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Family-Involved Clinical AAC Intervention for a Chinese Child with Autism Spectrum Disorder

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Abstract

Background: Various studies support the benefits of Augmentative and Alternative Communication (AAC) intervention for communication and language development in children with autism spectrum disorder (ASD). However, to date, limited research evidence has focused on AAC intervention for language development using high-technology AAC systems for Chinese children with autism.

Aims: This clinical case study aims to illustrate the potential of applying AAC intervention using an SGD to increase gains in expressive language for a Chinese-speaking child with autism in the home environment with family involvement as a critical feature of treatment.

Methods: A 6-year-old child with ASD participated in this case study. The child received an AAC intervention, which was conducted with a high-technology AAC device and aided language modeling. The intervention was delivered by the child's mother and grandmother while supported by the speech-language pathologist (SLP) in his home. The child was unable to receptively identify pictures of common objects and actions or follow one-step directions in spoken Mandarin Chinese (MC). The child's attempted verbalizations in MC were unintelligible. He showed the intention to communicate using vocalization, gestures, facial expression, or challenging behaviors (i.e., hitting or pinching others) to receive what he desired (i.e., food, toys).

The clinical case study adopted a multiple-baseline design to analyze the intervention effect across communication partners. The intervention materials included a 7-inch touchscreen device and twenty-five target words. These words consisted of a variety of parts of speech (e.g., verbs, pronouns, determiners), core vocabulary, and the client's communication gestural attempts and preferences (e.g., want, play, eat, drink, chocolate, cookie, video). Baselines were collected by introducing an AAC system to the child without teaching the child to use the device. The intervention consisted of two sixty-minute sessions per week (20 minutes per communication partner) over 17 sessions per partner (including baseline and intervention). A least-to-more prompting hierarchy was used to gradually assist the child in selecting words on

the AAC system during the intervention phase. All communication partners provided aided language modeling by selecting the target words on the AAC system. The mixed model trajectory analysis demonstrated that curvilinear improvement of intentional communication using the AAC device occurred with each communication partner.

Results: The results showed the large effect sizes of intentional communication using an AAC device. Positive outcomes were intentional communication using an AAC device and spontaneous speech monitored as the number of words and mean length of utterance. The family's satisfaction was positive.

Conclusion: The study showed that the language-based AAC intervention protocol incorporating the use of a high-technology AAC system demonstrated the effect of facilitating the gains in communication skills and language development for the child. The outcomes observed across caregivers and the SLP also supports the importance of the train-the-family training and family-implemented intervention. Family values and preferences influencing clinical decisions regarding intervention are discussed.

Keywords: augmentative and alternative communication, family-implemented, mixed model trajectory analysis, chinese, autism & other pervasive developmental disorders

1. Introduction

Augmentative and Alternative Communication (AAC) intervention using speech generating devices (SGDs) to represent language has been implemented for enhancing the communication of children with Autism Spectrum Disorders (ASD) who have limited or no speech (Schlosser & Blischak, 2004; Sigafoos, O'Reilly, Seely-York, & Edrisinha, 2004). Various studies support the benefits of AAC intervention for communication and language development in children with ASD (Olive et al., 2008; Schepis, Reid, Behrmann, & Sutton, 1998; Romski & Sevcik, 1996; Romski et al., 2010). However, to date, very few published studies (Chen et al., 2015) have focused on AAC intervention using an SGD for the millions of Chinese children with ASD (Sun et al., 2013; Wang, 2015). Despite a clear potential for similar outcomes in Chinese-speaking children, the implementation of SGDs for this population lacks the external evidence necessary for determining the suitability of treatment and expected outcomes. In addition, studies have shown positive outcomes from parent-implemented AAC intervention for children (Bruno & Dribbon, 1998; Kent-Walsh, Binger, & Hasham, 2010; Romski et al., 2011). However, these previous studies required parents to receive training in advance. This requirement is not practical in daily clinical practice because of time and resource restrictions of either the parents, the clinician or both parties. How to incorporate the family members in the treatment in a feasible and economical manner would be a solution. Clinical studies are needed to illustrate potential data-driven recommendations to fill the gaps in the evidentiary base for Chinese speakers with ASD, their parents, and clinicians.

A systematic review of AAC treatment studies for children with developmental disorders in Taiwan found that spontaneous speech and language development milestones such as word usage have not been included as outcome measures (Wu et al., 2011b). In addition, AAC treatment without voice output technology (a.k.a low technology AAC), remains more practical than treatment incorporating SGDs in Taiwan (Wu et al., 2014). AAC intervention using SGDs, however, has reported no harm and might facilitate speech improvement for children with developmental disabilities, including ASD (Millar, Light, & Schlosser, 2006; Romski & Sevcik, 2005; Schlosser & Wendt, 2008). Although results from previous AAC studies showed AAC interventions' advantages in communication, language and speech improvement, Chinese families expect their children to speak rather than to rely on AAC intervention or SGDs based on the authors' clinical observation. The observation echoes previous studies showing that families expressed concerns about the stigma associated with the use of these systems (Parette, Chuang, & Huer, 2004). Given that family background, beliefs and values are key factors to take into consideration in designing AAC intervention (Parette, Chuang, & Huer, 2004; Soto & Yu, 2014), incorporating SGDs to support gains in verbal skills may help balance treatment goals with parental and cultural emphases on natural speech.

Family involvement has been regarded as an essential role in language treatment for children using AAC (Romski & Sevcik, 2005; Sigafoos, 1999; Starble, Hutchins, Favro,

Prelock, & Bitner, 2005). Parent-led AAC intervention also has demonstrated positive outcomes (Bruno & Dribbon, 1998; Kent-Walsh, Binger, & Hasham, 2010; Romski et al., 2011). However, the previous studies were conducted with experimental controls, and parents usually received several hours of training before the intervention started. For example, Kent-Walsh et al.(2010) provided a 2.0~ 2.5-hour training to the parents before the intervention started. However, this type of protocol is not practical in daily clinical practice. In clinical practice, typically parents are not provided such training due to time and resource restrictions for two reasons: 1) the clinician is unable to cancel therapy sessions to provide training, and 2) parents cannot take off work or find childcare to attend several hours to training. Clinicians only have access to parents when they bring their children to clinics. Occasionally, parents are invited into the clinic room to observe the treatment session, but evidence on parents as SGD trainers in the treatment has not been published to support using treatment time for parent training. Hypothetically, cooperating with parents to execute AAC intervention may benefit the development of communication and language capabilities for a child with ASD. However, the effect of involving families in daily clinical practice, and any differences in results between family members and SLPs are unclear.

Therefore, the clinical case study aimed to answer the following research question: does implementation of an AAC intervention incorporating an SGD result in increases of vocabulary productions and the mean length of utterance when different family members were involved in the treatment sessions?

2. Methods

2.1 Participants

John (pseudonym), a 6-year and 3-month old Chinese boy, diagnosed with ASD, was referred to the clinic for potential Chinese speech-language pathology services. His mother was a high school teacher, and his grandmother was a retired elementary school teacher in China. Both were John's primary caregivers. They were Chinese speakers with limited or no English skills. John's mother reported that John received speech-language treatment focusing on developing speech (articulation) in China before they moved to the United States (U.S.). However, his speech had not improved, and his speech output was limited to vocalizations and verbal approximation. Mother also reported that John had no hearing or visual impairments. Meanwhile, John responded to sounds, music, and speech at conversational levels and tracked auditory and visual stimuli of interest. He would turn his head to the direction of various auditory stimuli or visual stimuli within his range of vision. He smiled, and/or clapped his hands as expressions of pleasure or to gain attention. Per parent report, John was diagnosed with ASD in China before the family moved to the U.S., and he also received the same diagnosis at the age five at the Children's Hospital in Pittsburgh, PA. He was reported to have severe intellectual

disability, but no formal assessments had been carried out due to his primary language input of Chinese and his severe speech and language limitations. John attended a local special education kindergarten where English was the instructional language. He used vocalization, gestures, and facial expression to communication with family members.

At the start of clinical services at our clinic, John had limited vocalizations, no intelligible spoken words, no spontaneous verbal language or spontaneous, novel utterance generation (SNUG; Hill 2010) during the evaluation. The observation of no spoken intelligible Chinese or English words was verified by a family report, although mother felt he was attempting to "say words." He had not acquired any functional English as a second language. Informal dynamic assessment strategies showed that John had acquired object permanence and cause-effect. To characterize John's language skills, we administered a Chinese standardized test: Revised Language Disorder Assessment for Preschoolers (Lin et al., 2008). He was unable to complete the Chinese standardized assessment due to his uncooperative behaviors and lack of attention and focus to tasks. Informal administration of the Test of Early Communication and Emerging Language (Huer & Miller, 2011), and the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997) were completed in Chinese along with observation in his home environment and parental interview.

Results of our review of available records and our current evaluation indicated that his receptive and expressive language fell within a 10 to 18 months range for a typically developing child (Paul, 1997). He could receptively identify pictures of common objects and actions, and follow one-step directions in spoken Chinese or English. His few attempted verbalizations in Chinese were unintelligible to unfamiliar listeners. He did not show attempted verbalizations in English. However, he showed an intention to communicate to meet basic needs using vocalization, gestures, and facial expression. John's ability to point to graphic symbols and to grab real objects to hand to the communication partner suggested his fine motor function was capable of learning to use an SGD with graphic symbols on the display. He also could hit targets on a touch screen display turn a play-based activity. In conclusion, John's language performance fell within the illocutionary (using gestures or vocalization to communicate intentionally) to locutionary (start to use real words to communicate intentionally) stage of language acquisition (Bates, 1976). In addition, John could be considered to be emerging into the pragmatic-semantic transition which means he had started to use his vocalization and few attempted verbalizations (word approximations in Chinese) to demonstrate communicative intent (Hill, 2009; Paul, 1997).

2.2 Setting

All baseline and AAC intervention sessions were conducted in the living room at John's home, because it was a natural communication environment for John and his family. The study was integrated into daily routine activities such as book reading, playing with toys, coloring pictures, and snack time. Mother and grandmother were taught to use the SGD as

communication partners within the intervention sessions. Chinese was used as the instructional language in treatment because: 1) John responded to spoken Chinese instead of English; 2) Chinese was the primary language used at home; and 3) both mother and grandmother had very limited English proficiency in implementing the treatment strategies in English.

2.3 Materials/Equipment

A 7-inch prototype SGD consisting of a 32-location touchscreen display with single meaning icons and Chinese digitized speech was used in the study (SpringBoard Lite from the Prentke Romich Company served as the hardware). The primary language components of the SGD consisted of core (high frequency) and extended/fringe (low frequency) vocabulary based on Chinese high-frequency vocabulary list established by Chen, Hill, & Chen (2009). Core vocabulary is used across populations, environments, and contexts, and is important for supporting language competence (Banajee, Dicarlo, & Buras Stricklin, 2003; Marvin, Beukelman, & Bilyeu, 1994). In contrast, fringe vocabulary is used for specific contexts or personalized use (Beukelman & Mirenda, 2013). Vocabulary used in the intervention phase was based on core vocabulary consisting of a variety of parts of speech (i.e. verbs, pronouns, determiners) and the client's high-frequency early communication gestural attempts and preferences (e.g. want, play, eat, drink, chocolate, cookie, video).

Single meaning icons were used on the display, and each icon represented one word/meaning (i.e., the icon with a person pointing to himself with his index finger means "I"). The icons included the typical printed word in Chinese. The vocabulary was organized to allow for SNUG. For example, every time John selected an icon, the corresponding digitized voice output of the symbol was presented immediately. By selecting and combining different words, John could combine words on the icon set to produce meaningful utterances. The process was similar to natural language in contrast to pre-stored whole-sentence messages, which means one selection would produce a whole sentence (e.g., press the icon "I," the SGD will produce "My name is John.").

Since several selections were available on the display to target for intervention, the SGD allows for hiding specific icons, so the participant only sees targeted vocabulary/icons at the start of treatment. This "hide-key" feature not only reduced distractions from showing all icons on the main display at once, but also allowed for vocabulary to be introduced gradually as the initially targeted words were learned. Twenty-five target words were introduced, combined with nouns based on John's interests (e.g., toys, blocks, chocolate, etc.). The 25 target words were split into 5 sets. For Each session, five target words were introduced, and the sets were rotated during the intervention.

2.4 Design

A multiple baseline single-subject design across communication partners' involvement (grandmother + SLP, mother + SLP, and SLP only) was utilized to evaluate the effect of the AAC intervention with three different conditions. (Kazdin, 2011). The multiple baseline single-

subject research designs have been commonly used in clinical demonstrations and trials. N-of-1 designs adeptly investigate within-person change, can test the effectiveness of an intervention and frequently are conducted in clinical settings. The frequency of treatment was two one-hour sessions per week. Three conditions (grandmother + SLP, mother + SLP, and SLP only) were completed in one 60-minutes session (20 minutes/ condition) in baseline and intervention phases. Baseline data were collected as was minimally necessary to establish a behavior trend: three sessions for grandmother + SLP, five sessions for mother + SLP, and seven sessions for SLP. The design was made for balancing the ethics issue of non-treatment in real clinical practice.

2.5 Dependent Variables

Dependent variables focused on John's usage of word tokens in three categories. First, Touch + Speech: the number of target word tokens that John generated spontaneously on the SGD accompanied with him repeating the target word verbally after the AAC voice output. For example, if a SLP asked John "what do you want to play?", he selected "toy" on the SGD; then he repeated "toy" after the voice output from the SGD without prompting from the SLP. Touch + Speech was used to address the family's primary concern that the child would not generate speech once AAC would be introduced. An important consideration of treatment was to integrate the family's concern and expectation so that they could engage in the sessions with higher motivation. Second, Total number of words (TNW): combined total number of target word tokens generated on the SGD with and without accompanying a verbal repetition. The words that John selected on the SGD. For example, if John pressed "listen music" on the device and did not say anything, the SLP still would play music for him, and the number of word tokens equaled. Third, the mean length of utterance (MLU), MLU is commonly used to measure children's language maturity and language complexity (Owens, 2004). It is a predictor of language development. Since John used MC during the intervention, we used the guideline of MLU (Cheung, 1998) to analyze John's language sample. These data were compared between baseline and intervention phases to supplement quantitative analyses with qualitative summaries of the content of the participant's communications.

2.6 Independent Variables

While using an SGD, the AAC intervention integrated several evidence-based treatment strategies, including enhanced milieu teaching, aided language stimulation (ALS) and feedback, which have been shown to result in positive outcomes for children with ASD. Enhanced milieu teaching is regarded as a naturalistic strategy for teaching functional language skills in children with limited speech or vocabulary skills with environmental arrangements (Kaiser, Yoder, & Keetz, 1992). The basic guideline is child-led teaching focusing on natural consequences and the ongoing interaction between children and communication partners (teacher, parents, etc.). The environmental arrangement allows interventionists to control the materials, activities, and choices during the intervention (Kaiser & Wright, 2013). For example, the AAC intervention

was conducted in the living room at John's home. No modification of the room was made. Beside the SGD, treatment materials were controlled within the items that John liked (toy cars, blocks, books, music, etc.). If John selected "want music" on the SGD, the SLP would play music for him. If John selected "more," then SLP would play music again.

Aided language stimulation (ALS) is an AAC technique combined with enhanced milieu teaching. The purpose of ALS is to provide modeling on an AAC device to teach children how to use the device for communication and also provide the opportunity for learning language mapping between symbols and the spoken word (Beukelman & Mirenda, 2013; Binger, Maguire-Marshall, & Kent-Walsh, 2011; Romski & Sevcik, 1996). Specifically, the communication partners use the AAC system when interacting with children to model or expand responses (Dada & Alant, 2009) and integrate the use of the system during daily routines (Romski & Sevcik, 1996). For example, when the SLP wanted to say "I want more music," the SLP would also select "I want more music" on the SGD. If the SLP said "Mom, what do you want to play today?" Mom would say "I want to play cars." and select "I want to play cars" on the SGD. If the music stopped, and John selected "more", then the SLP would expand it using the SGD, and say "you want more music".

A consistent least-to-more prompting hierarchy was used to gradually provide assistance to John for him to select words on the SGD (Wolery et al., 1992). The hierarchy included: 1) Independent: after initiating a communication exchange, wait three seconds to see if John pressed the [target word] on the AAC system, and repeated the voice output, 2) Visual: If John did not respond in three seconds, the communication partner pointed to the [target word] and asked John to find the [target word] on the AAC system, and 3) Full Physical Assistance: If John did not respond in three seconds, the SLP or others communication partners used full physical assistance (hand over hand) to assist him in pressing the [target word].

Reinforcements (ex: small edible, favorite music clips) with verbal praise/reinforcement was used during the intervention phase provided by the SLP when John touched the targeted icons on the AAC display, and repeated using speech. For example, when the communication partner pointed to the target then John pressed the target word on the touchscreen and repeated the word after the speech output, the tangible reinforcement was given. The SLP also gave simultaneously verbal praise (e.g., good job, you said the word). The reinforcements were chosen based on the observation before the intervention. The reinforcements were only used in the intervention phase by the SLP.

2.7 Procedures

2.7.1 Baseline Phase

John was introduced to the AAC system without instruction. The SGD and the materials that matched the participant's interests (e.g., cars, music, videos, chocolates, books, crayons, etc.) were on a table that he could reach and within his view where intervention occurred. In

the (grandmother + SLP) and (mother + SLP) conditions, the SLP and communication partners (grandmother and mother) initiated an interaction with the phrase, in Chinese, “Let’s see what we can play today.” The SLP then prompted grandmother or mother “you can use the talker to tell me what you want to play.” Mother or grandmother use the SGD, and generate an utterance (i.e., I want to read a book), then the SLP gave a book to Mom, and Mom would read a book. In SLP only condition, the SLP self-talked using the SGD. For example, the SLP used the SGD and said “Now I want to eat some chocolate.” then she ate a small piece of chocolate. John usually showed his intention to reach for one of the items he liked by grabbing, pointing, and/or vocalization. We did not observe any intelligible Chinese works during baseline sessions.

2.7.2 Intervention Phase

The intervention used Chinese and included 20 minutes for each condition with the sequence of grandmother + SLP, followed by the mother + SLP, then the SLP only within a one-hour session. The setting was the same as the baseline phase. The materials and the SGD were set within John’s view. The SLP initiated an interaction with the phrase, “Let’s see what we can play today.” Then the SLP said to John, “You can tell me what you want from here (the AAC touchscreen), let’s find the [the item] here, so you can have [the item] you want.” The SLP also provided verbal instruction to the mother and grandmother to implement the prompting hierarchy. For example, if John did not access the touchscreen after the verbal cue generated in 3 seconds, the SLP would say, “mother/grandmother, point the target icon and say “see, here is the [target].” If John still did not access the target, the SLP would say “mother/grandmother, hold his hand to point the target icon and say “see, here is the [target].” After John completed the behavior, a verbal praise and reinforcement were given.

During the grandmother + SLP and mother + SLP sessions, the SLP sat through each session and cued the grandmother and mother by repetitively providing verbal instruction. Each condition only had one caregiver involved (e.g., Mother was not present during the intervention with the grandmother + SLP condition). Additionally, grandmother and mother also served as models for John. The SLP would provide modeling by using the same prompts with the grandmother and mother when they were in the specific conditions, so John could see his mother or grandmother obtained the desired materials by using the AAC system. The SLP managed behaviors and directed the child and communication partners to allow natural turn-taking during the sessions. For example, the SLP would say, “Mother, tell me what you want,” Mother would generate an utterance on the SGD (i.e., I want a car), and then verbally repeated the voice output word by word. Then, Mother would receive a small piece of chocolate (as reinforcement) and a toy car from the SLP, then the SLP would say, “John, your turn, what do you want.” When the session was in the SLP only condition, the SLP served as the model for the target behaviors, and prompted John’s behaviors when needed with turn-taking by self-talking. For example, the SLP would ask John first, “John, what do you want to play?” If John did not show any intention, then the SLP would say “Ok! If you don’t want to play, then I want to play first. I want to play cars” Then the SLP would press “play” + “car” repeat using her

natural speech, then give herself a small piece of chocolate (as reinforcement), and finally play with the car. Then the SLP would ask John if he wanted to play and the steps were repeated.

2.8 Reliability, and Procedural Fidelity

A native Chinese speaking observer who was naive to the research questions, scored outcome data for 12% of the session videos. The Pearson r for the interrater reliability was 0.82. A second rater used a checklist to record whether the SLP implemented treatment as described for 20% of the session videos. The checklist covered: (a) the consistency of the setting, (b) implementation of procedures, (c) the implementation of the prompting hierarchy, (e) the implementation of the SLP's directions to the communication partners. The procedural fidelity was 100%.

2.9 Data Analysis

Data were first analyzed using visual inspection, specifically for changes in the level and trend of dependent variables between baseline and intervention phases (Kazdin 2011). While the visual analysis is the standard for evaluating the effectiveness of a single-subject intervention study, this approach alone is tenuous because it can be susceptible to bias due to factors such as serial dependency and heterogeneity of variance between study phases (Molenaar, 2004; Ridenour et al., 2013). Thus, the dependent variable Touch & Speech was also statistically analyzed using mixed model trajectory analysis for small samples (Ridenour et al., 2009, 2013, 2017). Lastly, language sample analysis was used to evaluate changes in language content of the participant associated with study phase.

In the mixed model trajectory analysis, differences in the mean levels and trajectories of dependent variables were tested between baseline and the intervention phases. Analyses were conducted for (a) the aggregate outcomes (centered at the transition from baseline to intervention) across communication partners and (b) each communication partner to check for differences among them. The following factors were tested as predictors in each model, both for fixed and random effects: session number (in sequential order according to date, i.e., to model the effect of time and maturation), study phase (to test mean differences between phases), and interaction between sessions and phase (to test slope differences between phases). Random effects in essence tested whether communication partners differed on any of the model predictors. Two covariance structures were tested to account for serial dependence: compound symmetry (correlations between same-communication-partner observations are equivalent regardless of lag time) and the autoregressive (lag 1) structures. The autoregressive (lag1) structure best accounted for serial dependency based on statistical fit and parsimony. How well predictors fit to the data were tested using the following fit statistics: Akaike's Information Criterion, Bayesian Information Criterion and -2 log likelihood. In the end, the foremost competing models had the same number of degrees of freedom, thereby precluding likelihood-ratio chi-square tests.

Cohen's d (1988) provided a standardized estimate for intervention effect size. For comparison between baseline and intervention phases, d is the number of standard deviations separating the phase means. If a random effect was found to be significant, a separate statistical model was estimated for each communication partner.

3. Results

3.1 MMTA

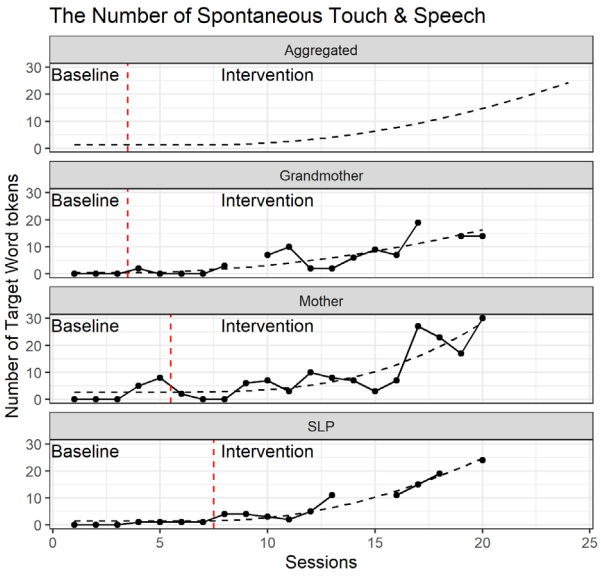
Figure 1 presents observed data and the MMTA model for Touch & Speech. The means of the baseline and intervention periods respectively, are 0 (SD = 0) and 6.33 (SD = 5.89) for grandmother, 2.6 (SD = 3.71) and 10.00 (SD = 9.69) for Mother, and 0.57 (SD = 0.53) and 9.8 (SD = 7.55) for SLP. A gradually accelerating increase in Touch & Speech was observed following onset of intervention for each partner. To statistically test whether outcomes associated with intervention could be explained by alternative factors such as maturation, all data were further analyzed using mixed model analysis. Table 1 presents fit statistics for competing models of Touch & Speech. The best fitting model consisted of (a) an aggregate interaction term, intervention phase x session2, which represents a quadratic increase in Touch & Speech but only during the intervention phase and (b) the same interaction term as a random effect (i.e. the size of the effect varies among communication partners). The aggregate model parameters are

Yij = 1.25 + 0.08 (session2 * phase).

Moreover, the models for individual communication partners were quite similar both in appearance (see dashed lines of Figures 1) and their parameters (see footnotes of Table 1).

Figure 1

The Number of Target Word Tokens



Note. This figure demonstrates that john generated spontaneously on the SGD accompanied with him repeating the target word verbally after the AAC voice output.; total words: combined total number of target word tokens generated on the SGD with and without accompanying a verbal repetition.

Table 1

Results of ML estimator of Touch & Speech

Models			AIC	BIC	-2Log	df
	Fixed	**Random**				
1	Int.	Int.	416.9	423.2	410.9	3
2	Int., session	session	381.5	389.9	373.5	4
3	Int., session^2	session^2	370.6	379.0	362.6	4
4	Int., session*phase	Int., session*phase	375.4	383.8	367.4	4
5	**Int., session^2 *phase**	**session^2*phase**	367.0	375.4	359.0	4

Note. AIC= Akaike's Information Criterion. BIC= Bayesian Information Criterion. df= degree of freedom. Int. = Intercept. Better fit to the data is indicated by smaller value of AIC, BIC and -2 log likelihood. In the table, with the same df, model #5 had smallest values (and thus better fit) for AIC, BIC and -2 log likelihood than other models. Models #2, 3, 4, and 5 fit statistically better than Model #1 ($p<.01$, likelihood ratio $\chi 2$).

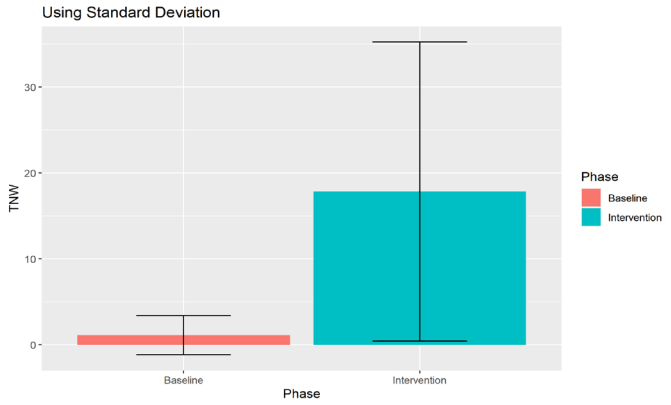
3.2 Language Performance

The TNW across the baseline periods (M = 1.13, SD = 2.29) and the intervention periods (M = 17.85, SD = 17.39) show the numbers increased over time (Figure 2). The MLU was increased from zero in the baseline period to 1.9 in the last session. The highest MLU (2.8) was

shown in the intervention period. Comparing to the data of Cheng (1998), John's MLU is in the age range of 2-3 years old.

Figure 2

The Average of TNW Between Phases



3.3 Effect size

Cohen's d effect sizes present the magnitude of difference between baseline and intervention phases of three communication partners. For Touch + Speech, the average d= 1.29 (Grandmother = 1.00, Mother = 1.75, SLP = 1.11). Thus, the effect sizes of the AAC intervention were very large (Cohen's definition of a large d=0.8) (Cohen, 1988). In addition, the results indicated that effect sizes were consistent across communication partners demonstrating that parental implementation can have a clinically significant impact as long as the parents receive the appropriate training.

3.1 Social validity

The semi-structured interview found that both family members agreed that (a) John improved in his expressive language, (b) the AAC intervention was effective, and (c) they still desired that the child would one day be able to verbally communicate (use natural speech) without the aid of the AAC system. Also, the results of the survey revealed that both agreed that (a) the SGD included the vocabulary for Chinese speakers to use in daily conversation, (b) the SGD allow John to generate his words and combined them into utterances, and (c) an SGD can promote effective communication. Furthermore, mother and grandmother had a better overall impression of the SGD than their first impression of the device when intervention started.

4. Discussion

The purpose of the study was to answer if implementation of an AAC intervention

incorporating an SGD would result in an increase of vocabulary productions and the MLU when different family members were involved in the treatment sessions. The results indicate that John showed that he had substantial improvement in learning to use the SGD to generate words independently irrespective of family members involved during the treatment. The results also show that John's MLU increased in the intervention period. These findings first add to the limited literature on improving the language performance of Chinese children with ASD and developmental disabilities receiving AAC intervention (Wu et al., 2011a, 2011b). Thus, the findings provide clinical evidence to support the assumption that Chinese children with ASD benefit from an AAC intervention using a high-technology SGD.

The results lend support that children with ASD can learn to identify words, generate words, and combine words into utterances by having different family members interact during treatment, even when family members did not receive prior training before the intervention started. In addition, the results of the effect size provide an opportunity to compare the intervention effects between the parents and SLP which help to confirm the positive effects when parents are involved with treatment. In the meantime, we also observed the outcomes of mother and grandmother aligning with start of SLP's intervention.

The results provide an alternative to previous studies which often required parents to receive training in advance of implementing AAC intervention (Bruno & Dribbon, 1998; Kent-Walsh et al., 2010; MaryAnn Romski et al., 2011). Isolated parent training may be a luxury, but still, a desired or sought after the outcome of initiating AAC services. However, given scheduling and time demands, parents frequently find attending AAC training outside of treatment sessions unrealistic. The presented study, instead, included the parents observing and participating in the treatment may be a more practical solution. Although the skills the parents learned in the intervention phase were not the focus of this current study, informal observation suggests that grandmother and mother learned some level of skills to interact with John and prompt him to generate messages using the SGD by observing the SLP modeling the desired intervention strategies.

This study prompts several clinical considerations relevant to clinicians and/or educators when working with a Chinese family or any other families with different cultural and language backgrounds. In this case, the treatment procedure intended to integrate speech practice along with the AAC intervention to incorporate the family's priority. The primary concern of the family was the child's lack of speech. However, they did not recognize that global language skills were delayed not only in English, but also in Chinese. The family regarded an AAC system as a replacement for speech rather than a strategy to support speech and language development. Also, an AAC system would call more attention to the child's communication disabilities. These concerns were similar to previous reports from American Chinese families with children with ASD (Parette et al., 2004). Although studies have shown that using an SGD would not harm and may facilitate speech and language development(Almirall et al., 2016; Kasari et al., 2014; Schlosser & Koul, 2015; Schlosser & Wendt, 2008), our clinical experience

also has been that children would naturally start to attempt to speak the words on their AAC systems, still the family's expressed values differed from our clinical experience about the role of AAC in building overall communication and language competence.

The Touch & Speech was added in the treatment procedure, because of the family's wish for adding speech practice in the treatment sessions and the goal to motivate the grandmother and mother to engage in the intervention. The result of the Touch & Speech suggest that John learned to press the target icon on the AAC device, and practice speech when the target icon was pressed. Furthermore, both family members reported the improvement of John using spoken words selected on the SGD, which might contribute to their treatment satisfaction. This integration echoes the recommendations for working with bilingual children using AAC (Soto & Yu, 2014), and follows the guidelines of evidence-based practice (Hill, 2010; Straus, Richardson, Glasziou, Haynes, 2005). The process also reminds us that family counseling and treatment modification may be needed to support AAC intervention when family values and expectations differ from professional clinical decisions.

4.1 Limitation

Although the goal for the design of the study was to be as rigorous as possible, clinicians should recognize that the study is more reflective of that which might be conducted as routine clinical practice and not an experiment protocol. A methodology limitation of the study was the missing data of the Touch & Speech. Having missing data points may have affected the final results of the study's trajectory model. Another limitation was that we were unable to conduct a follow-up phase typical of a true experiment. Therefore, we were unable to determine the maintenance of the AAC intervention and slope of the learning trajectory for word usage once the study's treatment was terminated. However, given our follow-up contact with the family, the mother reported that John spoke less compare to the intervention phase. The decline might due to stopping the structured treatment procedures and/or the family members did not carry over the instructional and prompting strategies. Last, the study did not collect the data of instructional strategy learning for the two family members. Thus, weakening the evidence to support the effect of family involvement without pre-requisite training. Finally, two modest increases were observed during the final two baseline sessions of mother + SLP, and strict adherence to research methodology would have warranted continued collection of baseline data. However, using clinical judgment, the increase was determined as being practically random, and delay of treatment would not be in the best interest of the child.

5. Conclusion

This study demonstrated an Chinese-speaking child with ASD learned to use words and word combinations as part of an AAC intervention incorporating the use of an SGD focusing

on high frequency and personalized words. The study increases the clinical evidence to support AAC intervention for Chinese-speaking children with ASD while previous studies have been limited or not reported as single-subject research designs. The learning of skills was observed across different conditions that involved not only a SLP, but additional family members who were naïve to the instructional strategies at the start of treatment. The result offers a possible solution to have parental/family involvement as part of an intervention in daily practice when pre-requisite training is not possible or impractical. The study also demonstrates the process of designing a treatment protocol that includes clinical decisions regarding the AAC technology, instructional strategies and techniques, and family evidence such as culture, values, and priorities to achieve identified goals. Future studies will include a plan for the SLP's intervention to be withdrawn while one or more family members continue intervention to test whether the outcomes will improve continually. Data collection for instructional skill acquisition in family members will be included for investigating the instructional skill learning in family members. A maintenance phase will be implemented to exam the treatment effect. Finally, implementing the treatment protocol in different settings (e. g., school settings) to investigate the outcomes in different contexts will be investigated.

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自閉症兒童的家庭參與式輔助溝通介入成效之個案研究

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摘要

針對自閉症兒童的語言及溝通困難，高科技輔助溝通介入 (High-technology AAC intervention) 已行之有年，也累積不少研究。然而，迄今仍少有 High-technology AAC intervention 促進華語自閉症兒童語言及溝通發展的相關研究。 因此， 本個案研究旨在探討一位說華語的 6 歲的自閉症兒童及其家人參與 High-technology AAC intervention 來促進該兒童表達性語言的成效。該兒童無口語，主要使用非口語行為進行日常溝通，無法指認常見物品或圖片、無法完成簡單口語指令。本個案研究採跨基線設計分析不同溝通伙伴的介入成效。介入是由個案的母親和外婆在一位語言治療師的支持下於個案家中進行，每周兩次，60 分鐘一次，共 17 次。介入目標詞有不同詞性的核心詞彙以及個案溝通所需的常用詞彙。基線時提供一台高科技溝通輔具，並未教他如何使用。在介入期，使用提示及輔助語言示範來協助個案選擇溝通輔具上的詞彙。本研究資料分析採混合軌跡模型分析，結果顯示，個案使用輔助溝通系統對每位溝通伙伴進行有意圖的溝通有很大的效果值，主動口語的數量和平句長度，均有提升，家人對進步也感到滿意。從本研究結果可知，利用 High-technology AAC system 的介入方案可以有效促進自閉症兒童溝通技能和語言發展，另外，讓家人參與介入是可行且重要的。本研究也討論家庭價值與偏好對於臨床介入決定的影響。

關鍵詞：輔助溝通系統、家庭實施、混合軌跡分析模式、華人、自閉症

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