was utilized for the Gillon (2000 & 2002) studies, reducing the degree of confidence in the results compared to an RCT, the researchers carefully documented their subjects' characteristics, verified reliability of scoring and utilized appropriate statistical analyses. Despite the studies' strengths, weaknesses should be considered when applying the findings. Firstly, the participants with spoken language impairments were a heterogeneous group. Each participant with a spoken language impairment presented with expressive phonological difficulties. Some, however, also exhibited delayed semantic and syntactic development which may have affected their ability to benefit from PA intervention. Secondly, there is also overall fidelity of treatment issues to consider. The PA intervention was provided by a variety of clinicians including the author, the research assistants (SLPs) and community SLPs. In order to reduce PA treatment variation, the researcher provided training to the community SLPs and the research assistants. Despite this training, the clinician-child interactions and environmental conditions still remain difficult to control. Differences in the traditional intervention programs were also not controlled and it is therefore difficult to determine how much PA may have been included by the different clinicians. The studies also do not make it clear if the pre/post test assessors (i.e. the researcher or research assistants) were blinded and therefore the results may have been affected by observational bias. Although positive conclusions were suggested by the findings, caution should be taken when interpreting the results from both the Gillon (2000) study and the follow-up study (Gillon, 2002).

Hesketh et al. (2000b) conducted a study comparing the change in the phonological output of children who received articulatory (ART) versus PA therapy. Sixty-one children with PD, between the ages of 3; 6 and 5; 0, participated in one of the two

intervention programs. A control group, consisting of children of the same age range, was also included to control for maturational effects. Phonological output measurements were compared before and after therapy and then 3 months post therapy using two measurements; a) PCC scores for single word production tasks and b) individual probe scores. A one-way ANOVA of the change in PCC showed that both treated groups improved significantly during the intervention period compared to the control group ($p < 0.001$). A Sidak post-hoc test showed that the differences were between ART/control and PA/control but there was no significant difference in the change in PCC scores between the ART and PA intervention groups. The ART and PA groups did differ significantly on the change in their individual probe measures as the ART intervention group made more change ($p < 0.05$) during the intervention period. The long term effects of therapy were examined 3 months post therapy. The results from both post phonological output measures indicated that there was no significant difference between the PA and ART intervention groups. Both groups did, however, show a slight deterioration in the probe measure. To determine if the level of PA skills, prior to therapy, effects the change in PCC, the ART and PA intervention groups were divided into subgroups of children with poor and good PA skills at the start of therapy. A one-way ANOVA and Sidak post hoc was conducted. The findings indicated a significant difference between the control group and those children with good phonological skills in both the PA and ART intervention groups ($p < 0.001$) but there was no significant differences noted between the other groups. This suggests that children with good PA skills at the start of PA and ART therapy tend to be more successful compared to children with poor PA. Overall, the results showed that there was no striking difference between PA and ART therapies in effecting a change on speech production. The PA group did, however, make as much progress as the ART group on the PCC score.

Certain limitations, including the lack of randomization to the treatment conditions, should be considered when interpreting the positive results reported by this study. The content of the PA intervention appeared limited with respect to the children's direct exposure to PA. Only the first four sessions of the PA intervention involved direct PA tasks. The remaining sessions focused on perceiving and producing sound contrasts using minimal pairs. The study's methodology is also questionable as the authors did not include details about who conducted the intervention or the pre/post testing. It is therefore unclear whether experimenter bias may have affected the results. A small sample size participated in this study and the authors did not include effect size calculations to indicate the power of the results. For

these reasons, Hesketh et al.'s (2000b) results should be interpreted with caution.

Lastly, Denne et al. (2005) conducted a between groups pre/post-test design to monitor the changes in phonological speech production of children with PD following PA intervention under conditions similar to those existing in community clinics. Twenty children with PD were randomly assigned to a treated and untreated group. The treated group received 12 hours of PA group therapy, with three children per group, in community clinics. PCC was used to analyze the children's phonological speech production during single word elicitation tasks. Comparison of the groups was completed using a two factor mixed ANOVA in which the groups were a between subject variable and the time of testing was the within group variable. A significant main effect of time ($p < 0.001$) was noted and reflected an improvement in the speech production measurements for both groups. The treated group made more progress; however, there was no significant group by time interaction ($p = 0.09$). The authors did note, however, that the interaction of group by time approached significance and perhaps with larger sample size a significant result would have been realized. Overall, the results seem less substantial than those provided by the other studies summarized above. This suggests that the effect of PA intervention on phonological speech production is uncertain or that more intense PA intervention may be required for significant speech production benefits to be achieved.

Though this study provided randomization of the participants to the treatment groups, ensured reliability of the PCC scoring, and attempted to blind the post treatment assessors, there are several limitations that should be considered when evaluating the evidence. Firstly, the participants had all received assessments and/or treatment prior to the study which could have affected the results as change during the study may have occurred due to the effects of previously received therapy. The content of the PA intervention could also be disputed. A portion of the PA therapy gave corrective feedback about the children's articulation errors and the children were then given the opportunity to attempt more accurate productions. It is therefore difficult to determine whether progress was due to learning during PA tasks or production tasks. In addition, the pre-treatment scores of the untreated group were reported as higher than the untreated group's scores, even though the participants were randomly assigned. The difference, however, was not significant. Nevertheless, this difference may have contributed to the less rapid improvement made by the untreated group as the untreated group may have had less room for improvement (Denne et al., 2005). Though the sample size was small, the authors discussed the effect size calculations and indicated that a larger sample size may have shown a significant difference. The authors also

addressed the fact that the test scores had large standard deviations, indicating considerable variation in the participants' performance. The authors indicated that this variation may be due to the heterogeneity of the population sampled or the fact that some children respond more rapidly to therapy than others. Considering both the strengths and weaknesses of this study, the findings need to be considered tentatively and further research is required.

Recommendations

The effect of PA intervention on the speech output of children with expressive PD has not been well-documented at this time. Some studies have shown the effects of PA intervention on enhancing the PA skills of children with expressive phonological disorders (Adams et al., 2000; Denne et al., 2005; Gillon, 2000). The above results section, on the other hand, summarizes the current research regarding the effect of PA intervention on the phonological output of children with PD. It is thought that by stimulating a child's explicit awareness of the structural components of words, a cognitive reorganization may occur resulting in more accurate phonological representations. This in turn may lead to improvements in child's phonological productions (Sutherland & Gillon, 2007). Since the evidence is limited to a few quasi-experimental pre/post test designs with reported weaknesses in methodology, the findings should be considered subjective yet still provides important information for clinical practice and direction for future areas of research.

The presented evidence suggests that intensive PA intervention has an advantageous effect on the phonological speech output of a number of children with PD (Adams et al., 2000; Gillon, 2000; Gillon 2002; Hesketh et al., 2000). At least, based on the evidence, it appears that PA intervention used to enhance the PA skills would not be conducted at the expense of the child's expressive phonological skills. Given the present evidence; however, it is difficult to conclude that the benefits of PA intervention are superior to more traditional approaches to treating the phonological output of children with PD.

The evidence presented also provides a basis for future research. Although the intervention programs evaluated in these studies focused on PA tasks, it should be noted that there was emphasis given to correct articulation. This raises a clinically important issue; no therapeutic approach is "meta-free". It is difficult to make a clear distinction between PA intervention and articulatory or phonological intervention as PA cannot be dealt with independently when providing treatment to children with PD (Stackhouse et al., 2002). PA is, in fact, an integral part of articulation and phonological intervention. This

is a problem when investigating the effects of PA intervention for children with PD or when comparing intervention approaches within phonology (Stackhouse et al., 2002). It is therefore critical that future research compare the effectiveness of PA intervention with and without the integration of productive speech practice in order to explore the effectiveness of PD intervention that focuses entirely on remediating the underlying phonological representational deficits. Though some research has compared PA intervention with more traditional approaches to working with children with PD (Hesketh et al., 2000), further studies making such comparison would be beneficial so that clinical practice can be scientifically directed.

Given that children with PD represent a heterogeneous population and that the current evidence suggests that some children benefit from PA intervention more than others (Adams et al., 2000), future research should focus on identifying which children may or may not benefit from PA intervention to enhance their phonological expression. It would be beneficial to conduct longitudinal controlled studies to identify the factors of the child that succeeds and does not succeed when enrolled in PA intervention. Factors that warrant exploration include the participants' level of PA skills at onset of therapy, co-occurring semantic or syntactic delays, age, severity of the phonological disorder, stimulability, and the onset of therapy. Analysis of individual cases within samples may also reveal specific characteristics predictive of response to treatment. Based on the less substantial results of the Denne et al. (2005) study compared to other studies, further effectiveness research is also required in order to determine the minimum duration of therapy that is required for children to benefit from the potential positive effects of PA intervention on their expressive phonology.

The presented evidence does not suggest that PA intervention is inappropriate for children with expressive phonological disorders but clearly more research is required as to the effect of PA intervention on the expressive phonology of children with PD. Until such information is available, clinicians should be advised that there is no prescribed approach to working with the heterogeneous population of children with PD (Dodd & Bradford, 2000). Clinicians should draw upon a range of therapeutic approaches and combine these in ways appropriate for the individual child (Dodd & Bradford, 2000). This results in SLPs taking a more eclectic approach to their clinical practice. The inclusion of more explicit PA tasks into more traditional programs to target expressive phonology may be appropriate as children with PD often have difficulties with PA development (Hesketh et al., 2000). Further the current research suggest that PA intervention can at least be conducted without detracting from the gains in the child's phonological

output while potentially preventing future literacy difficulties.

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