# Improving Pragmatics in Nonverbal Children with Autism Using Melodic Based Communication Therapy

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## Abstract

**Background of study:** Persistent deficits in social communication and social interaction are key components in the diagnosis of autism. For this reason it is clear that successful intervention for individuals with autism must address this deficit. Melodic Based Communication Therapy (M.B.C.T) has been previously found to improve expressive vocabulary and verbal imitative abilities in nonverbal individuals with autism over the age of 5; however findings on the effect of M.B.C.T. on pragmatic (social) language have not previously been discussed.

**Purpose:** The objective of this study was to examine the effect of 5 consecutive weeks of Melodic Based Communication Therapy on pragmatics in nonverbal children with autism.

**Method:** Participants were 12 nonverbal children with autism ages 5 through 7 randomly assigned to the M.B.C.T. or control group. Participants received 5 weeks of intervention, with four 45-minute individual sessions a week. The Pragmatic Language Skills Inventory (PLSI) was used to measure pragmatics pre and post treatment.

**Results:** Following treatment, the M.B.C.T. group showed significant improvement in PLSI score ($72.3 \pm 10.1$ vs $65.4 \pm 7.0$, p=.04) while the control group did not ($67.7 \pm 1.2$ vs $66.8 \pm .5$, p=.32). However, there was no significant difference in improvement between the two groups ($6.9 \pm 2.4$ vs $1.0 \pm .5$, p=.11).

**Conclusions:** Results suggest M.B.C.T. may be a viable means of improving pragmatics in children with autism over time. However, a larger sample size may be needed for more conclusive results.

**Keywords:** Autism; Pragmatics; Social skills; Music; Speech therapy; Nonverbal

Autism has often been described as a disorder of social communication characterized by a distinct lack of social instinct [1]. In the *Diagnostical and Statistical Manual of Mental Disorders, 5th Edition: DSM-5* [2], the American Psychiatric Association (APA) lists persistent deficits in social communication and social interaction across multiple contexts, as manifested by deficits in social emotional reciprocity, deficits in nonverbal communication behaviors used for social interaction and deficits in developing, maintaining, and understanding relationships appropriate to developmental level as key components in the diagnosis of Autism [1,3-6]. Thus it is clear that successful and appropriate therapy for children with autism must address the social components of language.

Music therapies have been shown to influence social functioning in children with autism in the past [7-12]. Such therapies, however often focus on improving social interaction by influencing peer interaction, play, and/or social compliance, while overlooking the integration of language interventions, another key area of deficit for many individuals with autism. Furthermore, these studies were typically conducted on children below the age of 5 with mild to moderate disabilities, which leads to the question of whether or not such therapies would be equally effective on an older more severe population.

The importance of early intervention for children with autism has been well established [13-16]. However, many early intervention programs across the United States are unable to meet the high demand for such services [16]. This highlights the need for further study of clearly defined interventions targeting the social aspects of language in children with severe autism over the age of 5.

Melodic Based Communication Therapy (M.B.C.T.), developed by Sandiford (2013), is a research based intervention shown to improve expressive vocabulary and verbal imitative abilities in nonverbal

individuals with autism over the age of 5 [17]. The theory behind M.B.C.T. is based on literature indicating right hemisphere dominance in individuals with autism [17]. Multiple research studies have found neurological differences between children with autism and children who are developing normally [18-22]. These studies have commonly found asymmetry between the left and right hemispheres of the brain with the dominant hemisphere being the right hemisphere in individuals with autism while the left was favored in normally developing controls. While the left hemisphere is responsible for language the right hemisphere is known to be responsible for processing melody, intonation, prosody and art [23]. Other research has indicated that the corpus callosum, which joins both hemispheres and allows for transfer of information between hemispheres, is often impaired in children with autism [24]. Studies conducted on the corpus callosum indicate that it can be strengthened by exposure to music prior to the age of seven in typically developing individuals [25,26]. The right hemisphere has been shown to be responsible for the interpretation of melody and rhythm in the majority of individuals [23]. M.B.C.T. combines standard melodies and operant conditioning in the form of positive reinforcement to improve oral expressive and imitative abilities in nonverbal children with autism. The objective of this study was to examine the effect of exposure

to Melodic Based Communication Therapy (M.B.C.T.) on pragmatics/social skills as measured by score on the *Pragmatic Language Skills Inventory* (PLSI).

## Methods

### Participants

Permission to conduct this study was obtained from a university's Institutional Review Board (IRB) ensuring appropriate adherence to informed consent procedures and handling of all research data. Participants were recruited from southern California using local media/newspapers, letters to paraprofessionals, flyers in local clinics, hospitals, universities, schools, contacting of local support groups, social networks and word of mouth.

Participants were included in the study if they had previously received a diagnosis of autism confirmed by the *Autism Diagnostic Observational Schedule* (ADOS) and were nonverbal. Nonverbal was defined as having an expressive vocabulary of no more than 10 words which were not used on a daily basis and having no functional speech. Participants also needed to be between the ages of 5 and 7 years. Participants were excluded from the study if they were receiving other speech or language interventions at the time of the study, were unable to regularly attend four 45 minute sessions of therapy for 5 weeks, had a history of severe hearing impairment, had severe visual impairment/blindness, had a diagnosis of an organic impairment of oral or laryngeal structures, or had a significant medical illness or condition which would prevent the child's participation in the treatment procedures. These conditions included, but were not limited to cerebral palsy, paraplegia, Spina bifeda, uncontrolled seizures, dysarthria, and amputation of arm(s). Twelve participants who resided in southern California were included in the study, 11 males and 1 female.

Upon entering the study, participants were put into three groups according to their age, and then were randomly assigned to one of two treatment groups. The treatment groups were: the traditional therapy, which represented the control group and the Melodic Based Communication Therapy (M.B.C.T.), which represented the experimental group. Participants who joined late were randomly assigned to either treatment. Participants received 5 weeks of intervention, with four 45-minute individual sessions a week.

### Instrumentation and Materials

The parent survey was compiled based on the information needed for inclusion/exclusion criteria as well as the information needed for a reinforcer assessment. For the purposes of this paper a reinforcer can be understood as a highly preferred stimulus item specific to each participant such as skittles or fish crackers given to the participant after the desired behavior occurred in order to increase the probability of the reoccurrence of that behavior. The reinforcer assessment was a modification of Sturmey's reinforcer assessment [27], which requires parents to list possible reinforcers with corresponding examples followed by a list of their child's top three reinforcers.

The *Autism Diagnostic Observation Schedule* (ADOS) is a semi-structured, standardized assessment of communication, social interaction, and play consisting of four modules that can be administered in 30-45 minutes and used to accurately diagnose individuals with autism across age levels, developmental skills and language abilities [28-31]. Module 1, intended for children who do not use phrase speech consistently, was used for the purposes of this study. Module 1 consists of the following: free play, response to name, response to joint attention, bubble play, anticipation of a routine with objects, responsive to social smile, anticipation of social routine, functional and symbolic imitation, birthday party, and snack [28].

The *Pragmatic Language Skills Inventory* (PLSI) is a norm-referenced rating scale designed to assess the pragmatic language abilities of children ages 5-12 and can be administered in 5-10 minutes. It has three subscales: personal interaction skills, social interaction skills, and classroom interaction skills. The PLSI's authors specify that a rater who knows the child well and is familiar with the child's language skills is to rate the child on a scale of 1 to 9 based on his/her knowledge of the child and that of children of the same age regarding a particular skill. A qualified examiner such as a speech language pathologist or school psychologist then completes scoring. For the purposes of this paper, parents blinded to the treatment group of their child acted as raters. A school psychologist blinded to the purpose of the study and the treatment groups, derived percentile rankings and standard scores. Reliability and validity of the PLSI are reported as adequate. Additionally the test demonstrates high levels of internal consistency, interrater agreement, test-retest reliability and was found to correlate highly with the *Test of Pragmatic Language* (TOPL) [32,33].

Twenty-five target words were chosen based on high frequency words children typically use first (Appendix A). Twenty-five stimulus items were chosen to represent the target words. Target words and stimulus items were the same for each group. Portable Compact Disc players and Compact Discs (CDs) were used for the M.B.C.T. group. CDs consisted of the 25 target words set to 25 different melodies. Words were set to repeat 10 times with approximately a 10 second break between repetitions. Video cameras were used to record sessions.

Reinforcers were chosen based on the responses of parents on the reinforcer assessment. Reinforcers were kept with a list of the participants' known allergies and special instructions as indicated by the parent. Some parents opted to bring in their child's reinforcers due to special diet considerations when food reinforcers were used.

### Procedure

The goal of therapy for each treatment group was to train the production of the twenty-five target words. If the twenty-five target words were learned, then two word utterances incorporating the twenty-five target words were then trained (e.g. "kick ball"). Pragmatics were not directly targeted during therapy sessions in either group. The *Pragmatic Language Skills Inventory* (PLSI) was used as a baseline measure for the purposes of this paper in order to measure social language ability pre and post treatment. The parents prior to and following the intervention filled out PLSI ratings. Parents were kept in an external waiting room throughout the duration of the intervention and were not told which treatment group their child had been assigned to. A school psychologist, blinded to the purpose of the study as well as the treatment groups of the participants, scored the PLSI tests.

Clinicians were first year graduate students in a university speech-language pathology program who were trained extensively to provide both the traditional therapy and Melodic Based Communication Therapy under the supervision of the first and second authors. Supervision took the form of direct in room observation, direct observation via a two-way window and random review of session videotapes to ensure proper adherence to therapy techniques. The two-way window was out of the view of parents waiting in the waiting room. Treatment procedures for the traditional therapy consisted of using the child's three primary reinforcers, as previously identified by the parent, to train and reward

correct productions as well as attempts to name stimulus items. The clinician stated the word clearly while holding up the stimulus item, then asked the child to repeat the word after him/her. Acceptable cues were: phonemic cues, manual manipulation of lips/articulators, visual cues for placement and verbal instructions about where and how to use articulators. Therapy progressed from having the child imitate nouns and verbs to asking the child to independently name the items in response to the question: What is this? If the child was able to name the majority of the words independently, the procedures were repeated for two word utterances such as "kick ball" [17]. See Appendix B for a complete list of procedures used for traditional therapy including the schedule of reinforcement used by clinicians.

Procedures for M.B.C.T. were similar to the traditional therapy in that the same 25 words and stimulus items were used. The child's top three reinforcers as identified by the parents were also used to provide rewards for correct responses and attempts during therapy. A CD recording of the 25 target words set to 25 different melodies was utilized for all participants in the M.B.C.T. group providing a greater level of standardization of melodies. The children were allowed to listen to the CD recording of a specific word set to melody while the therapist presented the stimulus item to the child simultaneously. Therapy then progressed from listening to a recording of the word set to melodic tone, to hand over hand clapping of the rhythm, to unison clapping of the rhythm. Therapy then progressed to independent clapping of the rhythm, to independent clapping of the rhythm while singing to the recording with the clinician. This was followed by singing with just the clinician and then singing while the clinician mouthed the word silently. The final stages of therapy involved singing the word independently, then answering the sung question, "What is this?" with the melodic version of the expected target word. The ultimate step was answering the spoken question, "What is this?" with the expected target word. If the child was able to name the majority of the words independently, then the same procedures were followed for two word utterances [17]. Appendix C for a complete list of instructions used for M.B.C.T. including the schedule of reinforcement used by clinicians.

The main outcome measure for this study was score on the PLSI. Data was summarized using means and standard deviations. A two-way mixed factorial ANOVA (2 groups×6 times) was used to examine changes in PLSI scores between the two groups over time. Ages and PLSI scores at baseline for the 2 groups were compared using the Mann-Whitney U Test. The level of significance was set at p<.05.
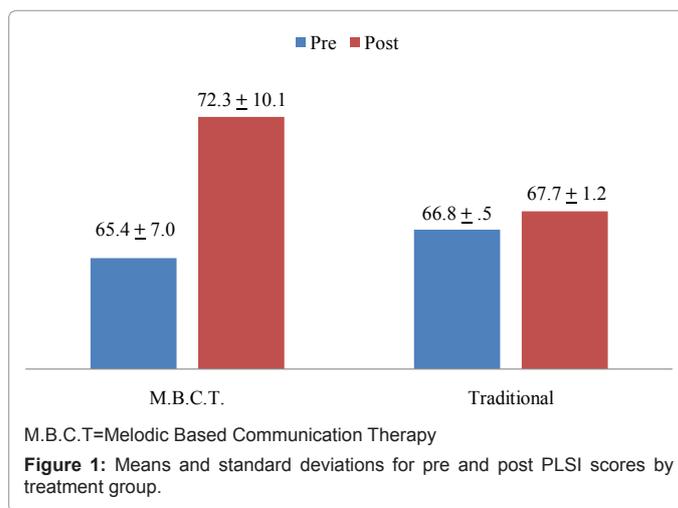
## Results

Fourteen participants were originally included in the study; however, one dropped out after a few days and the other was not readily available for testing due to illness. The traditional group had 5 participants. The M.B.C.T. group had 7 participants. Two participants, however, did not receive the full five weeks of therapy due to later enrollment in the study. All participants received at least 3 weeks of therapy. Ten participants received 5 weeks of therapy, five participants in the traditional group and five participants in the M.B.C.T. group. There were no significant differences for age and PLSI scores between the two groups at baseline (Table 1). There was a significant improvement in PLSI score in the M.B.C.T. group post versus pre treatment (72.3 ± 10.1 vs. 65.4 ± 7.0, p=.04), however, no significant difference in PLSI score was found for the traditional group following treatment (67.7 ± 1.2 vs. 66.8 ±.5, p=.32) (Figure 1). When comparing the PLSI score difference (post-pre) between the M.B.C.T. and the traditional group, however, there was no significant difference in improvement between the two groups (6.9 ± 2.4 vs. 1.0 ± .5, p=.11).

| Variables | | Melodic (n=7) | Traditional (n=5) | p-value |
|---|---|---|---|---|
| **Gender**† | Male | 6 (85.7%) | 5 (100%) | .29 |
| | Female | 1 (14.3%) | 0(0%) | |
| **Age (Mean ± SD)***  | | 5.9 ± .8 | 5.9 ± .9 | .91 |
| **PLSI at baseline (Mean ± SD)***  | | 65.4 ± 7.0 | 66.8 ± .5 | .50 |

†: Chi-square test
*: Independent t test
PLSI=Pragmatic Language Scale Index

**Table 1:** Distribution of demographic data by group (N=12).



M.B.C.T=Melodic Based Communication Therapy

**Figure 1:** Means and standard deviations for pre and post PLSI scores by treatment group.

## Discussion

Results indicated that social language scores improved for participants in the M.B.C.T. group but not in the traditional therapy group. This finding supports what other researchers have found on the importance of music-based interventions for improvements in social functioning [7-12], and may support the notion that M.B.C.T. can be used to strengthen social language skills in children with autism. The lack of difference in improvement in social language between the M.B.C.T. and Traditional therapy groups may have been due to the small sample size.

While the main goal of the therapy was to improve verbal expression in children with autism, the importance of social skills in the diagnosis of autism warranted a measure of social language be administered pre and post assessment to ascertain whether the therapy would also impact social language. Researchers did not directly target social skills; however, it is possible that as imitative abilities improved significantly in the M.B.C.T. group, these individuals may have begun to imitate the social behaviors of those around them [17].

There were several strengths and weaknesses for this study. One strength is the revealing of a new method of potentially improving social language abilities in nonverbal children with autism over the age of 5; a population for which little research has been done in the past. Another possible strength of this study is the use of parents as raters of the participants' social language abilities. Since it is implausible for researchers to follow the participants in their home environment for the entirety of each day, the use of familiar raters (as recommended by the PLSI authors) to rate the participants' behaviors gives researchers more insights into how the therapy may be affecting the behavior of the participants in other environments other than the therapy room.

Since the goal of intervention in most cases is to generalize the learned skills to environments outside the therapy room such as the home and classroom, knowledge of whether or not such skills have begun to generalize is vital to assessing whether an intervention has been successful. The finding that parents of participants who received the M.B.C.T. intervention noted a significant improvement in pragmatics functioning as a result of treatment suggests that this treatment may be successful in achieving this goal.

Another strength of this study is the use of child-specific reinforcers for eliciting change in nonverbal children with autism. The use of reinforcers in behavioral interventions for this population in order to bring about change has been well established [27,34]. Other interventions such as Applied Behavioral Analysis (ABA) and speech-language therapy have a long history of successfully employing the use of reinforcers with minimally verbal children [35,36].

While this study did have many strengths, there were some limitations as well. The most significant limitation of this study was the small sample size. Additional studies using M.B.C.T. may achieve a larger sample size by increasing the total number of words participants can speak or by targeting children over the age of 7. Another potential limitation may be the use of parents as raters. Although the test authors specify the use of raters familiar with the child, such as parents or family members is preferred, not all of the parents may have had the technical knowledge to assess their child's abilities based on what a typically developing child's behaviors should be. Future studies using M.B.C.T. may wish to employ multiple raters in addition to the parents, such as the child's classroom teacher or classroom aide, in order to gain more complete insight into changes noted over time.

As the number of children being diagnosed with autism continues to rise [37], the need for appropriate interventions targeting multiple modalities of the disorder has risen as well. Appropriate interventions should target social language as well as receptive/expressive language and imitative abilities. Research supports right hemispherical strengths in children with autism as well as improvement in corpus callosum function with exposure to music [18-26]. Therefore, the implementation of therapy techniques employing the use of melody and rhythm, right hemisphere tasks, may be helpful for this population. Preliminary findings of this study indicated that Melodic Based Communication Therapy in addition to improving expressive vocabulary [17] may have some impact on social language deficits in nonverbal children with autism ages 5-7. However, additional research involving a larger sample size may be needed to confirm the effects of M.B.C.T. on social language development in nonverbal children with autism.

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