Critical Review:
Effectiveness of Combining Peer-Mediated Intervention (PMI) with Speech Generating Device (SGD) Intervention for Children with Autism Spectrum Disorder (ASD)

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This is a critical review examining the evidence of the efficacy of combining peer-mediated interventions (PMI) with speech generating device (SGD) interventions for children with Autism Spectrum Disorder (ASD) who are non-verbal or minimally verbal. A total of seven studies were selected and reviewed. Study designs include: single subject design (multiple baseline design) and randomized control trial design. Overall, the study findings show suggestive evidence that PMI in combination with SGD intervention, results in improved communication and social engagement in children with ASD.

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that is characterized by impairment in communication skills and social interactions (Campisi et al., 2018). Individuals with ASD also display restricted repetitive pattern of behaviours, interests, or activities (Campisi et al., 2018). The prevalence of ASD among children and youth (5-17 years old) across Canada in 2015 was 1 in 66 (Public Health Agency of Canada, 2018). Because of the range of symptoms, deficits and abilities an individual with ASD may display, it is termed a "spectrum" disorder as abilities and deficits may lie anywhere along a spectrum (Public Health Agency of Canada, 2018).

Augmentative and Alternative Communication (AAC) is an effective method to allow for individuals with ASD to communicate in alternative manners. Speech Generating Device (SGD) is a type of AAC device that replaces or augments speech communication through the use of digitized and/or synthesized speech for non-verbal or minimally verbal individuals (Boesch et al., 2013).

Peer-mediated intervention (PMI) is used to increase and improve social skills in children with ASD, by training typically developing peers to model social initiations, responses, and interactions (Chang & Locke, 2016). Peer mediated intervention (PMI) allows peers to be the intervention agents (Chan et al., 2009). This may be beneficial for children with ASD because it provides opportunity for children with ASD to practice their communication skills and social interactions with peers and be included in their social settings (Chan et al., 2009).

Although there is a number of research supporting the use of SGDs and PMI separately, there is less literature on increasing augmented communication through the use of peer-mediated approaches or the potential benefits of PMI on social communication and engagement for children with ASD who use a SGD. As Thiemann-Bourque et al. (2017) suggested, combining PMIs with SGD interventions may support their communication and social engagement by teaching peers how to effectively use the SGD, how to respond appropriately to the communicative acts (CA) of those using a SGD, and encourage SGD use across various settings, allowing for greater generalization (Thiemann-Bourque et al., 2017).

Objectives

The objective of this study is to critically evaluate existing literature regarding the effectiveness of incorporating PMI with SGD intervention for children with ASD, and whether that results in improved communication and social engagement as compared to SGD intervention alone.

Methods

Search Strategy

Online databases including Medline, PubMed, CINAHL and PsychINFO, were used to find journal articles relating to the topic of interest. Keywords used for database search included the following: (speech generating device) AND (autism OR autism spectrum disorder) AND peer.

Selection Criteria

Studies selected for inclusion in this review were required to involve the implementation of PMI along with SGD intervention for children with ASD under the age of 12;11 (years;months). The children with

ASD included in the studies also must be non-verbal or minimally verbal in order to be candidates for AAC devices, specifically a SGD.

Data Collection

The literature search resulted in seven articles that were aligned with the selection criteria mentioned above. The articles included 6 single subject designs (multiple baseline design) and 1 randomized control trial design.

Results

Trembath et al. (2009) conducted a multiple baseline design study comparing the effectiveness of peer-mediated naturalistic teaching without and with a SGD. Participants included three children with ASD between the ages of 3-5 years, and six typically developing preschool-aged children, aged 3-5 years. Data was collected in both baseline and intervention phases during 10-minute play activities in the classroom. Two peer-mediators were randomly assigned to the two conditions for each child with ASD and were trained for two 20-minute sessions on consecutive days. Training included the use of the *show, wait and tell* procedure, as well as the use of the SGD. Generalization probes were given during snack time in the classroom. The methods employed in the study for each phase were somewhat described, allowing for replication in the future.

Results showed that both conditions resulted in statistically significant increase in communicative behaviours per minute in all three children, but maintenance varied. When comparing the two conditions, two out of three children had more communicative behaviours per minute when peer-mediation was combined with SGD. However, one child with ASD participated in less sessions because of the display of self-injurious behaviour, and this was not considered in the statistical analysis. Interobserver agreement (IOA) was completed with an overall agreement among the observers but it was not indicated whether observers were blind to the purpose of the study.

Overall, this study presents somewhat suggestive evidence of increased communicative behaviours when combining peer-mediated instruction with SGD intervention. Statistical analysis was done based on the number of communicative behaviours per minute and the researchers provided the criteria for what defined a communicative behaviour. However, no standardized assessments or measures were used. Other weaknesses included a very small sample size and not controlling for the number of prompts provided by researchers during the intervention phase.

Trottier et al. (2011) conducted a multiple baseline design study to compare whether having peer-mediated training increases spontaneous appropriate communicative acts (CA) of students with ASD who use SGDs, as compared to having no peer training or support. Participants included two students with ASD, ages 11;4 and 11;1, as well as three typically developing peers (confederates) for each student with ASD (12 or 11 years old). Inclusion criteria for both the students with ASD as well as the confederates were included. Games used as the intervention activities were tailored to the individuals' interests or abilities, but they were all similar in length of time and number of play turns. Confederate training occurred once for 15 minutes, which included training on SGD use and using prompts to encourage SGD use by the student with ASD. The criteria for what constituted a CA was provided and the CAs were also coded based on whether it was prompted or spontaneous, and its level of appropriateness. The methods employed for each phase were clearly described, allowing for replication in the future.

Results provided evidence that confederates were trained successfully to support the use of a SGD by a student with ASD. Results also showed that there was an overall increase in spontaneous CAs as well as more appropriate CAs when PMI was combined with SGD, as compared to baseline (only SGD). However, with the small sample size and only one showing significant change, a functional relationship could not be established. Treatment fidelity check was completed and showed strong adherence to the training protocol. IOA was also completed by an observer who was blind to the purpose of the study and showed strong agreement.

Overall, this study presents suggestive evidence of increased spontaneous and appropriate CAs when interventions combined PMI with SGD. Although there was no control for the number of prompts per session, this study documented and coded the frequency of prompts given as part of the analysis. Statistical analysis and visual inspection of graphic results were used to analyze the data, but no standardized assessments or protocols were used. The study also had a very small sample size.

Strasberger and Ferreri (2014) conducted a multiple baseline design study to observe whether having a peer-mediated intervention increases more sophisticated communicative behaviours and socialization in children with ASD using iPod-based

SGDs. Participants included four children with autism, ranging from 5;8 to 12;11 years old, as well as five typically developing peers, ranging between 7-13 years old. Inclusion criteria for both participants with ASD and without disability, was included. Peer assisted communication application (PACA) training was specifically used as the peer training component. Each peer participant had a one-on-one training session where they were taught how to use the iPod-based SGD and the responsibilities as the communication partner. Frequency data was collected based on independent and prompted mands (i.e. requests) and responses. For example, coding of participants' responses to questions of "what do you want" and "what is your name?"

Results showed that there was some evidence that having peer-training led to improvement in children's ability to request (mand) and respond independently. According to a rating scale provided to teachers, it showed overall feelings of the intervention being acceptable and effective. However, no statistical analyses were completed or indicated, thus it was not possible to determine whether changes, if any, were statistically significant. Results also showed large variability among the participants with ASD. IOA was completed and showed strong agreement throughout all phases of the study but it was not indicated if the secondary investigator was blinded to the purpose of the study.

Overall, this study presents equivocal evidence regarding improvements in independent mands and responses, and overall communication abilities. Observed results were based on qualitative comparison but there was a lack of standardized or validated methods of statistical analysis. There were also no standardized assessments used as a measurement outcome. Weaknesses of the study includes small sample size, and inconsistencies in procedure. For example, not all participants with ASD completed the projected PACA phases in its entirety and did not complete the generalization and maintenance phases. The age range of the participants included in the study was also quite substantial, which may have impacted the results of the study in ways that were not planned for or as expected.

Tan and Alant (2018) conducted a A-B single subject design to observe if having peer-mediated intervention supported a student with ASD's use of a SGD, both in terms of frequency and purpose, during mathematics activities. Participants included two students, both 7 years old, one with ASD and one without disability (peer). There was one peer training session that lasted for approximately15 minutes. The peer was trained to use the SGD and to encourage the use of the SGD by the student with ASD. The overall duration of the baseline, peer-orientation and intervention phases occurred within a 2-month period, where participants met two or three times per week for sessions lasting between 5 and 13 minutes. The primary data collected throughout each phase of the study, was the CAs displayed by the student with ASD, and were calculated based on the rate per minute. The CAs were coded based on whether they were prompted or spontaneous as well its appropriateness.

Results showed positive outcomes on social interactions as a result of the PMI combined with SGD intervention. There was an increase in the student with ASD's overall CAs, spontaneous CAs and relevant CAs, and the achieved levels were maintained during the follow-up probes and even increased. This indicated some lasting effect from the intervention. Data was analyzed through visual inspection of graphs and appropriate statistical analyses to compare means between and within phases. Both an IOA and procedural fidelity check was completed, which showed strong agreement and high level of procedural fidelity; however, it was not indicated whether the observers were blinded to the study's purpose.

Overall, this study presents somewhat suggestive evidence that implementing a PMI with SGD intervention may help facilitate social interactions with others for students with ASD, by increasing the level of CAs, both in its spontaneity and relevance. However, this study only had two participants, with only one being a student with ASD, thus the results must be interpreted with caution. This study also looked at interactions during mathematics activities only, so it would be difficult to generalize it to all academic or social settings.

Thiemann-Bourque et al. (2017) conducted a multiple baseline design to look at the effects of peer-mediated intervention on SGD use for preschoolers with ASD. Participants included 3 preschoolers with ASD between the ages of 4;5 to 4;7, as well as three typically developing peers between the ages of 4;5 to 4;6. Baseline and intervention activities included various play activities, while generalization probes were given during snack time in the classroom. Peer training took place during 30-minute sessions for 3 days. Peers were taught to be responsive communicators and play partners using two different social intervention methods. Measures of the study included the rates of CAs, communication mode and function, reciprocity, and engagement with peers. Description of the study procedure as well as coding

procedure were described, allowing for replication in the future.

Results showed that all three children with ASD showed improvement in higher levels of CAs. The statistical analysis showed moderate effect sizes for all three participants with ASD. The total number of reciprocal exchanges between the children with ASD and their peer partner appeared to improve as well but only one participant with ASD showed ideal balance in CAs between initiations (IN) and responses (RS). Generally, all three children with ASD improved in their social engagement with the onset of the peer-mediated SGD intervention. Analyses of data included visual analysis of graphed data, and statistical analysis to provide a quantitative measure of the degree of change between the phases.

Overall, this study presents suggestive evidence that having PMI with SGD use for preschoolers with ASD is beneficial in such a way that improves the quantity and quality of CAs. This study expanded the collected measures (e.g. reciprocity, engagement, etc.), which allowed for a broader scope and better picture of overall communication skills and quality of social interactions. However, this study had a small sample size and did not look at generalization effects. This study also added two conditions (preferred toys and snack) to the intervention phase but did not evaluate it within an experimental design. Therefore, results from the added contexts should be taken with caution.

Thiemann-Bourque et al. (2018) conducted a multivariate randomized control trial design to look at the effects of incorporating a peer-mediated approach with a SGD intervention, and whether that will lead to better communication outcomes and more balanced exchanges between children with ASD and peer partners. Participants included 45 children with ASD, between the ages of 2;11 and 5;0, as well as 95 peers without disability between the ages of 3;4 and 5;1. Inclusion criteria for both the children with ASD and the peer partners were included. Participants were randomly assigned to either the experimental group (PMI with SGD) or the control group (SGD; "business-as-usual"). Peer-mediated training took approximately 80 minutes over 2-3 days. Peers were taught how to use the SGD, and how to be responsive play and communication partners. Common preschool activities (e.g. puzzles and matching activities) were used as intervention probes. Generalization probes used included snack time, motor activities, etc.

Results showed that for the treatment group (PMI and SGD together), there was significant increases in intentional communication for both communication partners, as compared to the control group. These children were also shown to generalize and maintain these skills. Large effects were found for children with ASD and trained peers without disabilities, suggesting statistically significant differences between the treatment and control group. Those in the treatment group showed more balanced proportions of initiations (IN) and responses (RS). Through a poststudy survey, it showed high degree of satisfaction by school staff, and improvements in social communication behaviours were also reported by teachers and parents of the participants. The study included the use of two standardized, norm-referenced tests, interobserver agreement checks by blinded secondary coders, treatment fidelity checks, and statistical analyses to examine individual growth over time.

Overall, this study presents highly suggestive evidence that incorporating PMI with SGD interventions may lead to better communication outcomes and social interactions. This study employs a large sample size and a well-designed randomized control trial study. Clear description of the study's method and procedure were included, allowing for replication in the future. However, although the participants with ASD were all non-verbal or minimally verbal, they varied in skill level for symbol selection in the beginning of the year, which may have contributed to observed differences in the use of the SGD during the intervention phase. Also, when standardized assessments were administered postintervention, the researchers were not blinded to group assignment, which may have introduced some potential bias.

Bourque and Goldstein (2020) conducted a multiple baseline design to further analyze the communicative acts observed from the previous study conducted by Thiemann-Bourque et al. (2018). They sought to examine the individual communicative differences that were found in the children with ASD who were placed into the peer training and SGD intervention combined group and showed a subsequent increase in CAs. Participants included 6 preschool children with ASD, ranging from ages 3;7 to 5;1, as well as 15 peers without disabilities, ranging between ages 3;7 to 5;0. The inclusion criteria for both the children with ASD and the typically developing peers were included. Peer partner SGD training took place over three 20- to 30-min sessions and were taught responsive play and communication skills. Social activities used during intervention included similar activities as those in preschool classrooms (e.g. pretend-playsets), while generalization sessions occurred in a different location (e.g. snack). Coding of child and peer communication behaviours were completed by the first author and

project coordinator as the primary coder; therefore, was not blind to the goals of the study.

Results showed that the children with ASD showed more balanced INs and RSs when SGD use was combined with peer intervention. It also showed that the children with ASD demonstrated a wider and improved use of communicative modalities and functions. Judges who were unfamiliar with the study goals reported positive changes in the quality and quantity of child-peer social behaviours. Analyses included visual inspection of graphical displays via. bar graphs, as well as statistical analyses to describe the differences between phases. Further statistical analyses were completed to measure changes in the rate of CAs for child and peer behaviours between baseline and treatment. IOA checks were completed by a secondary coder who were blind to the goals of the study and showed an overall agreement throughout the study.

Overall, this study presents suggestive evidence that peer-mediated interventions combined with SGD use may result in improvement in the amount of exchanges and quality of communicative interactions for preschool children with ASD. This study served to further analyze the individual differences found in the study of Thiemann-Bourque et al. (2018). Appropriate statistical analyses were completed; however, the sample size employed by the study was very small, and the primary coder was not blind to the goal of the study.

Discussion

Altogether, the seven articles selected to be reviewed, showed suggestive evidence that peer-mediated intervention or instruction in combination with speech-generating device intervention, results in improved communication and social engagement. This manifested mostly in overall increased rate of communicative acts that were more appropriate and spontaneous, as well as improved balance in initiations and responses between children with ASD and their trained peers.

However, small sample sizes were an inherent weakness for many of the studies. Most studies reported having a sample size of six or less and there was only one study using a randomized control trial design with a larger sample size. The reviewed studies collected data and measured outcome based on the rate of communicative acts, but there was a lack of consistency across the studies of how communicative acts were defined and coded for, and most studies did no employ a standardized method of measuring outcome (e.g. standardized and norm-referenced assessments). As well, peer mediated intervention or instruction varied among the studies, such that there were no standardized or established method in doing so. For many of the studies, there was a lack of indication of randomization for peer partner allocation to children with ASD. These inconsistencies may have impacted the similarities or differences observed throughout the reviewed studies.

Clinical Implications

For children with ASD who are non-verbal or minimally verbal, introducing the use of a SGD as an AAC strategy in combination with peer-training on how to use and communicate with someone who uses SGDs, may lead to better communication outcomes and social engagement, as suggestive evidence has been found through this review. Therefore, for children with ASD who are candidates for a SGD, it may be beneficial to provide some form of training for their peers, so that better social communication and interactions can be achieved in their schools, daycares, or other social environments the children are situated in.

Generalization and maintenance of these effects have not been well studied, and results from the reviewed studies above, were variable. Therefore, further studies looking into generalization and maintenance effects will be needed. As well, further studies are needed to look at the role of Speech-Language Pathologists in providing SGD training for both the children with ASD and their peers, and what that would look like implementing it into children's natural environments, like their classrooms, daycares, clubs, etc.

References

Boesch, M.C., Wendt, O., Subramanian, A. and Hsu, N. (2013). Comparative Efficacy of the Picture Exchange Communication System (PECS) versus a Speech-Generating Device: Effects on Social-communicative Skills and Speech Development. *Augmentative and Alternative Communication, 29(3)*, 197-209.

Bourque, K. S. and Goldstein, H. (2020). Expanding Communication Modalities and Functions for Preschoolers With Autism Spectrum Disorder: Secondary Analysis of a Peer Partner Speech-Generating Device Intervention. *Journal of Speech, Language and Hearing Research, 63,* 190 – 205.

Campisi, L., Imran, N., Nazeer, A., Skokauskas, N. and Azeem, M.W. (2018). Autism spectrum disorder. *British Medical Bulletin, 127*, 91-100.

Chan, J.M., Lang, R., Rispoli, M., O'Reilly, M., Sigafoos, H. and Cole, H. (2009). Use of peer-mediated interventions in the treatment of autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 3*, 876-889.

Chang, Y.C. and Locke, J. (2016). A systematic review of peer-mediated interventions for children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 27,* 1-10.

Ganz, J.B. (2015). AAC Interventions for Individuals with Autism Spectrum Disorders: State of the Science and Future Research Directions. *Augmentative and Alternative Communication, 31(3)*, 203-214.

Public Health Agency of Canada. (2018). *Autism Spectrum Disorder among Children and Youth in Canada 2018.* https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/autism-spectrum-disorder-children-youth-canada-2018/autism-spectrum-disorder-children-youth-canada-2018.pdf.

Strasberger, S. K. and Ferreri, S.J. (2014). The Effects of Peer Assisted Communication Application Training on the Communicative and Social Behaviours of Children with Autism. *Journal of Developmental and Physical Disabilities, 26,* 513 – 526.

Tan, P. and Alant, E. (2018). Using peer-mediated instruction to support communication involving a student with autism during mathematics activities: A case study. *Assistive Technology, 30(1)*, 9 – 15.

Trembath, D., Balandin, S., Togher, L. and Stancliffe, R. J. (2009). Peer-mediated teaching and augmentative and alternative communication for preschool-aged children with autism. *Journal of Intellectual & Developmental Disability, 34(2),* 173 – 186.

Thiemann-Bourque, K., Feldmiller, S., Hoffman, L. and Johner, S. (2018). Incorporating a Peer-Mediated Approach Into Speech-Generating Device Intervention: Effects on Communication of Preschoolers With Autism Spectrum Disorder. *Journal of Speech, Language and Hearing Research, 61*, 2045-2061.

Thiemann-Bourque, K. S., McGuff, S. and Goldstein, H. (2017). Training Peer Partners to Use a Speech-Generating Device With Classmates with Autism Spectrum Disorder: Exploring Communication Outcomes Across Preschool Contexts. *Journal of Speech, Language and Hearing Research, 60,* 2648 – 2662.

Trottier, N., Kamp, L. and Mirenda, P. (2011). Effects of Peer-Mediated Instruction to Teach Use of Speech-Generating Devices to Students with Autism in Social Game Routines. *Augmentative and Alternative Communication, 27(1),* 26 – 39.