

An Integrative Review of the Effectiveness of the Tomatis Method in Children with Autism Spectrum Disorder

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ABSTRACT:

OBJECTIVE: The aim of the study is to conduct an integrative review that will identify effectiveness of Tomatis method as an option for treatment of children with autism spectrum disorder (ASD).

DATA SOURCES: A comprehensive search of meta-analyses and case studies, letters, opinion papers, citations in papers, references, books in English, French and Spanish published during the last 30 years.

RESULTS: A total of 14 articles and 2 books met the inclusion criteria and all were read and analyzed according to an integrative review protocol then categorized. It was observed that there are 6 quantitative studies, 6 with mixed method design and 4 qualitative studies. Almost all of them support Tomatis method (except 1) as an intervention that can help in children with ASD. Even that 1 study that estimated that the positive results were not related to the Tomatis treatment, concluded that the majority of the children in the study demonstrated general improvement in language. A number of studies indicated as a result that children were no longer considered with ASD.

CONCLUSION: Tomatis method offers interventions that significantly improve the autistic traits in children but more research has to be done, especially randomized control trials that will strengthen the evidence.

KEYWORDS: “Tomatis”, “autism”, “children”, “autistic”, “autisme”, “autistes” and “enfants”, “autismo”, “ninos”, autistas”.

SAŽETAK:

INTEGRATIVNI PREGLED UČINKOVITOSTI TOMATIS METODE KOD DJECE S POREMEĆAJA SPEKTRA AUTIZMA
CILJ: cilj istraživanja je provesti integrativni pregled koji će identificirati učinkovitost Tomatis metode kao opcije za intervenciju kod djece s poremećajem spektra autizma (PAS).

IZVORI PODATAKA: sveobuhvatno pretraživanje meta-analiza i studija slučaja, pisma, referati, citati u radovima, reference, knjige na engleskom, francuskom i španjolskom jeziku objavljene u posljednjih 30 godina.

REZULTATI: ukupno 14 članaka i 2 knjige ispunjavalo je kriterije za uključivanje i svi su pročitani i analizirani prema protokolu integrativnog pregleda, a zatim kategorizirani. Uočeno je da postoji 6 kvantitativnih studija, 6 s mješovitim istraživačkim pristupom, 4 kvalitativne studije. Gotovo svi podržavaju Tomatis metodu (osim 1) kao intervenciju koja može pomoći djeci s PAS-om. Čak je i ona 1 studija koja je procijenila da pozitivni rezultati nisu povezani s Tomatis metodom, zaključila da većina djece u studiji pokazuje opće poboljšanje jezika. Brojne studije rezultirale su time da djeca više nisu smatrana s PAS-om.

ZAKLJUČAK: Tomatis metoda nudi intervencije kojima se značajno poboljšavaju simptomi autizma kod djece, ali potrebno je napraviti više istraživanja, posebno randomiziranih kontrolnih pokusa koji će ojačati dokaze.

KLJUČNE RIJEČI: “Tomatis”, “autism”, “children”, “autistiic”, “autisme”, “autistes” i “enfants”, “autismo”, “ninos”, autistas “.

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INTRODUCTION

1.1 Autism

Not every child with autism spectrum disorder looks like others, some are with very mild, some with severe symptoms. To be diagnosed with ASD, a child must present many disturbances, among important ones are: deficits in social communication and interaction, in nonverbal communicative behaviours, restricted patterns of behaviour, stereotyped motor movements, excessive adherence to routine, fixated interests, etc. Parents often do not receive an accurate diagnosis what would represent a first step in treating autism¹, as diagnosis serves as a base for treatment². There are many different approaches used to improve symptoms of ASD. The therapeutic intervention discussed in this paper - the Tomatis method - is one of many possible interventions available to those with ASD³. It is not suggested as a cure to ASD, but as a possibly effective therapy that could improve communication skills, physical and motor skills, and social and behavioral skills in children with ASD⁴.

1.2 Tomatis Method

One of the greatest discoveries in neuroscience is neuroplasticity of the brain. Music is a powerful stimulus for neuroplasticity and balances the brain's electrical activity⁵. It is shown by brain scan studies that neurons fire in unity to music in perfect synchrony and that is the reason why music can affect the rhythms of the brain⁶.

A lot of data speaks in favor of the exposure of pregnant women and newborns to music which promotes brain development and the inner ear of a child⁵. The impact upon children with ASD is no different. The most significant link between music and performance improvement in neuropsychological activity has been demonstrated in Campbell's studies involving Mozart's music⁶. It is undeniable, as Campbell⁷ states, that the rhythms, melodies and high frequencies of Mozart's music inspire creative and motivational areas of the brain. Campbell⁷ based his discovery on the works of a French doctor Alfred Tomatis, who hypothesized that the lack of sound stimulation or abnormal stimulation in utero and/or early childhood can cause aberrant behaviours and delayed or disabling communication skills⁶.

Tomatis Auditory Stimulation is performed by listening to music (Mozart and Gregorian Chants) mother's voice recording and someone's own voice through an active vocal work, processed and filtered through an electronic device⁴.

METHODS

This integrative review of the literature aims to gather and analyze the available scientific evidence produced on the effectiveness of the Tomatis method in children with ASD that will contribute to the development of knowledge on the issue. The Integrative Review will be presented in six stages: Guiding questions, Search strategy and sampling of data, Data collection and extraction, Critical analysis of the studies included, Discussion of

results and Presentation of the integrative review⁸.

GUIDING QUESTIONS

The evidence within the literature will be critically reviewed in order to answer the following guiding questions:

- What has been published in the last thirty years on effectiveness of the Tomatis method in children with ASD and
- Is there any evidence that the Tomatis Method is an effective treatment option for ASD.

SEARCH STRATEGY AND SAMPLING THE DATA

The first step of the search strategy was to search for primary sources: meta-analyses and case studies and secondary sources. The Keywords used in the search strategy were: "autism" AND/OR "autistic children" AND "Tomatis".

INCLUSION AND EXCLUSION CRITERIA

Inclusion:

1. Timeframe: from 1987 to 2019
2. The sample: children with the ASD, age group: from 2-21.
3. Intervention researched has to be Tomatis method
4. Data should be presented in English, French or Spanish language
5. The types of research design are: meta-analyses, randomized control trials, cross-over trials, case-control, letters, opinion papers, case reports, books and other grey literature.

Exclusion:

1. Other sound-based interventions, other music therapies or other Mozart music therapies
2. Other medical conditions and psychological disorders

The literature search identified 113 papers and 2 books. Several articles were also obtained by scrutinising the reference lists of key articles or reviews. After the title/abstract screening, 34 publications were obtained for detailed evaluation. 1 article was sent by e-mail by the author upon the request. After detailed evaluation all sources that did not meet the criteria of relating specifically to Tomatis method and autistic children were excluded. From the final 16 papers and 3 books we excluded brief clinical vignettes and anecdotal stories.

The remaining 16 studies form the basis of this review: 6 of them are quantitative, 6 are mixed method designs and 4 of them are qualitative ones.

DATA COLLECTION AND EXTRACTION

The selected studies are analyzed and submitted into a table (Table 2.)

CRITICAL ANALYSIS OF THE STUDIES INCLUDED

Studies are ranked according to the type of evidence⁹ (Table 3).

File Index Ref	Data Base used	Search Terms used	Number of articles
1.1	Cochrane	Autism and children and autism and Tomatis	1
1.2.	CINAHL	Autistic children and autism and Tomatis	1
1.3	MEDLINE PubMed	Autistic children and autism and Tomatis	4
1.4	Lilacs	Ninos autistas and autismo and Tomatis	0
1.5	WEB of Science	Autistic children and autism and Tomatis	8
1.6	Scopus	Autistic children and autism and Tomatis	8
1.7	Google Scholar	Autistic children or enfants and autistes and Tomatis	8
1.8	OVID through UCLAN library	Autistic children and Tomatis	34
1.9	Discovery	Autistic children and autism and Tomatis	14
2.0	Wiley Online Library	Autistic children and autism and Tomatis	3
2.1	Proquest Medical Library	Autistic children and autism and Tomatis	16
2.2	Reference lists	Autistic children and autism and Tomatis	9
2.3	Tomatis Association website	Autistic children and autism and Tomatis	5
2.4	Other		4
	TOTAL		115

LEVEL 1 EVIDENCE – QUANTITATIVE DESIGN, META-ANALYSES AND SYSTEMATIC REVIEWS

1. Gerritsen¹⁰ conducted a meta-analysis and systematically assessed 35 research studies on the impact of Tomatis method on different disorders, among many - ASD. Gerritsen¹⁰ has reviewed 7 small scale research projects on the impact of Tomatis method in children with ASD: Neysmith-Roy³, Vervoort et al.¹¹, Corbett et al.¹², Tatum et al.¹³ and Nel¹⁴. The results indicated the improvement of social, linguistic and psychological skills in all studies, except Corbett et al.¹². Corbett et al.¹² did not show any statistically significant difference between the Tomatis and a placebo group. Also Gerritsen¹⁰ reinterpreted the results of Corbett et al.¹² and showed that by changing methodology from quantitative to qualitative, results changed in favour of Tomatis method in terms of positive behaviour changes in children with ASD who benefited from Tomatis method to a certain extent.

2. Gerritsen⁴ critically reviewed studies that investigated the effects of Tomatis method in children with ASD: Neysmith-Roy³, Vervoort et al.¹¹, Corbett et al.¹². According to Gerritsen⁴, Neysmith-Roy³ and Vervoort et al.¹¹ showed significant improvements in behavior in children with ASD and objectively reported positive outcomes.

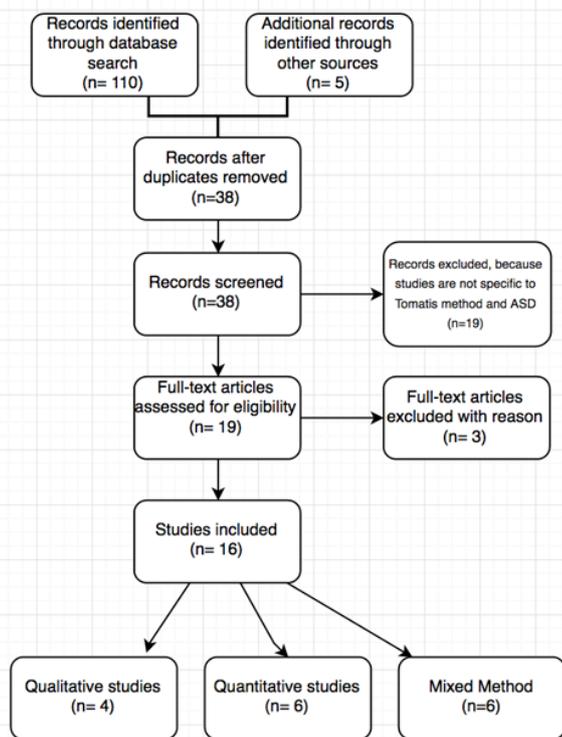
Corbett et al.¹² according to Gerritsen⁴ did not show a statistically significant difference in the language skills between Tomatis treatment and placebo because the sample size very small and too heterogeneous to be analyzed as a group. A cross-over design was also inappropriate to measure the impact of an intervention, after the treatment has been completed, because Tomatis first/ Placebo second measured the sum of the Placebo Effect plus the Extended Tomatis Effect and the second phase was no longer a true Placebo.

LEVEL 2 EVIDENCE – QUANTITATIVE DESIGN, RANDOMIZED CONTROL TRIALS

1. Corbett, et al.¹² aimed to determine the effects of Tomatis method on language skills in children with ASD using randomized, double-blind, placebo-controlled, crossover design. Corbett et al.¹² resumed that the results in the study reflect a lack of improvement in language using the Tomatis Method for children with ASD. Participants in the study were heterogeneous, considering their age, language skills and different IQ levels. While one group had received Mozart music and Gregorian chants with amplified high frequencies with both: air and bone conduction (Tomatis method) first (90 hours) and then placebo treatment (90 hours), the other group - had received an intervention with Mozart's music and Gregorian chants without the modulation of frequencies and without the bone conduction (placebo) and the music was not processed through the Electronic Ear.

So called placebo intervention in this study represents an intervention well known and documented the Mozart effect and Corbett et al.¹² should have acknowledged it and should have offered a different form of intervention to the placebo group, in a form of a white noise, which would reduce a possible influence on participants. Because it is unclear if the results reported were caused by the Tomatis method or by Mozart Effect intervention or both, or if they would have occurred anyway. Mozart's effect has also been observed with a positive effect to communication, speech, reading and writing skills⁷.

A cross-over design in this study is the most controversial, because both groups had actually received two different interventions – Tomatis stimulation and Mozart Effect stimulation, and both interventions might have led to significant improvements in majority of children, which might be directly related to interventions themselves rather than, as the author interprets, are unrelated to the interventions received and are independent of them. Also when interpreting research results it is also important to evaluate the size of the sample. Larger sample sizes would give results with increased precision and better statistical strength.



If the sample size is as small as 11 participants, the results will probably not be statistically significant. Therefore, small sample sizes should not be used to make broad conclusions. This study has substantial weaknesses of a study design and interpretation of results.

2. AbediKoupaia et al.¹⁵ aimed to investigate the effects of Tomatis method in reducing the autistic symptoms in children using randomized controlled trial. 34 children aged from 4-8 years were randomly assigned and equally divided into experimental and control groups. We cannot confirm, because the authors were not giving the information whether all children in experimental group wore headphones that were equipped with air and bone conduction. It remained equally unclear because it was not explained in the study what sort of music participants had been listening through 30 sessions / 60 hours of the program: were they listening only to Mozart music or both Mozart and Gregorian chants that represent the core of the Tomatis method along with filtered mother voice recording? Also the information was missing if the music was modulated or not in terms of high frequency enhancement which is also specific to Tomatis method. The Listener Profile was made for each participant and served as the basis for choosing the most adequate among different categories of classical music albums. Descriptions concerning Listener Profile test and description of music materials chosen are not included in the description of methods. Comparing the results of the two groups – experimental and control, the

research showed that the Tomatis sound therapy could reduce autistic symptoms, increase social interaction, communication, and reduce stereotypical movements according to the Gilliam Autism Rating Scale, G.A.R.S. questionnaire, performed before and after the intervention as a measurement tool in this study. Since the study did not explain whether all the parameters of the Tomatis method were performed: filtering (music modulation), headphones with an attached bone conductor as well as the usual air conduction, it is difficult to say with certainty whether there is an evidence of Tomatis effect or Mozart effect. AbediKoupaia et al.¹⁵ acknowledge only following limitations of their study: parents’ unwillingness to respond to questions during tests and geographical limitation of this study. Since methods are not clearly described the experiment cannot be replicated independently. The study is flawed by weaknesses of reporting therefore conclusions are based on insufficient data.

LEVEL 6 EVIDENCE – QUANTITATIVE STUDIES, CASE SERIES

1. Davis¹⁶ aimed to investigate changes in 100 children with ASD, after 60 hours of Tomatis method in 12 areas of consideration: Interpersonal growth; Listening and speech; Academic Achievement, Thinking, Learning; Attention; Behaviour; Intra-personal Growth to know and express Self; Movement, Sports and Rhythms, Musical and Vocal Skills; Relaxation; Creativity; Reading, Writing, Spelling; Well being. The Parents rated each of the area before and after treatment from their point of view. Some of the areas where changes occurred were highly rated (Interpersonal Growth 87%, Listening and Speech 85%, 81% in Academic Achievement, Thinking, Learning, 80% in Attention, 79% in Behavior, 69% in Intrapersonal Growth to Know and Express Self, 66% in Movement, Sports, and Rhythm, etc.) and some of them lower (Well-being 20%). It is significant that in every area of consideration the changes were evident. There is no indication of how long the research has been conducted, it is not indicated if participants were randomly selected and we do not have information if the parents were informed about the research (Informed Consent). It is said that every parents filled the forms before (“Abilities to be Improved” form) and after the 60 hours of intervention (“Abilities improved” form) regardless of whether or not the research has being carried out. It was reported that participants were exposed to 60 hours of a basic Tomatis programme, but it is not described what a basic programme is. The weakness of this study is a lack of transparency in reporting. Also it is possible that the results are biased or that the criteria of improvement differ from parent to parent.

2. Torres de Carella¹⁷, aimed to investigate if Tomatis method could reduce echolalia (immediate or delayed repetition of what has been heard) in children with ASD. Echolalia represents the phase in acquiring and learning language in children with ASD. Research design is quantitative descriptive and the aim is to describe the opinion of the participants on the impact of Tomatis

method on echolalia in children with ASD. The Standardized Questionnaire with 12 questions was prepared for parents of children with ASD who present echolalia. From 51 distributed, only 8 questionnaires were returned and accepted for the research. Tomatis Intervention varied from 62 hours (25% of participants) to 110 hours (50% of participants). 100% children presented echolalia before the treatment. 37% of parents reported improvement in echolalia. Generally, during the Tomatis intervention many other interventions are being undertaken at the same time and the improvement cannot be exclusively attributed to the Tomatis method. 8 questionnaires represent a very small sample to draw any conclusion and results are not statistically significant. The other weakness of this study is unequal duration of the programme that children were exposed to, authors did not report which programmes were included in Tomatis intervention.

LEVEL 7 EVIDENCE

a) - Mixed Method Design, Individual cases study

1. Six boys with severe ASD (aged 4 to 11 years) received the Tomatis Method stimulation with the aim to assist them in behavioural changes³.

All parents of the children with ASD (diagnosed according to APA criteria¹⁸) were beforehand informed about the possibility that the children might not benefit from the treatment and made an informed decision about their participation signing the Informed Consent Form which described the study in details. The study did not include a control group because of the ethical reasons (withhold of the treatment) and because of the differences of each of the boys.

Twenty-minute video samples were registered for each boy, every time they completed one intensive of the Tomatis programme. After a year, all tapes were randomized and evaluated by educated evaluators who did not know about the treatment program nor about the children. Each participant's videos were rated by the two research assistants and the scores were averaged.

Children's Autism Rating Scale is measured at the beginning and end of treatment. Participants were followed and treated individually.

At the end of each intensive a progress interview was conducted with the parents. Three (50%) boys showed positive changes in behavior after the treatment. From a developmental point of view the changes occurred in pre-linguistic areas for 5 out of 6 boys that are considered as prerequisites for verbal communication.

One boy was no longer considered autistic, two boys showed mild symptoms of ASD and three boys remained within the severely autistic range. These research results suggest that it would be useful to evaluate the effects of the Tomatis Method on children with ASD in a research environment where experimental conditions can be more rigorous.

2. Vervoort et al.¹¹ aimed to study whether Tomatis Method

can reduce neurological dysfunctions in children with ASD in a form of the Qualitative Case Study, using measurement tools: Auditory Evoked Potential technique, EEG Brain Mapping and Tomatis Listening Test System. During the intervention period none other interventions was applied. The observed time of intervention with the Tomatis method differed from case to case (in a range from 6 months to 5 years). The comparison of each of the four cases was with itself (before and after the treatment). All four children exhibited great changes and improvements. Such a small sample, 4, may compromise the conclusions of the study and can prevent extrapolation of the results. On the other hand this study took a lot of time with extensive and intensive treatments because of the severity of the cases. Certainly a bigger sample would impose some practical and technical obstacles but larger samples sizes can lead to statistically significant differences that can contribute to evidence-based practice.

b) - MIXED METHOD DESIGN, SINGLE CASE STUDIES,

1. Tatum et al.¹³ aimed to investigate whether synergistic benefits exists from the simultaneous combination of Tomatis method with a speech therapy.

Tatum et al.¹³ presented the case of a 14-year-old girl diagnosed with ASD, not verbal. In spite of 10 years of speech therapy, she pronounced only few syllables Ba, Da, Ma. The girl was evaluated prior to the start with Tomatis Method (Pre-test "Abilities to be Improved" Form), during the intervention (Daily Observation Form) and after each intensive (Post-test "Abilities Improved" Form).

After the first intensive of Tomatis method without any additional speech therapy, parents reported increasing awareness of listening, independence, motivation, and desire to communicate. She was no longer too sensitive to the sounds and she verbalized more.

From nonverbal, she has had a significant improvement in communication, attention, understanding, socialization and learning in general. The speech therapy alone for 10 years has not made great progress as the Tomatis method contributed through 150 hours of passive and active work program.

This case demonstrate the usual situation In a real word where we cannot observe positive changes of Tomatis Method isolated from other social influences or educational interventions. Further investigation should be done to more precisely determine the effect of combining more interventions for children with ASD.

2. Nel¹⁴ aimed to identify the effect of Tomatis Method on psychological well-being and communication skills in a 14-years old boy with Asperger's syndrome, one of levels of symptom severity of ASD according to DSM-5¹⁸. Mixed method design is used in a single case study. Qualitative data were obtained through semi-structured interview before and after intervention, quantitative data through Projective drawing and Profile of Mood States (POMS). Tomatis programme consisted of 75 hours of filtered

music, mother's voice recording and active vocal work over 6 months in three intensives. Results indicated improvement in Interpersonal Communication and psychological well-being. A scientific contribution of this case study (Nel, 2005) is in its holistic approach and empirical value.

3. Pralong, Espinosa, & Trigo¹⁹ in their single case study aimed to investigate if the Tomatis Method could reduce autistic traits and improve reading and writing skills in 8 years old boy with ASD. Mixed method design is used. Qualitative data were obtained through observation and analysis of reactions of the boy and quantitative data from measuring anxiety with SCAS (Spence Children's Anxiety Scale) and hyperactivity level (Vanderbilt Assessment Scale, NIOCHQ, 2010). A focus group was also carried out with relatives of the child, with the theme: "Strategies that parents use to confront the crises of their children with ASD". After 4 intensives (9 months and 120 hours) and the use of the Tooballo® (active voice work) 5-10 minutes every day during those 9 months, the child achieved a remarkable level of maturation, a decrease in anxiety levels, but no significant changes in attention and hyperactivity. In the academic part there were advances in the process of literacy. There were significant behavioral improvements.

4. Davies & Smith²⁰ aimed to investigate whether Tomatis Method could help 18-year-old boy with Asperger disorder (ASD) who suffered from behaviour problems (outbursts of anger and violence, obsessive-compulsive disorder, anxiety), sleeping problems, eyesight problems, motor problems and diarrhea. Before and after each of 4 intensives, the boy was assessed through mixed method design. Qualitative data were obtained through interviews and observations and quantitative through Tomatis Listening Tests (TLTS). TLTS is a measuring instrument used to determine the listening curve and listening distortion and it enables monitoring of changes and planning for the next programme. The programmes were made from filtered Mozart's music and Gregorian chants. Recordings of filtered mother voice and active vocal work has not been introduced into programmes. There were improvements in his behaviour, his sleep and a bowel movement were better, improvements were noted in a posture and motor skills as well. Davies & Smith²⁰ considered that the Tomatis therapy was more effective because it was used in combination with other interventions. This single case study has not been found searching through electronic database and it has not been published in peer-review journals. It has been identified on Tomatis professional organisation website therefore it is of a lower-level of evidence than previous single case studies.

c) – QUALITATIVE DESIGN, BIOGRAPHY

Ruben²¹ presented personal experience story, a real autism success story of her daughter who was diagnosed with ASD and completely recovered from it. In a book (Ruben, 2010) we follow

a life experience from the time her daughter was diagnosed until she got well and completely out of ASD. When diagnosed with ASD, she was 22 months old. Tomatis method together with sensory integration were applied during about 1,5 year in 6 intensives. Already after the first intensive, a girl started to talk more spontaneously. During the second intensive, mother voice recording and active vocal work were introduced, echolalia appeared as well as her coordination and motor planning improved. After her third intensive, a girl started to talk, sing and express herself. After the fourth intensive she had more balance and coordination, spoke spontaneously, hugged and showed her affection, only year and half beforehand she was still nonverbal. After her 5th intensive, a girl was retested and the results showed a normal child's development. 6th intensive brought further improvement in her body – not only promoted her speech, it liberated her from typical repetitive mannerisms.

LEVEL 8 EVIDENCE – QUALITATIVE DESIGN, OPINIONS OF SPECIALISTS

1) Madaule²² observed that many of children with ASD had normal development and then started to present at about the same age (around 18 months) symptoms of ASD. The Tomatis programme of neuro-auditory stimulation for children with ASD usually takes from 150 to 200 hours over 6 to 12 months. Madaule has confirmed that results vary from a child to child, but the overall progress has been observed in 80% of cases, and even more, 80-90% is observed regarding development of pre-linguistic skills. Filtering out the lower frequencies from mother voice recording simulate the hearing sounds in the womb (intrauterine hearing, also called a sonic birth).

2) Gilmor & Madaule²³ observed that children with ASD react more emotionally expressive, especially towards their mothers after they have been stimulated with filtered mother voice recording. Nonverbal children with ASD start to produce sounds, eye contact and attention span improve, repetitive body movement and aggressive behavior decrease. Intensity and duration of periods of autistic social withdrawal diminish and children with ASD start to establish contacts with other children.

3) Madaule^{22,23} presented his long professional experience in form of a personal letter, an article and a book which are of lower evidence comparing to previous studies from the higher level of evidence but his opinion gave us possibility of better understanding of the method itself, a procedure of implementing Tomatis programme and possible outcomes. He is the most experienced living expert in this field and he learned about Tomatis method from dr. Tomatis 50 years ago. and was treated from dyslexia by dr. Tomatis himself when he was a young boy in France^{6,22}. In this integrative review he has been represented by 3 studies, experts' opinions (lowest level of evidence) because of valuable number of cases of ASD that he has treated, he is indispensable

source of evidence for Tomatis method.

DISCUSSION OF RESULTS

DATE OF PUBLICATION:

16 researched studies were predominantly published during 2000 except two oldest, published in 1989²³ and 1998²². The most recent was published in 2016²⁰.

Authors:

2 authors Gerritsen and Madaule^{4,10,22,23} published more than 1 study.

Country of origin:

Studies were conducted in 9 countries: Belgium, Canada, Ecuador, Iran, Mexico, Puerto Rico, South Africa, United Kingdom, United States of America. USA, 4 and Canada, 4 being leading countries.

Designs:

Quantitative design 6: Meta-analyses and systematic reviews 2; Randomized control trials 2; Case series 2; Mixed Method Design 6: Individual cases studies 2; Single Case Studies 4;

Qualitative 4: Biography 1; Experience of Specialists 3

Measurement instruments:

Choice of measurement instruments depended of design and purposes of particular study.

In Quantitative research various measuring tools were used, ranging from scales relative to autism degree to different psychological evaluation, semi-structured interviews etc.

1 study - The Gilliam Autism Rating Scale (GARS), pre- and post- questionnaire

1 study - Children's Autism Rating Scale (CARS)

1 study - The Autism Diagnostic Observation Schedule-Generic (ADOS-G) The Stanford-Binet Intelligence Scale-Fourth Edition (SB4), IQ, The Peabody Picture Vocabulary Test-Third Edition (PPVT-III), The Expressive One Word Vocabulary Test (EOWVT).

1 study - The Profile of Mood States (POMS), The Draw-a-Person (DAP), The Draw-a-Tree (DAT),

1 study -The Spence Children's Anxiety Scale (SCAS), Vanderbilt test for hyperactivity;

2 studies - Pre- and Post- assessment ("Abilities-to-be Improved" form, "Abilities Improved" form).

1 study - Electroencephalogram (EEG) and Auditory Evoked potentials (AEP).

Only 4 studies used the Tomatis Listening Test^{3,11,16,20} which belongs exclusively to the Tomatis method and helps to identify listening potential providing information on voice quality, language acquisition, learning ability and many more. 2 systematic reviews and 3 experiences of specialists are excluded from analysis.

INTERVENTION:

More than a half of studies, 9, specifically mentioned usage of both interventions, passive and active phase, 4 used Mozart music and Gregorian chants with bone and air conduction and 1¹⁵ did not specify what kind of classical music was applied in the research, 2 systematic reviews¹⁰ were excluded from this evaluation because they are not specifically assigned to the music programme. It was observed that all 4 quantitative and 2 mixed method studies used only Mozart music and Gregorian chant, without filtered Mother Voice Recording and active vocal work. 1 of them used additional program which is not part of Tomatis method¹⁵.

Intervention duration:

5 studies are excluded: 2 systematic reviews¹⁰ and 3 experiences of specialists^{22,23}. Intervention duration varied from study to study, in a range from 2 intensives - 60 hours to 37 intensives¹¹. An intensive usually corresponds to 30 hours - 15 days, 2 hours but it is not always a case.

Aims and purposes:

3 studies aimed to investigate if Tomatis method can reduce ASD symptoms, 1 if it can reduce echolalia in children with ASD, 1 study investigated the effects of the Tomatis Method on language skills in children with ASD, 1 study aimed to investigate the effect of Tomatis method in the area of change in academic achievement thinking, learning, attention, behavior, creativity, interpersonal growth, intrapersonal growth to know and express self, well-being, listening and speech, reading, writing, and spelling, movement, sports, and rhythm, musical and vocal skills, and relaxation. 1 investigated the effect of Tomatis Method on the psychological wellbeing and communication. 1 investigated synergistic benefits from the simultaneous combination of Tomatis method with a speech therapy. 1 investigated if Tomatis Method can reduce neurological dysfunctions.

Participants sample:

The number and age of participants vary from study to study, 5 studies have 1 participant and the biggest sample is 100 participants in 1 study. The majority of studies had small group designs. The youngest participants were 2 years old and the oldest 21. Majority of participants were boys.

Outcomes:

All studies reported similar results: reducing symptoms and stereotypical movements, increasing social interaction and communication, improvements in speech, emotional and attention enhancement. Even a study (12), that estimated that the positive results were not related to the Tomatis treatment, concluded that the majority of the children in the study demonstrated general improvement in language. A number of studies indicated as a result that children were no longer considered with ASD.

PRESENTATION OF INTEGRATIVE REVIEW

2.6.1 Limitation:

This integrative review has identified 16 studies that reviewed and evaluated the effectiveness of Tomatis method in children with ASD.

The methodological quality of studies in general was adequate although some deficiencies were detected, particularly in aspects related to a cross-over design and a interpretation of results¹², related to poor and insufficient data¹⁵ and generally a very small sample in majority of studies which made results not statistically significant. Only 1 study obtained informed consent thus maintaining ethical standards.

All studies showed that Tomatis method can contribute in reduc-

ing symptoms of ASD.

RECOMMENDATION:

Most of studies were focused on communication skills because a lack of communication skills is the main feature of ASD. Research outcomes in this integrated review show that the Tomatis method can play a very important role and fill the hole in the current situation where we find ourselves helpless with outdated and ineffective measures and protocols in front of growing numbers of children with ASD. Neuroscience gives us new evidences and shows us that auditive neurostimulation, in this case the Tomatis method, can significantly improve the general condition of children with ASD if not completely resolve it.

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