

Critical Review:
Is phonological awareness intervention efficacious for children who have expressive phonological disorders?

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This critical review examines the literature measuring the effectiveness of phonological awareness intervention with children who have phonological disorders. More specifically, it focuses on whether or not this type of intervention influences speech output and phonological awareness abilities. Overall, the examined research in this review provides suggestive evidence to support phonological awareness intervention. Recommendations for future research and clinical practice are provided.

Introduction

Hesketh et al. (2007) define phonological awareness (PA) as a complex developmental ability in which children are gradually able to make finer distinctions within words, from large units (syllables and rimes) to smaller (awareness of individual phonemes within a word). This refinement takes place in typically developing children over a number of years. Stackhouse and Wells' (1997; as cited in Stackhouse et al., 2002) model pertaining to PA development suggests that PA tasks are dependent on how a child processes, stores, retrieves and produces spoken and written words. Stackhouse et al. (2002) state that PA is a product of speech processing skills and that difficulty "...in the basic speech processing system will result not only in spoken difficulties but also in problematic PA development".

It is presumed that individuals with phonological disorders (PD) have difficulty acquiring the language rules that underlie speech in the absence of any apparent physical cause (Bleile, 2004, Major & Bernhardt, 1998). Aspects of expressive PDs may have their origin at different levels of the speech processing system including limited phonetic inventories resulting in phoneme discrimination difficulties; restricted syllable and/or wordshapes; and/or incomplete or inaccessible representations. Indeed, recent research suggests a link between poor PA and PD in children (Hesketh et al., 2000b, 2007).

Many clinicians are uncertain about the best way to treat individual children who have PDs due to the heterogeneity of this population. Gierut (1998) states that approximately 10% of children have PDs and that this group dominates the caseloads of S-LPs who work in schools. Past therapy approaches have included phonological intervention, core vocabulary, speech/motor control and articulation (Dodd and Brandford, 1999, Stackhouse et al., 2002). Therapy often resulted in improved speech production; however PA and literacy skills usually remained impaired (Gillon, 2005).

Research suggests that PA training improves the literacy skills of children with specific reading difficulties (Stackhouse et al., 2002). Researchers and practitioners have begun to question how PA training might be used in intervention for children with PDs (Stackhouse et al., 2002).

Theoretical assumptions would suggest that interventions addressing the deficient component(s) of the speech processing system will not only help resolve the origin of the expressive PD, but may also improve PA skills and speech production abilities.

Objectives

The primary objective of this review is to critically evaluate the existing literature that examines the effects of PA intervention on PA and speech output abilities of children who have expressive PDs. Secondary objectives are to provide evidence-based recommendations for continued research in this area, as well as clinical implications for future treatment.

Methods

Search Strategy: Computerized databases including ProQuest, InformaWorld, PubMed, Thieme Connect and Communication & Mass Media Complete were searched with the following terms:

[(PD) OR (phonological impairment)] AND [(PA) OR (metaphonological)]

Selection Criteria: The studies selected for this critical review investigated the impact of PA intervention on speech production and PA skills of children with expressive PDs with no concomitant cognitive and/or language difficulties. No limits were set on the geographical location of the studies. Papers including several participants who had concomitant cognitive and/or additional language disorders as evidenced by assessment results conducted at baseline were subsequently discarded (Major & Bernhardt, 1998, Gillon, 2000).

Data Collection: Results of the literature search yielded the following types of articles congruent with the aforementioned selection criteria: randomized (2) and non-randomized (2) clinical trials, and one nonrandomized clinical cohort study (longitudinal and retrospective).

Results

Hesketh et al. (2007) completed a randomized control trial with 42 children with PDs between the ages of 4;0-4;6.

Participants met specific criteria prior to entry of the study and were subsequently assigned to PA intervention or control (language intervention) groups. Participants then received 2-3 30 minute sessions a week for a total of 20 individual sessions. The authors provided a program summary for each intervention approach.

Fisher's Exact test was used to interpret results and revealed significantly greater improvement for the PA intervention group on the phoneme isolation ($p<0.01$), phoneme segmentation ($p<0.01$) and phoneme addition and deletion tasks ($p=0.02$) but not on the alliteration awareness task. The authors noted both groups improved their PCC scores in a similar fashion. The control group made more improvement than the PA group on a story retell task, however this finding needs to be considered with caution as the scores of the control group were lower on this test pre-intervention. Post-intervention measures indicated that there was no longer a significant difference between groups on this measure.

The strengths of this study include the use of recognized standard measures (such as the *Primary and Preschool Inventory of Phonological Awareness*), blinding procedures prior to participant allocation and during post-intervention assessments and adequate reliability for all measures. Despite the study's strengths, weaknesses should be considered when interpreting the findings. An adequate definition of PD and inclusion criteria specifications were provided, however there is concern regarding adherence to the criteria based on presented results. Furthermore, it is unsure whether small sample sizes impacted the study's results, since the authors did not include effect size calculations to indicate the power of the results. The authors mentioned that results should be interpreted with caution due to the low number of children who improved and the wide range of performance variability in the PA intervention group, stating that choice of tests and age of participants may have contributed to variability. Overall, the findings of this paper are suggestive of a positive effect of PA intervention on speech and PA skills.

Hesketh et al. (2000) included 61 children with expressive PDs between the ages of 3;6-5;0 in a nonrandomized clinical trial that compared participants' metaphonological and speech output abilities pre- and post-intervention. Participants met specified criteria before intervention and were placed in PA therapy or articulation therapy (ART) groups. No significant group differences pertaining to pre-intervention assessment results were found. Participants received ten individual therapy sessions. A control group of 59 typically developing peers was also included to control for maturational effects. Three months post-therapy, 47 children from the intervention groups who had not received additional therapy were re-assessed in order to gain a better understanding of the long term intervention effects.

Results of appropriate tests (including ANOVAs and t-tests) indicated that, as a group, children with PDs made significantly more improvement in metaphonological

abilities pre-and post-intervention ($p<0.05$) than the control group but not when the PD group was further subdivided into ART and PA groups. Initially, the control group obtained a significantly higher score on metaphonological tasks than children in the PA and ART groups ($p<0.05$). Post-therapy scores revealed no significant differences between control, ART and PA groups on these tasks suggesting that the PD groups caught up to their typically developing peers regardless of the type of intervention received. The ART and PA groups made significantly more improvement ($p<0.001$) than the control group when comparing pre- and post-therapy PCC scores. No significant difference was found in PCC change between ART/PA groups. Individual probe measures that focused on speech processes indicated the ART group made a significant change in scores ($p<0.05$) compared to the PA group.

Three months post therapy no significant differences between the PA and ART groups for PCC and individual speech probe measure scores were noted; however a slight deterioration between post-therapy assessment at the three month follow-up assessment was noted for both groups. According to their findings, the authors summarized that ART and PA intervention as having a positive impact on metaphonological abilities and speech production regardless of the type of intervention received.

There are several limitations to Hesketh et al.'s (2000) non-randomized study to take into consideration. Information regarding inter-rater reliability, blinding and effect size due to small samples was not included in the article. Furthermore, only 77% of children who had PD, and no typically age-matched controls were included in the three month follow-up; however the authors compared progress made by children with PDs during this time to normal controls. It is unclear where the data for the normal controls during the follow-up originated from. Information pertaining to metaphonological skills was not available at the three-month follow up, since these tasks were not included in the re-assessment. The authors also devised a test pertaining to PA acquisition and subsequently administered it to 33 typically developing children in order to establish acquisition norms. The results of this test are questionable due to the small sample size of participants. Results were then used to test the metaphonological abilities of participants and classify them as having poor or good PA skills during the study. Finally, the PA intervention provided may have underestimated the impact of PA intervention. Only the first four sessions included direct PA tasks, while the remaining six sessions involved perceiving and producing minimal pair contrasts. The importance of this paper is therefore regarded as suggestive.

Adams et al. (2000) completed a nonrandomized control trial with 31 children with expressive PDs between the ages of 3;6-5;0. A control group of 34 typically developing children participated in the assessment portion of the study to control for maturational effects. Participants with PDs

received ten weekly sessions of PA intervention. It is unclear as to whether this study is based on the same research as the paper by Hesketh et al. (2000), as it was written by the same authors and includes the same inclusion criteria, assessment batteries (including the metaphonological test battery the authors created and normed on 33 typically developing children) and intervention procedures as the above article.

Initial assessment results of children who received therapy were categorized into two groups depending on whether they performed well on the metaphonological test battery (GPA) or performed poorly (PPA).

Results of appropriate tests (t-tests and ANOVAs) revealed significant changes in PA task results pre-and post-intervention for both the PA group ($p<0.005$) and the control group ($p<0.05$), with the PA group making significantly more improvement on two of the five subtests (though p values were not provided). Significant differences were not found between GPA and PPA subgroups. Significant changes in PCC scores were also noted for both groups ($p<0.005$) when pre- and post-intervention scores were compared with the PA group improving significantly more ($p=0.001$). It is interesting to note that a significant group difference between GPA, PPA and control PCC scores was noted ($p<0.05$). Specifically, the GPA group made significantly more improvement ($p<0.05$) than the controls on this task, whereas the PPA group did not ($p=0.188$). Overall, the study claims that PA intervention improved speech output and PA skills in children who have PD more than what would be expected in the process of maturation.

Despite the authors' positive conclusions, some factors need to be taken into consideration. Information pertaining to inter-rater reliability and blinding were not included in the article. The use of the same metaphonological assessment as the one found in Hesketh et al.'s paper (2000) in order to categorize children with PD as GPA or PPA is questionable since it was only normed on 33 children and may therefore not be truly representative of typical PA acquisition. The authors do mention the impact the small sample size had on results in the study and note that further research should include more participants. Overall, the importance of this paper is regarded as suggestive.

Denne et al. (2005) included 20 children with predominantly expressive PDs in their randomized control trial. Participants met specified criteria in order to rule out concomitant difficulties and were then divided into treatment or no treatment groups. The treatment group participated in eight weekly one-and-a-half hour group sessions (three members per group) that were conducted by two of the authors. Therapy intervention was based on the Gillon Phonological Training Programme (Gillon, 2000). It is important to note that corrective feedback was provided to participants when speech errors occurred and subsequent opportunities for correct sound production were provided.

Appropriate statistical methods (MANOVAs) were employed in order to compare pre- and post- intervention assessment data. Results pertaining to PA tasks indicated that the treatment and non treatment groups made significant PA gains over time ($p<0.001$), with the treatment group improving significantly more ($p<0.01$). PCC scores used to analyze speech production abilities indicated that both groups made significant gains in this area over time ($p<0.001$). The authors noted that a significant group by time interaction was not observed ($p=0.09$) These results need to be interpreted with caution since the authors noted that initially scores between groups were not the same on this task (pre-therapy scores of the untreated group were higher) and this may have contributed to differences in improvement observed. Finally, reading and spelling scores indicated that both groups made significant improvements in reading ($p<0.01$) and spelling ($p<0.01$) over time; however no significant differences were found when the treatment and non treatment groups were compared. Participants obtained low scores on the non-word reading task but significant improvement was noted for the intervention group ($p<0.05$). Overall, results indicate that PA intervention improved PA skills and non word reading more than what would be expected based on maturation alone, while speech production skills as evidenced by PCC scores and literacy abilities did not.

This study has several strengths including the use of randomization, reliability and blinding procedures. Several limitations need to be taken into consideration including small effect sizes. The authors noted that larger sample sizes may have revealed significant differences in literacy and speech production tasks (Denne et al., 2000). Differences on pre-intervention assessment scores, though not significant, may have also influenced results. The fact that all of the children received previous S-LP assessment(s) and intervention before participating in the study may also have had an impact on results. Furthermore, aspects of the articulation-based approach were included and therefore PA intervention alone should not be credited with the study's findings. The authors noted considerable variation in group and individual performance. Range values could have been included along with group means and standard deviations in order to present a more comprehensive and realistic performance on assessments. Despite these limitations, findings from this study are suggestive that PA intervention improves PA skills.

Finally, Gillon (2005) included 12 children with PDs between the ages of 3;00-3;11 in a nonrandomized clinical trial. Participants received 2-3 blocks of therapy (between the ages of 3 and 5) after meeting inclusion criteria to rule out concomitant difficulties. The number of blocks received depended on the speech needs of each child and therapy consisted of one 45 minute group and one individual session a week. Sessions were administered by the researcher, by a qualified S-LP trained by the researcher or by a trained S-LP student under the

supervision of a qualified S-LP. A control group of typically developing children of the same age was included in order to control for maturational effects. They participated in the assessment portion of the study only. The only significant difference between the two groups at baseline was PCC scores used to measure speech production ($p<0.001$), with the control group obtaining higher scores.

Intervention was influenced by traditional approaches (such as Cycles Phonological Remediation) and focused on improving speech intelligibility, facilitating the acquisition of PA skills at the phoneme level and letter-name and letter-sound knowledge. PA tasks increased in complexity as participants got older.

The author then conducted a nonrandomized retrospective clinical trial when participants were approximately six years of age. The performance of ten children from the original experimental group (PAI) pre-intervention (at approximately three years of age) was compared to that of a control group of children with PDs (PDC) who did not receive PA intervention during preschool/school. Participants were matched between groups for most measures, however the children who received PAI initially had significantly more severe speech difficulties ($p=0.049$).

The author mentioned that these findings should be interpreted with caution since there was no information pertaining to reliability of results in the PDC participant files. Children from the PDC group received previous therapy ranging in length (5-70 individual therapy sessions) and therapeutic approach (metaphon, cycles and oral motor). Both groups completed a (re-)assessment battery that included tasks measuring speech production and PA and literacy skills.

Statistical tests (Wilks' Lambda, ANOVAs and MANOVAs) indicate all children significantly improved over time ($p<0.001$) for rhyme oddity, phoneme matching and letter recognition tasks but not for rhyme and letter recognition. The interaction between assessment time and group for the phoneme matching task was significant ($p<0.05$). Further analysis of this task indicated that the PA group made significantly more improvement from the first-to-second assessment than the control group ($p<0.01$); however this was not the case for subsequent assessments. Standardized PA test performance results were obtained when children approached school entry, indicating no significant group effects ($p=0.754$). Approximately one year later the same test yielded similar results ($p=0.325$), suggesting that PA skills of children with PDs were similar to those of typically developing skills. Scores pertaining to speech production skills indicated that speech performance of the PA group at five years of age was significantly inferior to the control group's performance at study entry when they were only aged 3;05 ($p<0.05$). No significant correlations were found between initial speech production measures (PCC) and performance on PA tasks or between speech production measures at five years of age and PA tasks.

Results from the nonrandomized retrospective clinical trial when participants were approximately six years of age indicated no significant group difference in age, speech production abilities ($p=0.085$) or letter-sound knowledge ($p=0.088$). The PAI group scored significantly higher than the PDC group on PA, word recognition, nonword reading (all at $p<0.001$) and spelling tasks ($p<0.05$), implying that the intervention provided increased skills in these areas.

There are several merits to this study, such as the author discussing sample and effect size impacting results. Validity and reliability procedures were also employed. Several factors need to be taken into consideration when interpreting results. During the first part of the study, the author used different tests to measure PA skills at different time periods even though the second test included the age ranges from the beginning of the study. The use of this test throughout the study would have allowed a better comparison of results. Intervention provided was based on an integrated approach (Gillon, 2005), where PA tasks were included among other activities and therefore PA intervention alone cannot be attributed with the findings. Reliability of PDC assessment scores at three years of age is also questionable. The results of this paper are therefore suggestive.

Discussion

According to the Oxford Centre for Evidence-Based Medicine Levels of Evidence (Phillips et al., 2001, as cited in Dollaghan, 2007) all of the studies included in this review are rated at evidence level 2 with the exception of Hesketh et al. (2007) which is rated at evidence level 1. Overall, results obtained from the articles reviewed varied considerably but generally reported that PA intervention had improved both the PA and speech production skills of children with expressive PDs. This may in part be due to several factors including differing intervention content and research methods.

Intervention Content

Hesketh et al. (2007) included direct PA intervention tasks only, while Hesketh et al. (2000) and Adams et al. (2000) included a mix of direct and indirect PA therapy tasks. Other studies incorporated tasks that were influenced by other therapeutic approaches. Gillon's study (2000) noted that a Cycles Phonological Remediation Approach was included in therapy, while Denne et al. (2005) created an intervention program that was influenced by an articulation approach.

Length and type of intervention also varied across studies. Hesketh et al. (2007), Hesketh et al. (2000) and Adams et al. (2000) provided ten individual sessions, whereas Denne et al. (2005) provided 8 weekly one-and-a-half hour group sessions. Participants in Gillon's study (2005) received both group and individual sessions for duration of two-to-three therapy blocks.

Research Methods

Several variations in methodology are present across

papers. Age is an important factor to consider since PA skills are refined over time (Hesketh et al., 2007) and would therefore hypothetically influence intervention content. Participants' ages ranged from 3;0-3;11 (Gillon, 2005) to 5;0-5;7 (Denne et al., 2005).

All studies specified that participants did not receive additional S-LP services for the duration of the study. Some studies only accepted participants who had not yet received S-LP therapy (Hesketh et al., 2000, Adams et al., 2000 & Gillon, 2005), while Denne et al.'s study (2005) included participants who had already received services. Though not explicitly stated, Hesketh et al. (2007) also accepted participants who had also received therapy. Performance may have been influenced by previous therapy interventions (or lack thereof).

The type of control groups also varied amongst studies. Gillon (2005) and Adams et al. (2000) included age-matched typically developing controls, whereas Hesketh et al. (2007) and Denne et al. (2005) included controls who had PDs. Hesketh et al.'s study provided language stimulation to the control group, whereas Denne et al.'s study provided no treatment. Hesketh et al.'s study (2000) included three groups: a PA intervention group, an articulation therapy group and a control group of typically developing age-matched peers.

The number of participants receiving PA intervention also varied from one paper to the next from twelve to thirty-one children. Overall, small sample sizes may have had an impact on the results obtained. Some authors commented on this fact (Adams et al., 2000, Denne et al., 2005 & Gillon, 2005), while others did not (Hesketh et al., 2007 & Hesketh et al., 2000)

Additional factors need to take into consideration when working with this population include the fact that factors influencing phonological abilities may in turn tax attention, memory and processing skills; children with more severe expressive phonology difficulties are at risk for problems with both PA and literacy (Denne et al., 2005). These aspects were not included in this review.

Conclusion

The above studies indicate that PA intervention for children who have expressive PDs is beneficial and may be as beneficial as other S-LP interventions. However, areas of improvement and the extent participants improved in these areas (more specifically speech production and PA) due to PA intervention alone varied across studies. Given the limitations of the existing literature presented, future research that ensures adequate research methods (including sufficient sample sizes, adherence to inclusion criteria, blinding and reliability measures) and age-appropriate PA intervention is needed. It would also be interesting to compare PA intervention only to traditional approaches (articulation and/or phonological therapy for example) and then to an integrated PA plus traditional therapy intervention, while including typically age-matched controls. This would allow researchers to compare how performance for each individual approach, as well as

integrated approaches fair compared to what is expected due to maturation.

Clinical Implications

Despite the aforementioned limitations of these studies, the evidence presented in this review indicate that children with expressive PD's benefit from PA intervention. PA tasks should therefore be considered when planning intervention for this population.

References

- Adams, C., Nightingale, C., Hesketh, A. & Hall, R.(2000). Targeting metaphonological ability in intervention for children with developmental phonological disorders. *Child Language Teaching and Therapy, 16(3)*, 285-299.
- Denne, M., Langdown, N., Pring, T. & Roy, P. (2005). Treating children with expressive phonological disorders: does phonological awareness therapy work in the clinic? *International Journal of Language and Communication Disorders, 40(4)*, 493- 504.
- Dollaghan, C. A. (2007). *The handbook of evidence- based practice in communication disorders*. Baltimore: Paul H. Brookes Publishing Co.
- Gillon, G. (2005). Facilitating phoneme awareness development in 3- and 4-year-old children with speech impairment. *Language, Speech and Hearing Services in Schools, 36(4)*,308-324.
- Gillon, G. (2000). The efficacy of phonological awareness intervention for children with spoken language impairment. *Language, Speech and Hearing Services in Schools, 31*, 126-141.
- Hesketh, A., Dima, E. & Nelson, V. (2007). Teaching phoneme awareness to pre-literate children with speech disorder: a randomized controlled trial. *International Journal of Language and Communication Disorders, 42(3)*, 251-271.
- Hesketh, A., Adams, C. & Nightingale, C. (2000a). Metaphonological abilities of phonologicallydisordered children. *Educational Psychology,20(4)*,483-498.
- Hesketh, A., Adams, C., Nightingale, C.& Hall, R.(2000b). Phonological awareness therapy and articulatory training approaches for children with phonological disorders: a comparative outcome study. *International Journal of Language and Communication Disorders,35(3)*, 337-354.
- Major, E. & Bernhardt, B. (1998). Metaphonological skills of children with phonological disorders before and after phonological and metaphonological intervention. *International Journal of Language and Communication Disorders, 33(4)*, 413-444.
- Otaiba, S.A., Puranik, C., Ziolkowski, R. & Montgomery, T. (2009). Effectiveness of early phonological awareness interventions for students with speech or language impairments. *The Journal of Special Education, 43(2)*, 107-128.
- Stackhouse, J., Wells, B., Phil, D., Pascoe, M., & Rees, R. (2002). From phonological therapy to phonological awareness. *Seminars in Speech and Language 23(1)*, 27-42.