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BRIEF REPORT

Brief Report: The Effects of Tomatis Sound Therapy on Language in Children with Autism

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Abstract Due to the myriad of problems associated with autism, parents often consider alternative treatments. The investigation was undertaken to determine the effects of the Tomatis Method on language skills in children with autism utilizing a randomized, double-blind, placebo-controlled, crossover design. The results indicated that although the majority of the children demonstrated general improvement in language over the course of the study, it did not appear to be related to the treatment condition. The percent change for Group 1 (Placebo/Treatment) for treatment was 17.41%, and placebo was 24.84%. Group 2 (Treatment/Placebo) showed –3.98% change for treatment and 14.15% change for placebo. The results reflect a lack of improvement in language using the Tomatis Method for children with autism.

Keywords Autism · Tomatis · Alternative treatment

Introduction

Autism is a severe neurodevelopmental disorder characterized by impairment in verbal and nonverbal communication, reciprocal social interaction, and a restricted repertoire of activities and interests (American Psychiatric Association 1994). Individuals with autism frequently have concomitant auditory processing problems especially as related to the processing of speech (Gervais et al. 2004; Lepisto et al. 2005; Samson et al. 2005; Tecchio et al. 2003). It has been suggested that impaired auditory perception skills may be associated with deficits in communication and reciprocal social skills (Kellerman and Gorman 2005).

Considerable empirical evidence has shown that early intervention based on applied behavior analysis (ABA) can result in significant, comprehensive and lasting improvements in children with autism (e.g. Birnbrauer and Leach 1993; Eikeseth et al. 2002; Eldevik et al. 2006; Lovaas 1987; McEachin et al. 1993; Smith et al. 2000). Additionally, traditional interventions such as speech and language therapy have been used to improve the language and communication skills of children with autism. However, parents looking for solutions may consider alternative treatments most of which have not been subjected to clinical research (American Academy of Pediatrics 2001). This paper describes a study designed to determine the effectiveness of one such alternative treatment, the Tomatis Method of sound based therapy (Tomatis).

There has been growing interest in the United States in Tomatis and other alternative treatments, which incorporate forms of music therapy. However, there is a lack of research to support or refute such interventions (Thompson and Andrews 2000). To date, there have been no well-controlled, experimentally designed studies from peer-reviewed journals examining the efficacy of Tomatis in autism. This is concerning due to the time and financial resources that could be directed to more proven interventions. Baranek warned that "relying on non-harmful but potentially ineffective

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treatments can squander valuable time that could be used in more productive educational or therapeutic ways" (Baranek 2002) (p. 418). Herein lies the impetus for this carefully controlled investigation of Tomatis.

The Tomatis Method has often been compared to Auditory Integration Therapy (AIT) (Berard 1993), another controversial treatment showing limited if any benefit for children with autism (for a review see: Baranek 2002). The Tomatis Method and AIT are similar in that they both are considered sound therapy and use high and low frequency filtered music. However, the techniques are distinguishable in the application and intensity of the intervention.

Alfred Tomatis, MD proposed that listening to modified music would stimulate connections between the ear and the central nervous system (Thompson and Andrews 2000). Anecdotal reports claim that Tomatis has improved the communication, social and behavioral functioning of some children with autism. Neysmith-Roy (Neysmith-Roy 2001) conducted a study of six children with severe autism ages 4–11 years who were administered several blocks of Tomatis treatment. The authors report improvement in behavior and prelinguistic behaviors in some of the six participants with the youngest subjects showing the most improvement.

The Tomatis Method consists of the administration of prepared auditory stimulation recordings through equipment designed to modulate the acoustical signal. The stimuli include specially created compact discs of Mozart music and Gregorian chants. The acoustical signal modulation equipment attenuates low frequency sounds and amplifies higher frequencies (800–300 Hz). Proponents hypothesize that this modulation allows the child to gradually focus listening on language frequencies. During the protocol the child listens through an "Electronic Ear" (EE) headphone with an attached oscillator permitting the sounds to be perceived through bone conduction as well as air conduction. The primary aim of this study was to determine if Tomatis contributed to the improvement of receptive and expressive vocabulary in children with autism.

Methods

Participants

Eleven children with autism between 3 years, 6 months and 7 years, 2 months were enrolled in this study. Inclusion required a diagnosis of Autistic Disorder based on the DSM-IV criteria (American Psychiatric Association 1994) corroborated by the Autism Diagnostic Observation Schedule-Generic (ADOS-G); (Lord et al. 1999), and clinical judgment (B.A.C.). Participants needed to speak at least 1–3 words, have a pointing gesture, and tolerate wearing headphones. Participants who had previous exposure to auditory stimulation treatments were excluded. Demographic information presented in Table 1.

Design

The study utilized a double-blind, placebo-controlled, crossover design. Assessments were conducted at baseline, midpoint, and conclusion of the study. The investigation was approved by the University of California Institutional Review Board (IRB) and written parental informed consent was obtained prior to participation.

Measures

The *Autism Diagnostic Observation Schedule-Generic* (ADOS-G); (Lord et al. 1999) provides observation of a child's communication, reciprocal social interaction, and stereotyped behavior including an algorithm with cut-offs for autism and autism spectrum disorders (Lord et al. 1999).

Table 1 Demographic information of study participants

Participant	Treatment group	Age	Gender	Ethnicity	IQ	Language
#10	Treatment/Placebo Group 1	3.50	Male	Hispanic	83	Single words
#05	Treatment/Placebo Group 1	3.92	Male	Caucasian/NatAm/Hispanic	63	Single words
#08	Placebo/Treatment Group 0	4.00	Male	Caucasian/NativeAmerican	65	Single words
#04	Treatment/Placebo Group 1	4.67	Male	Caucasian	52	Few words
#03	Treatment/Placebo Group 1	4.92	Female	Caucasian/Hispanic	60	Single words
#01	Placebo/Treatment Group 0	5.33	Male	Caucasian	63	Single words
#02	Placebo/Treatment Group 0	6.08	Male	Hispanic	66	Phrase speech
#07	Treatment/Placebo Group 1	7.08	Male	Pacific Islander	68	Phrase speech
#11	Placebo/Treatment Group 0	7.08	Female	Caucasian	83	Some full sentences
#06	Placebo/Treatment Group 0	7.17	Male	Caucasian	68	Phrase speech
#12	Treatment/Placebo Group 1	7.42	Male	Caucasian/Hispanic	64	Some full sentences

The *Stanford-Binet Intelligence Scale-Fourth Edition* (SB4); (Thorndike et al. 1986) is a standardized measure of cognitive functioning administered to all participants to provide a measure of overall intellectual ability (IQ).

The *Peabody Picture Vocabulary Test-Third Edition* (PPVT-III); (Dunn and Dunn 1997) is a measure of single-word *receptive* vocabulary used as the primary dependent measure

The *Expressive One Word Vocabulary Test* (EOWVT) (Brownell 2000) is a measure of single word *expressive* vocabulary also used as a dependent measure.

Treatment Procedures

The Tomatis Method was administered by two trained assistants at The Listening Clinic in Sacramento, CA. Each subject was randomly assigned to either treatment first, Group 1, (Treatment/Placebo) or placebo first, Group 0 (Placebo/Treatment). The M.I.N.D. Institute researchers and parents remained blind to the experimental conditions until the conclusion of the study.

The experimental condition involved receiving the Tomatis Method. Each subject listened to three different pieces of professionally produced Mozart music and one of Gregorian chant daily for a total of 2 h, passed through the EE for attenuation and modulation. Audio-vocal feedback was included consisting of verbal activities, such as repeating phrases into a microphone allowing feedback of their own voices. According to proponents of Tomatis, the combination of filtered music, the EE and auditory feedback results in enhanced auditory perception by stimulating middle ear hair cells leading to alterations in the central nervous system. Therefore, these three key components were not included in the placebo condition. Specifically, the placebo condition involved listening to commercially produced Mozart and Gregorian chant CDs and not using an active microphone or the EE.

Consistent with a cross-over design, the experimental phase of the study was divided into two equal rounds and three assessment time periods. The Tomatis protocol was divided into four blocks lasting 3 weeks each, followed by a break for a total duration of 18 weeks.

Block 1 included 15 days of passive listening to music for 2 h each day. Participants listened to non-filtered sounds of Mozart music and Gregorian Chants with gating (randomly alternating between high and low frequency sounds). Block 2 consisted of 10 days of active listening for 2 h each day alternating between filtered and non-filtered music. The compact discs introduced sound frequency at 1,000 Hz filtering up to 9,000 Hz. In Block 3, participants experienced 10 days of mixed active and passive listening for 2 h each day. Microphone work was introduced and participants listened to their modulated voices. Sound frequency filtering was up to 9,000 Hz. Block 4 exposed participants to 10 days of mixed active and passive listening for 2 h each day with filtering ranging from 2,000 Hz up to 9,000 Hz.

After completion of this first round (treatment or placebo), participants completed the mid-point assessment. The second round of the study followed using the same schedule of blocks for an additional 18 weeks. Once the second round was completed, participants returned for their final assessments.

Statistical Analysis

Data analysis was designed to evaluate the effects of Tomatis treatment on the functioning of children with autism compared to placebo condition. It was hypothesized that a positive response to treatment would result in a significant improvement in receptive and expressive language. A repeated measures Analysis of Variance (ANOVA) was used to analyze the profile of scores across the levels of treatment (experimental versus placebo condition) and across the three time periods. In this way we asked, if the groups differ in the dependent measure, do the language measures show changes across the different time periods, and are such changes different across both groups?

Results

The means and standard deviations for the primary dependent language measures, PPVT and EOWVT, are presented in Table 2. Repeated measures ANOVA was applied to compare the time period values and there were no differences between the groups in the PPVT $F(1,9) = 1.34$, $p = 0.28$. There was a time effect in the PPVT $F(2,8)$ 5.82 $p = 0.03$ that appears to be linear; there was a constant increase in the PPVT scores over time. The overall time by group interaction was not significant $F(2,8) = 3.5$, $p = 0.08$ although the linear contrast of this interaction was significant $F(1,9) = 7.30$, $p = 0.02$, but not the quadratic $F(1,9) = 0.84$, $p = 0.38$. Although small, the time by group interaction suggests that individuals in Group 0 (placebo/treatment) show a steeper increase in PPVT scores over time than in Group 1 (treatment/placebo).

The results for the EOWVT are similar in showing no differences between groups $F(1,9) = 0.72$, $p = 0.42$. The time effect was also significant $F(2,8) = 4.83$ $p = 0.04$ indicating a linear increase in EOWVT over time with no quadratic component. Further, there was no time by group interaction $F(2,8) = 0.50$, $p = 0.63$. The means and standard deviations for the ADOS and IQ are presented in Table 3.

Table 2 Means, Standard Deviations, % change for the PPVT and EOWVT

Treatment Group	Pre		Mid		Post		% Change	
	PPVT	EOWVT	PPVT	EOWVT	PPVT	EOWVT	PPVT	EOWVT
Placebo/Tomatis Group 0	32.20	25.20	40.20	29.40	47.20	34.40	P = 24.84	P = 16..67
	(25.21)	(19.82)	(26.69)	(22.65)	(24.45)	(25.00)	T = 17.41	T = 17.00
Tomatis/Placebo Group 1	20.83	16.50	20.00	18.00	22.83	21.50	P = 14.15	P = 19.44
	(28.52)	(21.11)	(25.76)	(18.73)	(29.36)	(23.30)	T = –3.98	T = 9.10
Total Sample	26.00	20.45	29.18	23.18	33.91	27.36		
	(26.38)	(20.01)	(26.98)	(20.40)	(28.85)	(23.81)		

Note: T = Treatment, P = Placebo

Table 3 Diagnostic and psychological variables pre and post treatment

Participant	Treatment Group	ADOS Pre	ADOS Post	IQ Pre	IQ Post
#01	Group 0	16	14	63	62
#02	Group 0	9	8	66	69
#03	Group 1	18	23	60	71
#04	Group 1	18	20	52	59
#05	Group 1	16	16	63	53
#06	Group 0	13	16	68	49
#07	Group 1	13	17	68	44
#08	Group 0	15	17	65	61
#10	Group 1	10	12	83	70
#11	Group 0	13	14	83	84
#12	Group 1	12	11	64	65

Discussion

The primary purpose of this study was to determine if Tomatis contributed to the improvement of the receptive and expressive language in children with autism. The results showed no significant differences on the language measures across the groups attributed to the treatment condition. In regards to receptive language, there was an overall trend for the participants to progress or develop in a linear way. All subjects showed improvement in their language skills over time; however, the change did not appear related to the treatment condition. It is unclear if the improvement is associated with general developmental progress or some other factor.

Although the participants were randomly assigned to the groups, the developmental level appeared to be different for each in that the placebo/treatment group was higher functioning than the treatment/placebo group. It has been suggested that variables such as age and level of functioning at the start of treatment need to be carefully considered when evaluating outcome (Rogers 1998). As is evident in Tables 1 and 2, the participants in this sample are heterogeneous. There is notable variability in terms of IQ and language skills at baseline. However, since we employed a randomized design we were unable to control for these possible effects.

In summary, our results did not demonstrate treatment-specific improvement in receptive and expressive language in children with autism. Due to the fact that this is the only known experimental study investigating the Tomatis Method, we are unable to unequivocally state that Tomatis does not show some benefit for children with autism. However, our results do not provide evidence for the presumed benefit of the treatment compared with music alone, a finding similar to studies of AIT indicating a lack of empirical support or unconvincing findings for the use in autism (Dawson and Watling 2000).

Despite our design and experimental control, there are limitations to report. The study may be underpowered due to the small sample size and the heterogeneous sample makes it difficult to determine if certain factors such as age or level of functioning make a child more responsive to treatment. Future investigations will need to consider contributing factors for general improvement including the treatment intensity, and placebo effects. Other forms of placebo such as "white noise" or comparing music treatment to consistent interactive play with a therapist on a regular basis may be informative. Explorations into the broader beneficial aspects of intervention and participation in research may be valuable and warrant our expanded study.

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