

Tomatis based Sound Therapy: A Research Review

By Rafaele Joudry

Introduction:

Music has been accepted as a powerful healing method since it was ancient Greece and doubtless longer. It has had many advocates over the centuries, and has been used therapeutically in many forms.

In the early 1950s a Paris based ear specialist, Dr Alfred Tomatis, opened a new field of pursuit in the therapeutic application of music, which has become known as Sound Therapy, Audio-psycho-phonology, or Tomatis therapy (Tomatis, 1991).

His method applies gating and frequency filtration, combined with right ear emphasis, to achieve enhanced integration in not just the auditory pathways but also many other parts of the nervous system.

Tomatis developed a unique theory of rehabilitation of the auditory system and nervous system, based on his knowledge of embryology and keen observation of many facets of life. The ear is uniquely positioned so it plays an integrating role in many neuroanatomical systems including hearing, balance, posture, movement, vision and the development of language.

The discoveries of Dr Tomatis, have been taken up enthusiastically by innovators in a wide variety of health and education fields. At the same time, most of the mainstream professions in those same fields have resisted and denied the usefulness of his approach because his theories do not conform to their current understanding of causal factors and current treatment approaches.

This article presents a review of the studies done to date in a wide variety of fields totalling over 100 studies reviewed, in 21 countries, being: Poland, South Africa, Italy, China, Sweden, Indonesia, France, South Korea, UK, Spain, USA, Ecuador, Austria, Denmark, Germany, Columbia, Belgium, Netherlands, Japan, Australia and Canada.

The search terms used to access the information were 'Tomatis' and 'Research'. The scope of this paper is limited in part one to actual clinical trials or published reports of clinical case notes using a method recognised as the official Tomatis method.

The conditions studied include vocal quality, singing, musicality, auditory processing, learning difficulties, dyslexia, ADHD, Autism spectrum disorder, stroke, communication, reading, academic performance, speech problems including dyspraxia and stuttering, voice, focus and concentration, spatial perception, severe developmental disability, epilepsy, brain damage, foreign language learning, depression and anxiety and pregnancy.

In a later edition we will review studies and surveys on the Joudry portable method of Tomatis-based Sound Therapy which pertain additionally to general well-being, sleep, stress among adult listeners, and to some particular ear-related disorders including tinnitus, hyperacusis, ear related

dizziness, chronic Eustachian tube disorder (blocked ear) and cocktail party syndrome (hearing discrimination problems in background noise.)

Tomatis was a pioneer and an innovator who asked questions which took him into uncharted territory. As a result, he discovered a method of stimulating the sensory and neural systems which was unprecedented, and the impact of which is only beginning to be fully understood some six decades later. The fact that he was so far ahead of his time may partly explain why his system, although it received considerable recognition during his lifetime, is not more widespread than it is today.

From Wholistic to Integrative

In earlier European-style medical thinking leading up to the 1950s, a more wholistic approach to the human being was the norm. Dr Tomatis's innovative exploration of the deeper psychological impact of sound on our wellbeing and relationships was acceptable within the general philosophies of this era, following Freud's introduction of ideas such as the subconscious and superconscious to our awareness.

In the ensuing decades, however, and particularly in English speaking Western countries, scientific reductionism and objective, empirical research led to a more fragmented and mechanised approach. In this research environment the Tomatis method was not a natural fit, as there was a tendency to want to isolate each part of it and find out which one was actually working, rather than acknowledging the possible synergy of all its elements on our whole, complex being. This may partly explain why the method has not reached a greater level of mainstream acceptance and recognition.

Stutt (1983) also noted that Tomatis's premises did not fit the dominant theories of the day, and being essentially based on neurophysiological and electronic approaches, were very removed from mainstream educational practice.

Fortunately, a new trend is now emerging in neuroscience. As we delved further into the workings of the brain in the late 20th century, and objective measures of brain function such as EEG, MRI ABR MLR and LLR were developed as research tools, giving us far more subtle, complex measures of the unseen parts of our functioning, a new spectrum of complexity and integration of the human system began to emerge.

Various neurodevelopmental scientists who had been innovating in their clinical practice were gradually able to find scientific verification for their observations. Some of the pioneers who helped to fuel this deeper understanding include:

1. Jean Ayres' work on sensory integration informed a new generation of occupational therapists and remedial educators who began to understand our developmental process in which all sensory pathways must develop an integrated harmony to give us useful perception.
2. Michael Merzenich and many other neuroscientists proved the reality of brain plasticity.
3. Stephen Porges developed the polyvagal theory, explaining links between the autonomic nervous system and the emergence of social behaviour.

Appropriate Research Methodologies

In reviewing a sensory-based, wholistic method such as the Tomatis method, we should first acknowledge how such treatments differ from a mainstream medical approach such as drug treatment or surgery. Sensory treatments are inputting and affecting our entire, complex system by drawing on its own self-organising and self-correcting, healing potential. In contrast, drugs work in spite of, or in contradiction to, the internal organisation of the system, compensating for its deficits by fixing a final symptom. The double-blind placebo-controlled trial model was designed to measure the effect of treatments such as pharmaceuticals, which directly treat a specific symptom. Because such treatments bypass the complex integrative systems of the body, they tend to have a fairly consistent, easily measured, narrow effect on the symptom concerned. They can therefore be measured in a very structured, numeric fashion to assess their effectiveness.

However, when we attempt to test a program that is entering into and enhancing our internal sensory integration systems, we do not know what outcome specifically we are looking to measure. Tomatis-based Sound Therapy has been observed to produce changes in our nervous system, our auditory system, our muscular system, our emotional system, our language system, our sleep system, our vestibular system, our sensory integration and all the diverse aspects of our functionality related to that. When someone undertakes Sound Therapy, a stimulus is being put into our entire set of living systems, physical, emotional and mental. We cannot anticipate what end result will occur from this, in the same way that we can predict symptomatic relief from a drug test.

For this reason, when researching Sound Therapy, qualitative research and case histories are often more suitable approaches than quantitative measures. In every study undertaken it is clear that certain individuals benefit extensively and experience multi-faceted, life changing results. Many other participants will have mild benefits, which in relatively healthy individuals may be hard to measure or may be outside the parameters being studied and therefore not be detected with the methods used. Therefore it is reasonable to assume that quantitative results will be lower than they should as they cannot accommodate the vastly varied and subtle responses of each nervous system.

The sheer body of studies that have been carried out and the continuing interest in Tomatis based Sound Therapy across many specialist fields are a clear confirmation of its profound benefits for the human system.

Reporting of treatment protocols

In the interests of brevity, I have not documented the length or specific configuration of Tomatis treatment given in each study. Many of the studies acknowledge that the duration of treatment was less than the recommended period. Nevertheless, some positive results were seen in all cases. For more specific detail, the reader is referred to look up the individual papers.

In general, Tomatis treatment involves:

- Listening through headphones
- Filtered sounds using Tomatis's Electronic Ear
- Progressively filtering out and then restoring a large portion of the low frequency sounds in each listening session
- Mozart and Gregorian chant
- A passive and an active phase
- A higher volume delivered to the right ear
- A Listening Test to determine protocols

- In some cases, listening to filtered programs of the mother's voice
- Several phases of treatment with a break in between

These elements were true in every study covered.

Tomatis theories and discoveries

Tomatis distinguished between organic and functional damage (Cuppola, 2016) — a distinction which has still not been acknowledged by current audiological practice. He believed that when damage is merely functional, it is principally caused by sub-optimal function of the middle ear muscles (stapedius and tensor tympani).

Initially Tomatis turned the music on and off at short intervals to activate and deactivate the muscles in order to exercise them. He then found a better effect resulted from alternating music through channels emphasising either base or treble sounds. He found that through listening to music processed in this way patients were regaining the ability to perceive frequencies that had been lost. At the same time there was an immediate and spontaneous improvement in the frequencies with in their voice. (Tomatis Conscious Ear)

Research Reviews

Over a hundred articles have been published on the Tomatis method since the mid nineteen seventies. Several research reviews have been undertaken previously to summarise the published literature.

Stutt (1983) at McGill University in Montreal in his paper *The Tomatis Method: A Review of Current Research* concludes, after reviewing four studies by Wilson, Gilmore, Roy and Neysmith-Roy, and Rourke and Russell, focusing on pre-school LD children, Dyslexic boys, and older children with LD, that "The evidence indicates that something of positive value is happening to most children who undergo this treatment program," and emphasised that benefits were produced beyond what could be expected through maturation or remedial education alone.

Some of the specific benefits that Stutt noted were:

- A significant increase in IQ
- Better reading skills
- Improved perceptual processing
- More developed communication skills
- An enhanced ability to verbally express thoughts and feelings

Gilmore in his meta analysis in 1999 in the International Journal of Listening stated:

"The Tomatis Method has been tested rigorously and has been found to be very effective in the treatment of learning difficulties and behavior problems."

Gilmor reviewed five studies which involved a total of 231 children. His finding was that the Tomatis method significantly improved:

- Linguistic skills
- Psychomotor skills
- Personal and social adjustment skills
- Cognitive skills
- Auditory skills

He also reviewed data from The Listening Centre in Toronto which had over 400 well-documented cases of children and adolescents with learning problems and under-achievement on psycho-educational tests. In parental grading of results over 95% observed that the program had helped their children in areas such as communication, attention, reading, speech, memory, spelling, maturity and decreased frustration. Moreover, 97% of the children had maintained benefits in a six month follow up.

Domain	Mean Effect Size (N = 225)
Linguistic	0.41
Psycho Motor	0.32
Personal and Social Adjustment	0.31
Cognitive	0.30
Auditory	0.04

Table 7: The Gilmor meta-analysis

Gerritsen, 2010

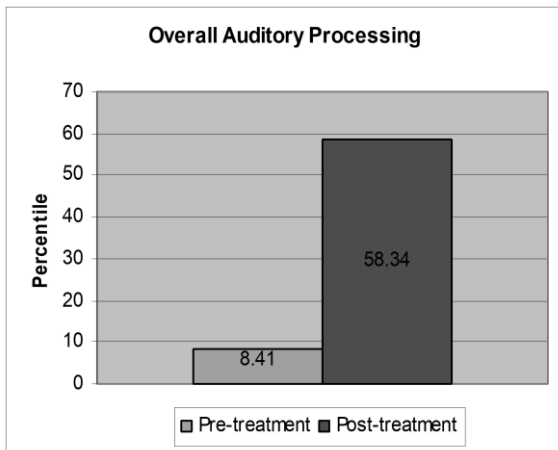
The table above is a summary by Gerritsen of Gilmor's meta analysis. Gerritsen notes that the scores for Auditory are lower than others due to the inclusion of the Kershner data, which contradicts the finding of Rourke and Russel and of Wilson. (Gerritsen, 2010)

In 2007, Deborah Ross-Swain, published a study in the International Journal of Listening which summarised the findings to date on the effects of the Tomatis treatment on auditory processing disorder.

Swain summarised Tomatis's hypothesis about the impact of Sound Therapy on auditory processing.

Swain referred to a hypothesis postulated by Sacarin and Gerritsen that the Tomatis Method stimulates the myelination of the auditory pathways (Sacarin, 2009, referenced in Gerritsen, 2010) which improves the speed of processing of the auditory signals.

Swain tested this theory in a study of 41 children aged from 4 to 19 years, presenting with auditory processing disorders. All subjects demonstrated significant improvement with skills of immediate auditory memory, auditory sequencing, interpretation of directions, auditory discrimination and auditory cohesion. The overall improvement in all of these combined auditory processing skills was 49.93%. (Swain, 2007)



Summary of Swain study, Gerritsen, 2010

Gerritsen (2009) reviewed 35 studies, covering APD, LD and behaviour problems, ADD, Autism, Foreign language learning, Voice, child birth and Stuttering. (Gerritsen, 2010).

This is an excellent and thorough review of the literature on Tomatis treatment up to that time. In the following pages I include Gerritsen's summaries of research on each condition made in 2009, plus adding the numerous additional studies done since that date.

Chastain has undertaken a review of the peer reviewed literature on sound therapy for autism. Most of these studies were done using the method developed by Dr Berard, known as Auditory Integration Training (AIT) which is widely seen as a derivative of Tomatis's work - though the filtering method, treatment protocols and psychological interpretations differ significantly.

The reason for the wider prevalence of Berard's method is the field of autism is mainly circumstantial, due to the widely acclaimed book by Anabel Stehli about her daughter, Georgie's almost total recovery from autism after receiving Berard's treatment. This sparked a great deal of interest, dissemination of the treatment and many research studies in the field of autism treatment.

Chastain's review of these articles is a useful investigation into the perceived value of the method for children with autism, with a particular focus on relevance to Sensory Processing Disorder (SPD) which is often concurrent with the autism spectrum.

While a number of sizable studies have failed to clearly demonstrate the effectiveness of auditory training for autism, resulting in the American Speech Language and Hearing Association (ASHA) refusing to recognise its validity, Chastain suggests that the evidence is still inconclusive. The results are mixed and indeterminate for most of the studies. As with other conditions, the treatment has been found highly effective in some cases, but only minimally effective in others, making qualitative measures a blunt tool for assessing a highly complex process.

Chastain makes the point that the problem with dismissing these results is that important changes may have been washed out due to heterogeneity of the subjects. Within the autism spectrum there may be both hypo and hyper responders. New definitions within the field of Sensory Processing Disorders (SPD) may enable more precise assessment of suitability, Chastain suggests.

It is likely that the Berard method has eliminated many of the more subtle and specific aspects of treatment originally included in the Tomatis approach.

New insights on the impact of sound training on those on the autism spectrum, based on a very different and scientifically validated way of viewing the nervous system, have recently been added to our understanding through the work of Stephen Porges on Polyvagal Theory.

Studies on Auditory Processing

Though generally used in the context of auditory processing disorder as a developmental learning difficulty, auditory processing more generically means the many facets used by every person in applying our language facility in daily life. Hence this section covers studies which also fall into this broader category.

While Sound Therapy treats a large array of ear and brain related conditions, in most cases its core action can be best described as enhancement of auditory processing.

Tomatis surmised that the development and functioning of the auditory system is intrinsically interlinked with our larger neurophysiological system via the cranial nerves and embryological origins. (Swain, 2007)

The auditory system is known to have capability functions which include equilibrium in space, sound perception, attention to and discrimination of sound, localisation of sound, and auditory input to the development of coordinated laterality. Tomatis also hypothesised that sound transmits energy via cortical brain recharge. (Swain, 2007)

Children with APD are known to have deficits in several of these abilities involving sound perception, discrimination and its hierarchical organisation. (Bellis, 1996; EAA, 1996; DeConde & Gillet, 1993). Quoted by Swain, 2007

Tomatis's sound therapy has been found to repair and restore many of these auditory processing skills by stimulating and re-educating the listening function, a process which relies on this spectrum of capabilities of the auditory system. (Swain, 2007)

Tomatis was unique in his claim that high frequency sound is an essential component of this rehabilitation, enabling the brain to improve its sound processing. We know that 80% of the cilia (hair cells in the cochlea) are responsive to higher frequency sounds, above 3,000Hz. Tomatis sound therapy re-trains the ear to high frequencies up to 10,000Hz or more. (Swain 2007.)

Bonthuys et al (2016) explored the self-regulating and coping skills of university students in response to the challenging adaptation and coping mechanisms required by their changing and demanding roles, both socially and academically. Hypothesising that listening and attention are crucial skills in self-regulation, they tested the impact of Tomatis treatment on a test group of 26 students against two control groups, using interactive qualitative analysis.

The Tomatis Method was shown to compare well with other interventions for the promotion of self-regulation. Qualitative observations showed improved listening in social and academic contexts, attention and awareness, self-control and interpersonal regulation.

Tests	Pre-post differences in mean scores	Significant differences $p < .05$
-------	-------------------------------------	-----------------------------------

Hypo-responsiveness Left ear N=25		
Tomatis	0.28	
Mozart	-0.98	Tomatis > Mozart
Control	-0.61	Tomatis > Control
Right ear spacialization N=19		
Tomatis	-0.83	
Mozart	-0.67	
Control	0.80	Tomatis > Control
Mental Health Continuum –social wellbeing N = 25		
Tomatis	4.50	
Mozart	1.44	
Control	-0.67	Tomatis > Control
Mental Health Continuum –psych wellbeing N = 25		
Tomatis	2.75	
Mozart	-1.56	Tomatis > Mozart
Control	-2.56	Tomatis > Control
Academic Motivation Scale –N = 25		
Tomatis	1.14	
Mozart	-0.50	Tomatis > Mozart
Control	0.08	
Shortened Self-Regulation Questionnaire –N = 25		
Tomatis	1.22	
Mozart	0.00	
Control	-1.50	Tomatis > Control
Table Bonthuys study, Comparison of Tomatis to Mozart and Control group		

Skrodzka et al (2015) at the Institute of acoustics and Mickiewicz University, Poznan, Poland, compared the impact of Tomatis treatment (Music) to an interactive auditory training program (acoustic training) on visually impaired children and teenagers. They measured the performance of subjects on auditory and spatial tasks which included pitch discrimination, pitch and timbre categorisation, pitch memory, lateralisation of stationary and moving sounds. 55 subjects were divided into two treatment and two control groups. All had normal hearing.

The results showed that both the Tomatis music treatment and the acoustic training delivered observable benefits, compared to the control groups, though with the limited treatment time (4 weeks), these were not statistically significant for Tomatis treatment. The limited sample size may also have affected the accuracy of results. The greatest improvement was in lateralization, and teenagers improved more than children.

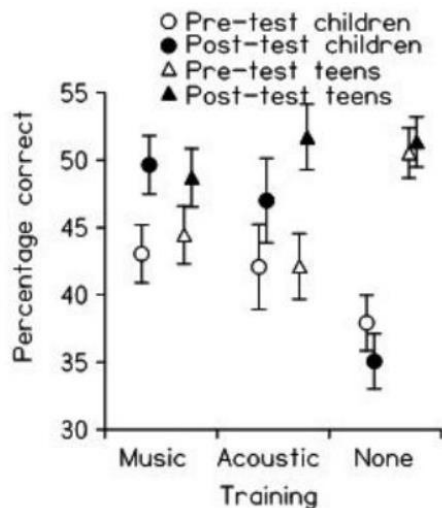


Fig. 2. Averaged results of pre- and post-training verification test for the MT, AT, and control subjects from both age groups.

Escera (2015) at the University of Barcelona, Spain, undertook research to demonstrate whether the effect of Tomatis therapy is due to modification of sound encoding along the auditory pathway, from brainstem to cortex. Comparing a treatment and control group of six healthy participants in each, EEG recordings were used to track complex auditory brainstem responses (cABR), Frequency Following Response (FFR) and mismatch negativity (MMN). The FFR is the biological signature of sound encoding at the level of the inferior colliculus, and has been shown to track plastic changes in the auditory brainstem in both short term and long term learning events.

A positive result was not detected. It is, however, useful to know that this appears not to be the level of measurement appropriate to recording the effects of the Tomatis method.

Young (2013) at Chicora Elementary School in the USA tested the Tomatis treatment on the performance of elementary school students, measuring for impacts on reading, writing, math, attention, focus, comprehension, auditory processing, classroom attention and productivity. The author suggested that the amount of improvements observed showed that the Tomatis method would benefit all students, not only those who were performing poorly, but also those who were doing well.

23 general school students, grade 4, age 9 and 10 started the program. 16 continued through stage 2.

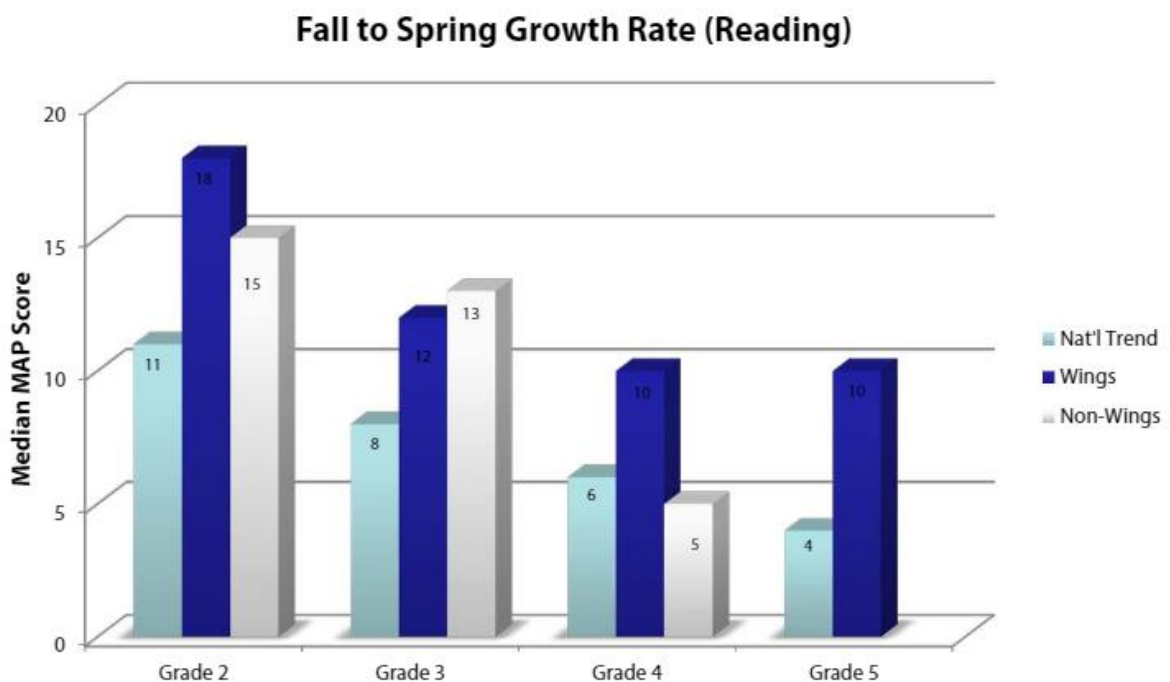
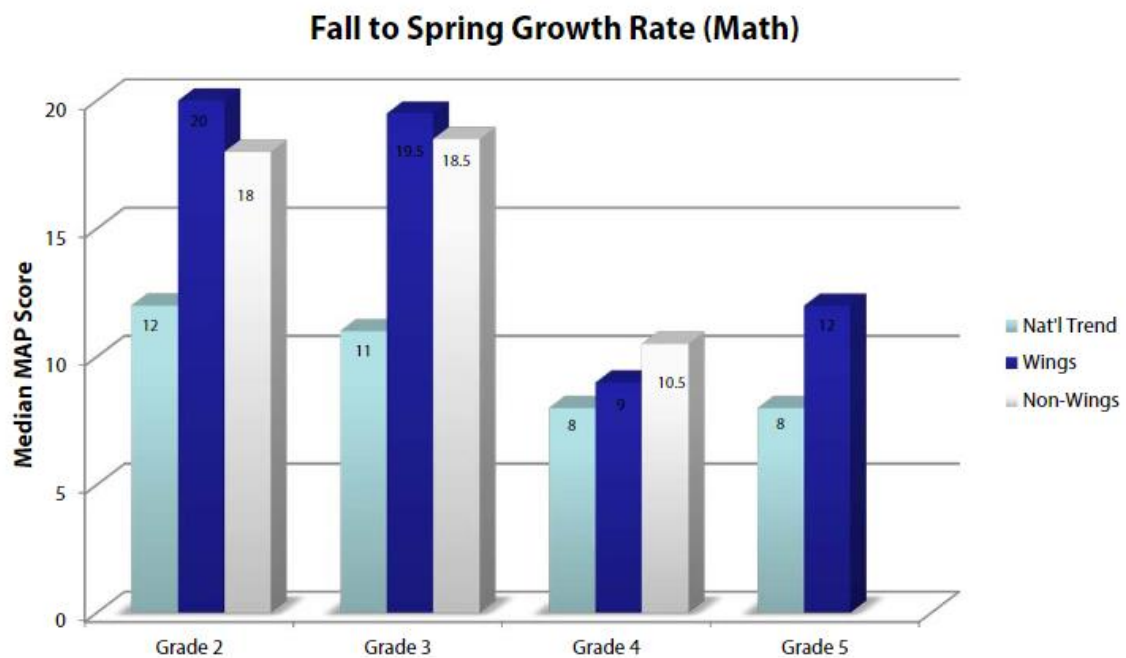
Results considered were based on MAP scores (Measures of Academic Performance compared to national averages), grades and a qualitative survey of teachers, researchers and parents.

Results indicate that the treatment provides great potential improvement for students at all learning levels and helps both weak and strong students.

The principal of the school stated that the children being studied live in daily fear for their lives. They appear to have ADD and live in anxiety for their survival both in and out of school. She observed that all of the students in the pilot study started to feel safe. She and others observed that leadership skills emerged, grades improved and you could see happiness on the children's faces.

Quantitative analysis showed that while the median scores of the students were just below national expectations, the rate of growth exceeded national expectations in all three grade years that were examined. The conclusion is that the children receiving Tomatis treatment are catching up at a more rapid rate than the control group.

The Figures show the growth rate comparing national trend to WINGS (the test group) and Non-WINGS, the Control group.



Qualitative survey results

Skills surveyed	Percentage of teachers who noticed improvement
Leadership skills	63.7%
Taking responsibility	58.8%
Academic performance	40.9%
Self esteem	65.9%
Overall behaviour	50%
Posture	52.3%
Attitude towards learning	54.6%
Communication skills	72.7%
Confidence level	63.7%

Mularzuk et al (2012) analysed auditory attention and hearing lateralisation of students receiving Tomatis treatment. The results indicated improvements in all the measured parameters, including auditory attention, internal auditory attention, sound discrimination and sound localisation. This paper was not available in English.

Du Toit et al (2011) at North-West University, Potchefstroom, South Africa, undertook a study in which the Tomatis method was extended beyond its more traditional clinical context of auditory processing disorders, to explore the specific challenges of auditory processing faced by interpreters. In the wake of apartheid, the integration of colleges in South Africa created an urgent requirement for greater numbers of simultaneous interpreters for students. This study demonstrated the value of the Tomatis Method in assisting the skill development of student interpreters. Nine interpreters receiving Tomatis treatment were compared to a control group, and tested for enhancements to their interpreting performance, performance, personality, attention, concentration, and mood and wellbeing. Despite some limitations due to sample size and matching of the two groups, statistical analysis indicated significantly enhanced techniques and wellbeing in the experimental group.

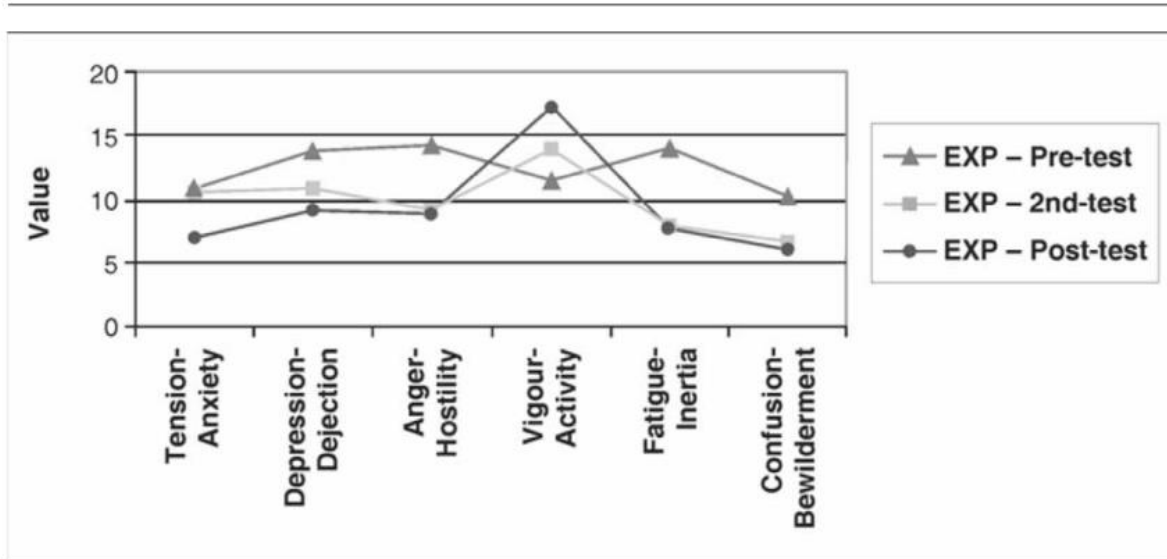
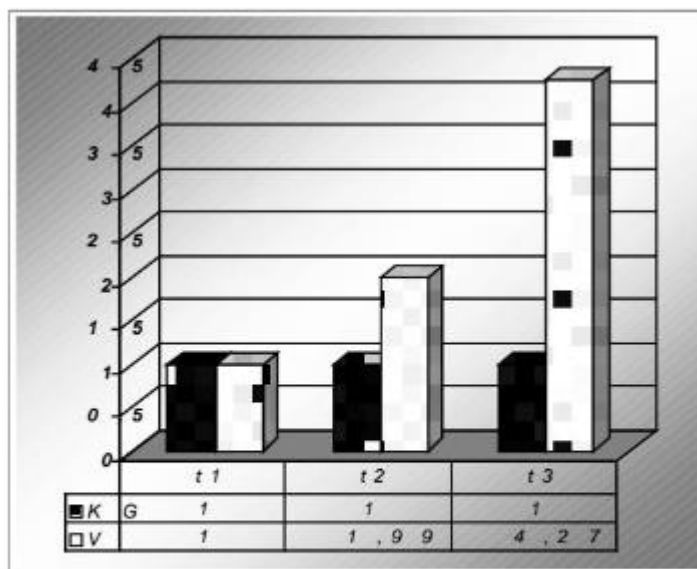


Figure 1. Pre-, In-Program and Post-Test Mean Scores on the Profile of Mood States for the Experimental Group (n=9)

Tinkl, (2011) working with Ulrike Koller at the University of Vienna, undertook to study the impact of the Tomatis training on the spatial sense in both the short and long term. A treatment group of 30 plus and control group of 30. Tested with Three Dimensional Cube test and Infinite Loop Test which test the ability to visualise manipulating 3D objects in space. Results for the 3D Cube test (shown here in the Table below) confirmed that Tomatis therapy significantly improves spatial reasoning ability and that this is sustained for the long term. Results for the Infinite Loop test were also positive in the short term, but were not sustained for the long term.



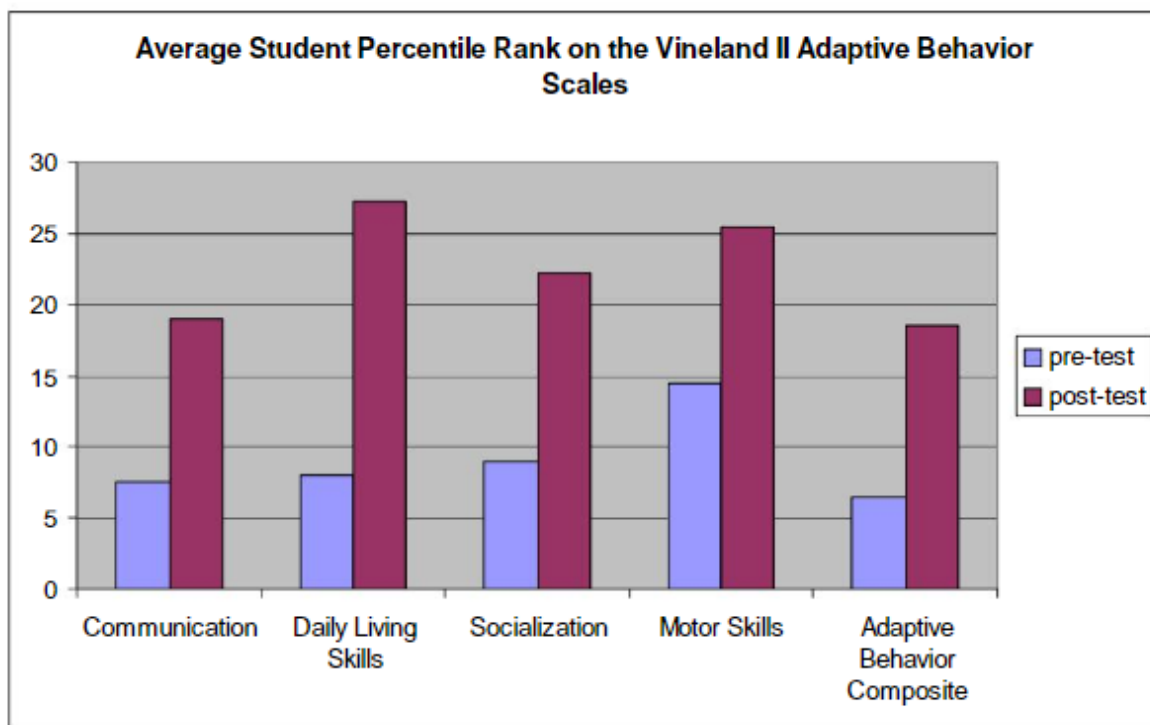
Picture 5 – Illustration of the relation of chances of KG and VG concerning the possibility of solving an item in the 3DW

Callahan (2009) at the Baker Academy early Childhood Centre, undertook two studies to assess the living skills on first grade and fifth grade students. The results of the testing confirm a substantial gain in the domains of Communication, Daily Living Skills and Socialization. On the average, students gained between 13 months and 34 months within these domains.

For First grade students, eight students participated in a study where the C-scan test was used to assess improved auditory perception in background noise. This in turn improved listening and communication, which had a flow on effect to their self confidence and social skills.

Callahan (2009) studied four fifth grade students using a teacher rating form to assess improvements in communication, living skills, socialisation and motor skills. Significant improvements were seen in all scales as a result of the Tomatis treatment.

Researchers noted: "As learning has become easier for these students, their frustration level has notably decreased which has resulted in less behavioural problems in the classroom." (Callahan 2009)



Callahan, C., 2009, Results of the Tomatis® Program within a Fifth Grade Setting Baker Victory Services early Childhood Centre, cited on

https://issuu.com/tomatidoc/docs/the_baker_academy_results_of_the_to_086657c91b54ce

There is debate about the degree to which children with dyslexia are affected by auditory processing difficulties. Tomatis said “all children read with their ears.” The aim of this study was to evaluate time and frequency processing in children with developmental dyslexia.

Szkielkoswska et al, (2008) in Poland, studied 20 test subjects with confirmed dyslexia, who were compared to a control group of 20 children who did not have problems at school. All children were right handed, had normal hearing and no vision defects.

Auditory discrimination testing of the subjects indicated that observed difficulties in temporal and frequency sequential analysis may be responsible for problems with the segmentation of phonic sequences which is required for effective reading skills. This confirms the role of central auditory processing difficulties (CAPD) in dyslexia. There was a high degree of coherence with results of the Tomatis listening test (80%) in the test group. In addition, 80% of the test group exhibited left ear dominance, as opposed to 10% in the control group. This corroborates Tomatis’s assertion that left auditory laterality is associated with auditory processing problems.

Kurkowski, (2000) at the institute of Physiology and Pathology of Hearing evaluated 110 children to assess the different impact of right sided versus left sided deafness on aptitude and performance in different fields. Tomatis postulated that left sided hearing laterality could lead to speech and language difficulties, due to the primary language centres being situated in the left hemisphere, which is more directly accessed via the right ear. Subjects were tested with a variety of questionnaires to assess school achievement, family relations, personality, auditory perception and motor activity of speech organs.

They concluded that right sided deafness is characterised by more serious linguistic difficulties, dyslexia, poor spelling and a lower standard of academic achievement. Left sided deafness was associated with emotional problems, nervousness and lower performance in humanities subjects.

Gillis and Sidlauskas, 1977, undertook a study to investigate the veracity of Tomatis’s theories of the preference of right ear dominance as an advantage for reading.

Tomatis suggested that children with dyslexia would read better when forced into right ear lateralisation. The subjects were ten children aged 8 who were approximately two years behind in their reading ability.

While reading, children listened to their own voice through the Tomatis filtering system, including right ear emphasis and alternating high frequency amplified sound.

Right ear lateralisation with and without increased high frequency filtering was tested. The main result observed was that increasing right ear emphasis increased reading speed. The results support the premise that children with dyslexia do not normally make use of the “right ear advantage” as normal children do. By requiring dyslexic children to listen with the right ear, may mean that they begin making more efficient use of neural pathways to the left hemisphere.

Studies on Learning Disabilities and Behaviour Problems

Mojs et al, (2017) studied forty children with dyslexia who had normal IQ. The children received Tomatis therapy over a nine month period before measurements were taken. Numerous benefits were observed including faster reactions, more acute hearing thresholds, greater ability to localise sounds, greater verbal fluency, attention, short term verbal memory and cognitive function.

Malak et al, 2017, studied the impact of Tomatis therapy on 78 children, using the Latysz non-word reading test.

Malak et al assert that phonological memory is one of the most important phonological skills for reading, and that it has not been studied in much detail. He discusses the neurophysiology of integration and segregation of auditory and visual stimuli. Although the Polish translation is a little unclear at times, this discussion will be of interest to neurophysiologists.

The researchers concluded that improved auditory synthesis leads to better selective attention. Enhanced short term phonological memory improves auditory memory, and these functions are improved by Tomatis therapy. They observed that the longer term the intervention, the greater the improvement.

Van Velze (2016) reported on six case histories of disadvantaged children at the Secunda Christian academy in South Africa. The children selected did not have any developmental delays.

Clinicians observed that all but one of the children who participated in the Tomatis program, in contrast to others, became less emotional, more motivated, mature and independent of the teachers. Teachers observed that concentration, and balance improved significantly. Families noticed changes in language skills, behaviour and maturity.

Kim and Sun, 2016, at Hoseo University in South Korea, undertook a study to investigate the effect of improved auditory processing on the neurological factors of dyslexia, among middle and high school students. From 168 high risk students, 24 students were selected for the study. Following Tomatis treatment, statistical analysis showed significant improvements in reading ability, decoding ability and auditory processing.

Categories	Pre-test	Post-test	Change Score
	Mean	Mean	
Reading ability K-WCPM	316.83	352.79	35.96***
Reading ability BASA	967.08	1153.20	186.12***
Phoneme fluctuation meaningful word	31.50	35.75	4.25***
Phoneme fluctuation meaningless word	27.04	33.54	6.5***
Reading ability total score	46.04	182.50	136.46***
Auditory perception ability total score	82.66	88.79	6.13***

Kim and Sun summary results. N=24

*** $p < .001$

N is capital when it refers to a sample. Small n means population.

Konarski and Ratynska (2014) at the Institute of Physiology and Hearing in Poland, conducted a three year study involving 62 schools and 1330 pupils to determine the effects of the Tomatis method on school students. The results given here were reported after one year. The schools included both regular schools and schools with special/integration departments. Since teachers who were administering the program were not fully trained Tomatis therapists, seven different standard programs were developed which they could select from.

A key competencies questionnaire was developed for the study. It included;

1. Learning skills
2. Language skills
3. Musical skills
4. Social skills

Prior to participation, children were assessed for learning disabilities and were tested using the Tomatis listening test. Children who exhibited abnormalities on the listening test received Tomatis treatment. This was a total of 776 children.

The study compared four groups: children with and without learning disabilities, who did and did not undergo the Tomatis treatment.

In all groups which received Tomatis treatment, the improvements were statistically significant. In the non-treatment groups the only area of improvement which was statistically significant was musical skills in children with disabilities.

The most prominent difference between the treatment and control groups were improvements in learning skills for all children, and in social skills for children with disabilities. For the musical and language skills, results were in favour of the Tomatis group, but the differences were not statistically significant.

The results after one year of treatment supported the premise that Tomatis therapy can be used effectively in a school curriculum and indicated that it is beneficial in supporting both children with and without special needs.

Summary Results Table				
	Yearly increase percentage in skills			
	Tomatis group		Non Tomatis Group	
	Disabilities	No disabilities	Disabilities	No disabilities
Learning skills	5.8%	5%	3.3%	0%

Social skills	6.3%	5.3%	1.5%	1.4%
Language Sills	7.5%	5.7%	3.2%	2.5%
Musical skills	10.3%	8.6%	6.7%	4.1%
Konarski and Ratynska Summary results				

Chou (2012) at the Wenzao Ursuline College of Languages in Taiwan conducted a pilot study to test the effects of the Tomatis Method on reading fluency for level 2 Taiwanese learners. Although English is studied from the third grade in Taiwan, many students lack speaking fluency when actually called upon to speak the language. To read aloud accurately requires phonological awareness, and this has been shown to be a significant factor in children's acquiring reading fluency. (Chou, 2012) the Tomatis Method was introduced as a way of enhancing phonological awareness.

The study aimed to determine which aspects of reading fluency could be enhanced by Tomatis Training.

A reading fluency test was conducted at the beginning and end of the treatment period.

8 volunteers participated. Despite the small sample and reduced treatment time, the results indicated significant improvements in fluency, tone, stress and intelligibility. However, pronunciation was not significantly improved, although it did improve to a degree. The researchers surmised that this is because individual pronunciation cannot easily be corrected through computer-based learning.

Based on the preliminary findings in this paper the author concluded that there is huge potential for regular use of the Tomatis method in language learning.

This paper has a good literature review and discussion of the Tomatis Method. Draw from it for explanation.

	Pre-test mean	Post test Mean
Fluency	2.63	3.38
Tone	2.13	2.75
Stress	2.13	2.88
Pronunciation	2.63	3.13
Intelligibility	2.5	3.25
Total Mean results	12.02	15.39
Summary of results from Chou study 2012, summarised by Joudry 2018		

Lozano (2009) at the National University of Columbia, set out to study the long term effects of Tomatis treatment on phonological awareness, language and cognition, and measure how this would enhance literacy and academic performance.

It has been established that phonological processing skills are the main predictors of successful literacy. Lozano undertook a study to explore whether the Tomatis Method would enhance literacy.

Also explored whether social adaptation to family and school would be promoted 10 to 14 months following treatment.

In which skill areas would academic performance improve and would new abilities emerge 10 to 14 months following treatment?

The students aged 6 to 7, were divided into three groups of 21 to 25 students in each, the groups being Tomatis, Music and Control.

The Tomatis group showed the most improvement across all measurements of language narrative skills, phonological processing, awareness and memory, and in reading skills. Most of the improvements were retained 10 to 14 months after treatment.

The author concluded that reading and writing acquisition skills and enhanced by Tomatis treatment.

Kati, 2002, at the University of Padua in Italy, undertook a Preliminary study aimed at evaluating the effectiveness of the Tomatis Method for the treatment of children with reading disorders. Measurements were taken using the MT Reading Test (correctness and speed) and the Words Reading Test.

The study aimed to determine whether the impact would be greater on reading disorders of a phonological (auditory) or lexical (visual/word recognition) nature.

Improvements were observed in children with both phonological and lexical difficulties. There was particularly notable improvement in the reading of non-words, indicating improvement in phonological processing.

This would seem to support the dual route hypothesis, which states that two neural routes are involved in reading aloud, combining phonological and lexical (whole word memory). But since the Tomatis Method is believed to work on the phonological aspect of auditory processing, it may indicate the primacy of this function in reading.

It was observed that the mean increases in reading speed after the treatment on both the MT Reading test (correctness and speed) and Words Reading Test were significantly greater in terms of development than would have been the case without treatment.

Gilmor

Rourke et al (1982) undertook a study at the University of Windsor, Ontario Canada, following 25 LD children for a year. Sixteen of the children received the Tomatis treatment while nine were allocated to the control group, assigned with a balance of IQ between the two groups. Most children also received remedial tutoring. A comprehensive standardized test battery was used to assess results, all of which were in favour of the Tomatis treatment group.

	Tom / Ctrl
N	16 / 9
WISC, Full Scale IQ	+5 / 0, s
WISC, Verbal IQ	+2 / -2
WISC, Performance IQ	+8 / +2, s
PIC, Adjustment Scale	-16 / -2, s
WRAT Reading Std. Score	+6 / +2, s
WRAT Arithmetic Std. Score	+2 / -3
Verbal Fluency	+27 / +11
Oral Reading	+35 / +21
GPT, Dominant Hand Score	-18 / -7, s
Table 2 : Rourke Study, % Change	

Gerritsen, 2010

Wilson et al, (1982) at North Shore University Hospital, Cornell University, NY, studied 26 language impaired children for nine months. Eighteen of the children received Tomatis treatment while eight formed the control group. Students in both groups also received the Wilson remedial program. Assessment included the WIG test in which parents and teachers rate children on a wide range of behaviours. The results, summarised in Table , show that the children who received the Tomatis treatment exceeded the performance of those in the control group on most measures.

The trends were suggestive in several instances and group differences were statistically significant on the more reliable measures used.

Behaviours measured included communication, auditory closure, sound mimicry, quiet, noise, articulation, gross motor skills.

On all of the communication skills the Tomatis group performed equally or better. On the Gross motor skills in this study, performance levels were similar in the two groups.

	Tom / Ctrl
N	18 / 8
WIG Communication Scores	
Parent's rating	22 / 12
Teacher's rating	34 / 27
Language Domain	
Sound Mimicry	86 / -9, s
Auditory Closure	38 / 3
Table 3 : Wilson Study, % Change	

Gerritsen, 2010

Mould (1985) undertook two studies on severely dyslexic boys living in a publicly funded school at Brickwell House, East Sussex, England.

Twelve older dyslexic boys, age 10 to 15, who received Tomatis treatment were compared to a control group of 11, who received no treatment. The boys had severely delayed reading and language skills, four or five years below chronological ages.

Several standard tests were applied and improvements were significantly greater for the treatment group, both in the short term and extended beyond the treatment.

	Tomatis / Control	
	1982	1983
N	12 / 11	12 / 12
Neale Reading (accuracy)	27 / NA	21 / 11
Neale Reading (comprehension)	NA	19 / 7
WRAT Reading (raw scores)	60 / 16, s	43 / 22
WRAT Spelling (raw scores)	53 / 18, s	53 / 23
Receptive Vocabulary (BPVS)	NA	19 / 4, s
Verbal Fluency (raw scores)	NA	52 / 39, s
Pupil Rating Scale	23 / 0, s	NA

Table 4 : Brickwall Studies, % change

Gerritsen, 2010

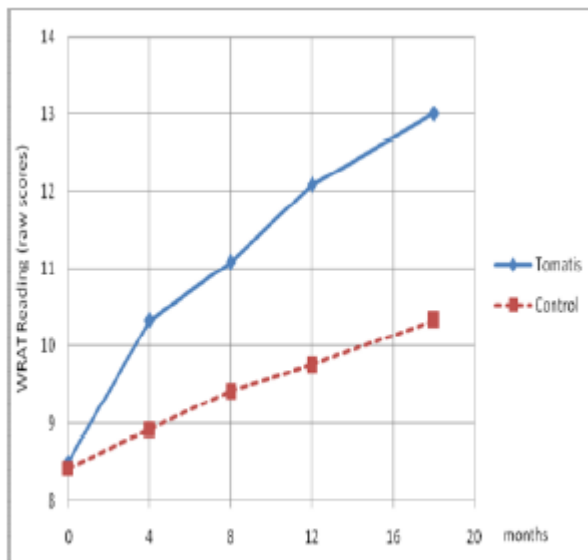


Fig. 1: Extended Tomatis Effect

Gerritsen, 2010

Kershner et al (1986) at University of Toronto, Canada, followed 32 children with learning disabilities between the ages of 8 and 14. This study caused some controversy as it is alone among published Tomatis studies that did not report a statistically significant improvement for the Tomatis treatment. However, the study design has been criticised by subsequent researchers to explain this anomaly.

All participants were receiving remedial intervention based on the Orton-Gillingham approach. Half of the children were allocated to a control group who received a 'placebo' treatment where they received audio-vocal feedback which was amplified but not filtered. Therefore, any differences between group results would potentially be minimised as much as possible.

Possibly skewing the results was the fact that the Tomatis treatment group were removed from class more often than the control group, therefore missing more class time. Also, the control group received three interventions which the test group did not receive. These are possible reasons cited (Gerritsen, 2009, Gilmore, 1999) to explain why the advantages of the Tomatis group were not reported as statistically significant by the authors.

Nevertheless, re-analysis by Gerritsen, highlights that in all but one measure, the Tomatis group did advance more than the control group, even though the difference was not statistically significant, and the improvements continued to grow by a greater extent than what would be expected purely through maturation.

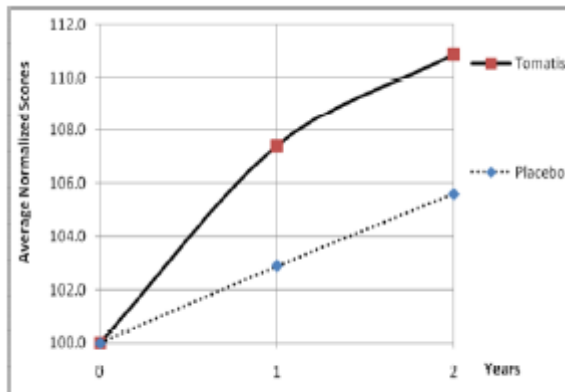


Fig. 2: Kershner Study, Average of the five key measures

Gerritsen, 2010

Roy and Neysmith-Roy (1980) at the University of Ottawa, Canada, examined the effect of the Tomatis method on five dyslexic boys over fourteen months and showed improved cognitive control and audio-vocal control in four of the subjects, in line with their age and intellectual potential. This improvement was achieved without any remedial tutoring. In one of the boys, IQ increased significantly, as measured by the WISC-R Full Scale IQ.

Gilles and Sidlauskas at the University of Ottawa Canada (1978) explored the relationship between aural laterality and reading ability. They studied ten children with dyslexia under different conditions of auditory feedback. They established that reading was 5% more rapid when feedback was given exclusively to the right ear, lending support to Dr Tomatis's Theory of preferential right ear dominance.

Studies on Attention Deficit Disorders

Start with a spiel and explanation on ST for ADHD

Davis, (2005) at The Davis Centre in Rockway N.J. studied the impact of Tomatis treatment on eleven children with ADD/ADHD. All of the parents reported improvements in their children after receiving Tomatis sound therapy. See table below.

Ability or Behavior	%
Interpersonal Growth	82
Listening and Speech	91
Academic Achievement	91
Attention	100
Behavior	91
Intrapersonal Growth	82
Movement, Sports, Rhythm	64
Musical and Vocal skills	55
Relaxation	73
Creativity	64
Reading, Writing, Spelling	55
Well-Being	36

Table 9: Davis Study: % of children who according to the parents had improved

Gerritsen, 2010.

Sacarin (2013) published a dissertation at Antioch University, California, being the first published study on the effects of Tomatis treatment on children with ADHD.

After spending two decades using the Tomatis treatment in her clinic, Sacarin undertook this study and to investigate the underlying brain physiology for the changes that she had been observing in clinic and to achieve objective quantitative analysis.

She studied the impact of the early stage of Tomatis therapy on processing speed, phonological awareness, reading efficiency, attention, behaviour and brain physiology. There were 15 children who received only the Tomatis treatment, while a control group of 10 were stabilized on medication.

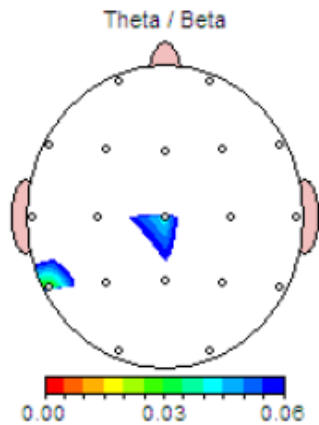
Tests included QEEG (Quantitative Electro Encephalogram) and ERP (Event Related Potential). An additional test battery of neuropsychological measures was used, plus parental observations.

Results revealed statistically significant improvements for the Tomatis compared to the non-Tomatis group. The treatment group showed significant improvement in processing speed, phonological awareness, phonemic decoding efficiency when reading, behavior, and auditory attention.

Researchers also observed a statistically significant increase in slow brain activity at central and parietal midline recording sites in the Tomatis group when they compared pre- and post treatment theta/beta ratios within each group.

Sacarin concludes that the significant improvements measured in cognition, attention and behavior, indicate that the Tomatis Method can be a brief and effective approach which has positive effects in children with ADD/ADHD.

Tomatis Group



Non-Tomatis Group

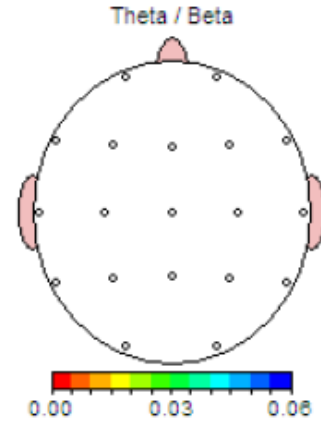


Figure 3. Spectral brain-maps: FFT Power Ratio Group t-test (p-Values)

Sacarin, 2013.

Studies on Autism

Start with a spiel and explanation on ST for Autism

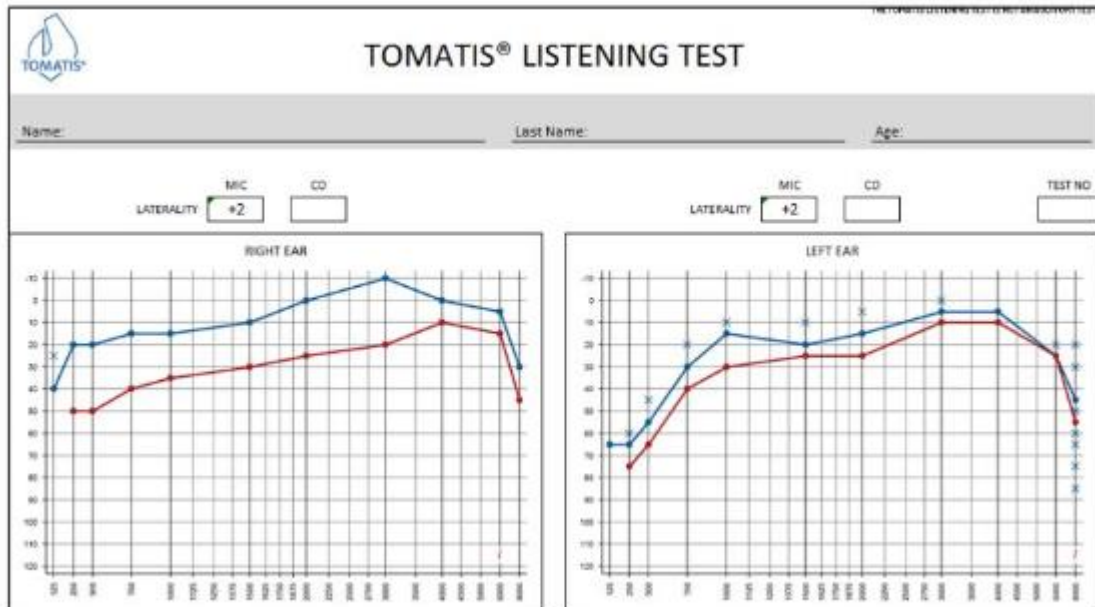
Tomatis himself is said to have acknowledged or claimed that the therapy works only in about 60% of cases for children with Autism. (Neysmith-Roy 2001). There is a wide range of responses, with some children responding quickly and others slowly. Some have very significant change and others only minor change (Gerritsen, 2010). More extensive use of the mothers' voice technique and longer-term treatment have been observed to improve results to up to 80% of the time (Vervoort, 2006).

Davies and Smith (2016) at Fit2learn in the UK, did a case study of an 18 year old male diagnosed with Aspergers, OCD and anxiety, and found his functionality and living skills improved significantly after Tomatis treatment. Prior to treatment he was excluded from two colleges because the staff could not cope with his behaviour. He giggled inappropriately and was prone to outbursts of anger. He obsessively talked about flags, kings and countries. The boy was angry about being in classes he considered below his skill level. Medication was giving him many difficult symptoms, including anger. Assessment showed the client had difficulty with motor skills, sound processing and binocular vision. Fit2 Learn treated the client with motor skills training, Tomatis therapy and vision therapy.

They concluded that a significant shift in his vestibular integration occurred as a result of Tomatis treatment. His posture changed from permanently leaning to the side and to developing a straight posture. The combination of Tomatis treatment with the motor skills and visual therapy was very effective.

His audiogram as recorded on the Tomatis listening test also improved over the 8 months of his treatment as shown.

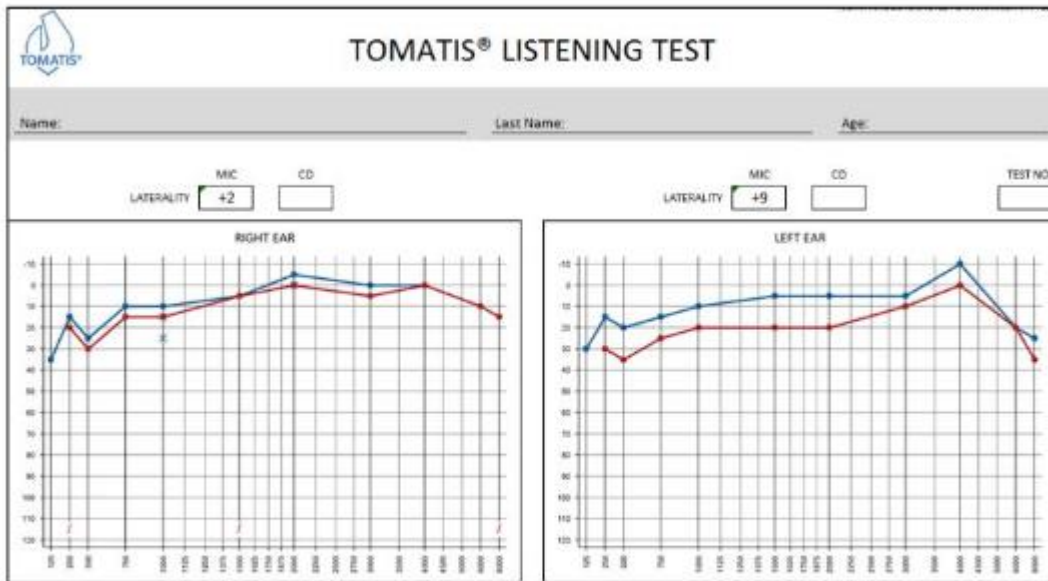
Baseline test as at May 2015



This test shows some loss of bone conduction in both ears plus a reduction of air conduction in the left ear.

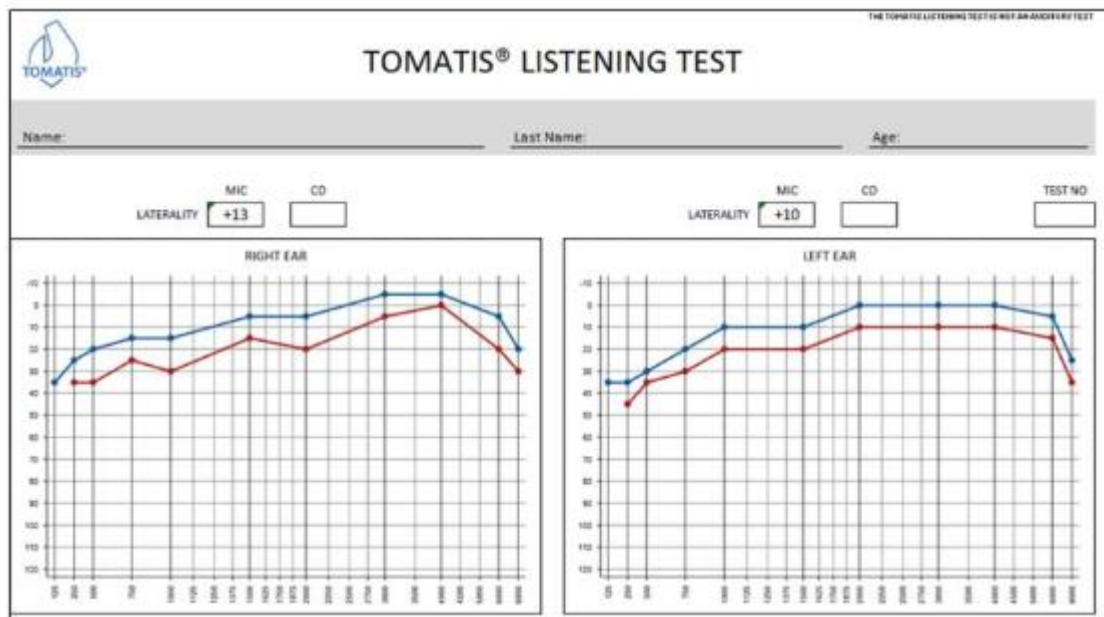
While Tomatis's interpretation of the meaning of the air and bone curves is done on a very different basis to standard audiological assessment, it does seem apparent that there was improvement in the audiogram overall by the end of the full treatment program. It is also a factor that due to improved behaviour and a reduction in several obsessive symptoms and motor deficits, it was easier to test the subject.

Retest as at Oct 2015



Note: There was a very noticeable shift in the client's posture and his ability to maintain an upright stance at this time.

Retest as at Jan 2016



Note: there was a noticeable shift in the client's behaviour at this time which was particularly marked by the cessation in obsessive pacing and bouncing on his trampoline. The client could now be still. The researchers attributed this to stimulation of the vestibular system having achieved greater vestibular integration.

Pralong et al, 2014, at the University of Technology in Equinoccial, Ecuador, conducted a qualitative study on an 8 year old child with autism. The tests used included the SCAS Spence Children's Anxiety

Scale and Vanderbilt TDHAS which is a tool for parental evaluation of hyperactivity levels. The results were that a significant evolutionary maturation was observed, anxiety was decreased while important progress was made in reading and writing skills.

AbediKoupaieia et al, 2013, at the University of Shahid Behshti, Iran, did a study of 34 children with autism, aged 4 to 8 years. They were randomly assigned to an experimental and a control group. The GARS test was administered pre and post treatment. ANCOVA analysis indicated that the Tomatis treatment reduced autism symptoms and stereotypical movements, increasing social interaction, communication and self-confidence.

Categories	Pre-test	Post-test	Change Score
	Mean	Mean	
Stereotyped behaviours			
Tomatis	20.82	14.47	6.35***
Control	20.35	20.35	0
Communication			
Tomatis	30.59	23.12	7.47***
Control	32.00	32.00	0
Social Interaction			
Tomatis	26.24	17.47	8.77***
Control	24.12	24.12	0
TOTAL GARS			
TOTAL GARS Tomatis	77.65	55.06	6.13***
TOTAL GARS Control	76.47	76.47	0
AbediKoupaieia study 2013 summary change in mean score			

*** p<0.001

The subjects in the Tomatis group showed significant improvement between pre and post tests, while the ones in the control group didn't change or improve in any noticeable way. There were significant differences between the Tomatis group and the control group on the post test (P<0.001) in all cases.

Corbett et al 2008 undertook a double blind, placebo controlled cross-over study of 11 children with autism. The study failed to demonstrate benefit for the Tomatis treatment. However, the study has been reevaluated by Gerritsen (2008) and Saccharin, (2) who point out that there were design errors which may have caused these results, such as a small heterogeneous sample, and differences in age and level of functioning, which would have needed to be accounted for more carefully in allocating treatment and placebo groups. In particular, the crossover design is problematic for this type of treatment. It is suitable when testing medication with short term effects. However Tomatis

treatment often has longer term responses and due to its re-ordering of the nervous system can have flow-on effects known as “The Extended Tomatis Effect” (refs). This response pattern makes a cross over design inappropriate for a Tomatis study.

Gerritsen, 2010, in reanalysing the study by Corbett et al took an individual case by case approach to investigate the results in more depth. Gerritsen found that six of the eleven subjects demonstrated significant improvement from the treatment, consistent with previous peer reviewed research. One child who was non verbal became verbal, one began spontaneously repeating words and several others increased their expressive and receptive vocabulary.

Increasing evidence suggests that auditory dysfunction is one of the most negative impacts on children with autism. This affects their expressive ability, their alertness and awareness of the world around them, and their ability to focus on auditory and visual attention. Either immediate or delayed echolalia (meaningless repetition of what they have heard) is present in 75% of children with ASD. This is believed to be a symptom of an auditory processing disorder.

Torres de Carrell (2009) undertook a study In Puerto Rico of 51 children to discover the effect of Tomatis treatment on echolalia. Prior to Tomatis treatment all of the children had speech therapy and a large percentage had many other therapies including Occupational Therapies, dietary changes and other specialist sensory training therapies. Parents said that some of these therapies had helped to reduce echolalia a little.

A questionnaire was specially designed for this study with 12 questions for parents, guardians or tutors to assess the children’s progress and changes in echolalia. Although in some cases echolalia can be caused by sound therapy, this study showed that in most cases it was reduced or eliminated. Out of 51 questionnaires, 14 were returned and 6 were ruled out. Of the 8 remaining questionnaires, the following results were obtained. Two of the questionnaires were ruled out because the children had not been verbal before Tomatis. They became verbal during Tomatis treatment, but also used echolalia. The authors conclude that echolalia can be a stage in the development of auditory processing and language development.

75% of the parents said that the Tomatis method was the most effective treatment they had tried in reducing echolalia. It should also be noted that many other improvements were seen in the children in this study such as language development, attention, motor functions, body image, visual following and balance.

Improvement noted	Percentage of parents
Echolalia completely gone	25%
Echolalia reduced quite a lot	37.5%
Echolalia reduced a little	37.5%
Torres de Carrell study 2009	

Davis, (2005) documented how parents of 100 autistic children reported on changes they noticed in their children pre and post Tomatis treatment. The subjects were aged 3 to 21. The subjects were selected from 500 presenting clients because their diagnostic evaluation protocol indicated that Tomatis treatment would be appropriate for them. Tests in the protocol include the Listening Test, laterality Test, Client Case History and Client Interview. The form that parents were asked to

complete was called “Abilities to be Improved Form” and included 102 possible changes that could be noted within 12 general areas. This was completed pre and post treatment.

The percentage of children observed to have made changes in each of the 12 areas is recorded on the Table.

Interpersonal Growth	87
Listening and Speech	85
Academic Achievement, Thinking, Learning	81
Attention	80
Behavior	79
Intrapersonal Growth to Know and Express Self	69
Movement, Sports, and Rhythm	66
Musical and Vocal Skills	63
Relaxation	54
Creativity	49
Reading, Writing, Spelling	39
Well-Being	20

Table 1
Change Pre-Post Tomatis with 100 Autistic Children

Within the 12 areas considered, all of the parents noted some change in their child during the treatment period.

Maudale, (1997) at the Listening Centre in Toronto Canada, reported on qualitative changes observed in children who have undergone treatment at The Listening Centre in Toronto. Pre-natal sound perception- listening to recordings of mother’s voice. Notice increase in voice production, babbling and desire to communicate. Listening and focus- observed changes increased eye contact, more erect body posture, especially in upper body.

Auditory processing time shortened—quicker response time. Ability to process multiple commands. Speech less hesitant, more to the point.

Auditory processing clarity. Children report on ability to hear more clearly. Parents notice they are not as foggy or vague. Speech more intelligible and explanations clearer.

Auditory vestibular interplay. Balance and coordination improve—swimming, skating or bicycle riding, better rhythm and spatial awareness. Reduced clumsiness, improved handwriting.

Regulatory effect. Better sensory tolerance, more regulated energy levels, reduced hyper activity. Improved sensory integration

The conclusion was that listening training prepares the ground for all subsequent communication, language and learning. Only when the sensory system is optimally prepared is the child able to fully benefit emotionally, socially and academically from any other types of intervention that may be offered.

Shiedeck (2000) at the University of Salzburg, studied 20 children and adolescents with mild autism. Ten received the Tomatis treatment while ten formed a control group which received no treatment.

Although the treatment time of 46 hours was only half of the recommended time, significant gains were seen on all measures for the treatment group compared to the control group. The abilities tested were motor skills, visual perception and pronunciation. The gains in pronunciation were only apparent when a correction was made for the ceiling effect, due to the fact that several subjects already had pronunciation scores of 100% before the trial. (Gerritsen, 2010)

Schiedeck Study results		
Normalised data (max = 100)		
	Tomatis	Control
	Pre / Post	Pre / Post
Motor Skills	27 / 54	28 / 29
Visual perception	34 / 58	39 / 40
Pronunciation*	26 / 44	33 / 34

*corrected for ceiling effect by Gerritsen

Gerritsen, 2010

Neysmith-Roy (2001) at the University of Regina in Canada undertook case studies of six severely autistic boys who enrolled sequentially for the program. The measure used for pre and post testing was CARS, the Childhood Autism Rating Scale. According to this scale, by the end of the study one boy was no longer autistic, score of < 30, and two were only mildly autistic, score = 31-36. The other three boys remained within the severely autistic range, score of > 36, though one of those did improve on the CARS scale.

The author concludes that the Tomatis method may help autistic pre-schoolers to develop pre-linguistic stepping stones for human perception and language.

	CARS
Subject	Pre / Post
A	44 / 26
B	48 / 49
C	47 / 34
D	44 / 35
E	47 / 47
F	53 / 47

Table 13: Neysmith-Roy Study

Gerritsen, 2010.

Vervoort et al (2008) at The Mozart-Brain Lab in Belgium, having treated 5,000 cases they present 4 recent cases with severe developmental problems and autistic tendencies as an illustration.

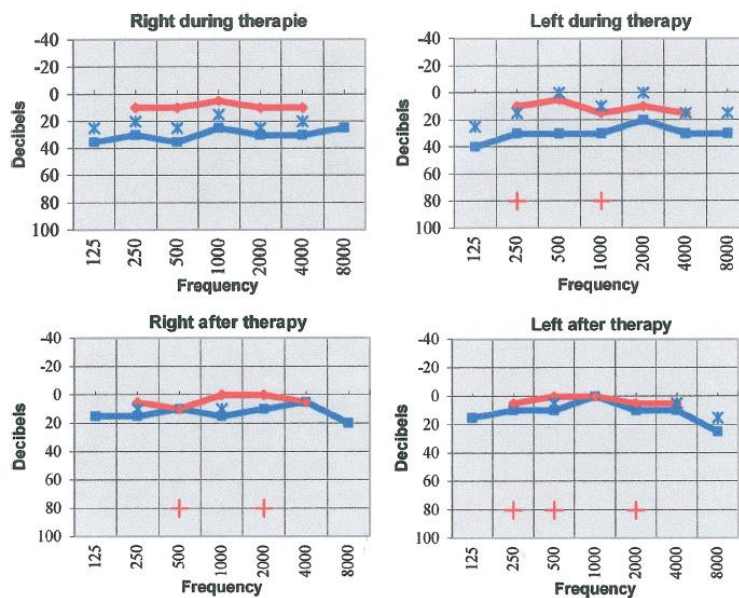
According to Vervoort, Tomatis' ideal listening curve postulates that air conduction should be about 10 dB better than bone conduction. (The listening test is essentially a hearing test, though the method of presentation and interpretation is varied.)

However, audiologists are aware that this is not possible, since air conducted sound (transmitted via the middle ear) must also be transmitted via bone conduction (via the inner ear) in order to be heard. For this reason, bone conducted sound is always found to be equal to or better than air conducted sound, unless there is an equipment error. Tomatis's misapprehension is understandable since at the time when he was developing his theories, the profession of audiology was still in its infancy.

The listening test results given for two subjects in this study corroborate these facts, since both of the subjects have better bone conduction than air conduction. However, the interesting effect to notice is the improvement both subjects achieved in air condition and one achieved also in bone conduction as a result of the treatment. These improvements are something that would not be expected within the current body of audiological knowledge. The improvements do provide support for Tomatis's theory of the filtered sound providing a gymnastic re-education of the middle ear muscles. The improvement in bone conduction points to possible restoration of processing within the auditory neural pathways and brain centres.

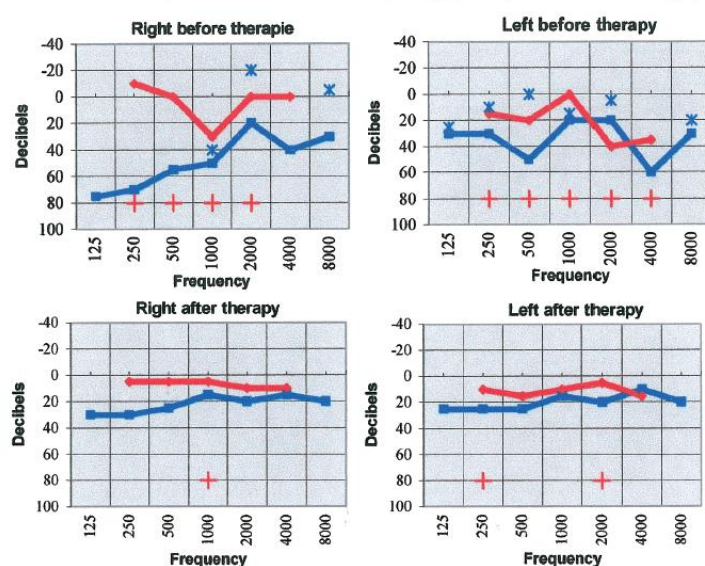
Results of the listening test given for two subjects indicate an improvement in hearing perception. One subject showed improvement in air conduction from mild loss to normal range. See figure below. This change over a two year period corresponded with improved speech and language skills. During the same period EEG measurements indicated normalisation of brain activity. Having started life following a traumatic gestation, with delayed development and autistic tendencies, on completing her treatment, Lena was assessed as being only one year behind her age level.

FIGURE 3. Listening tests for the right and left ear of Lena during (above) and after the therapy (below). *Note.* The spatial errors in the air conduction are indicated by blue stars and in the bone conduction by red crosses.



The other subject showed improved bone conduction from mild loss to normal range, and improved air conduction from moderately severe loss to normal range. See below.

FIGURE 5. The Listening tests of Francis at the beginning (above) and after the therapy (below).



For both subjects, an improvement in hearing was matched by an improvement in spatial perception.

All four subjects were also measured using QEEG and Auditory Evoked Potentials to assess neural integration and maturation. Cognitive auditory evoked potentials are often disturbed in children with cognitive and learning disorders. In all cases significant improvements were seen in hemisphere integration and improved perception and performance. The authors concluded that the Tomatis Method is an effective and harmless treatment for patients with severe psychomotor and/or neurological dysfunctions. They also noted that auditory evoked potentials and electroencephalographically based brain mapping seems to be an appropriate examination to demonstrate neurological changes after Tomatis therapy.

Corbett et al (2007) at the University of California, Davis, ran a double blind, placebo controlled cross-over study on eleven autistic boys to determine the effect of the Tomatis Method. Gerritsen however identifies a number of design errors in this study, which explains why the quantitative results were not favourable. For example, a cross-over design is unsuitable for a method which is known to have lasting developmental benefits. The sample group was not large enough for such a trial, and the allocation of subjects to each group was not adequately controlled.

Gerritsen's later qualitative analysis indicated favourable results that were not detected in the quantitative analysis. For example, one child developed verbal skills for the first time, while others improved their living skills, reduced hyperactivity, improved concentration improved motor skills and achieved toilet training. (Gerritsen, 2010)

Spaggiari, (1995) cited by Gerritsen (2010) was a psychiatrist and Tomatis practitioner in Reggio Emilia, Italy, who evaluated the effect of Tomatis treatment on 13 children with autism and noted improvement in 54% of these cases.

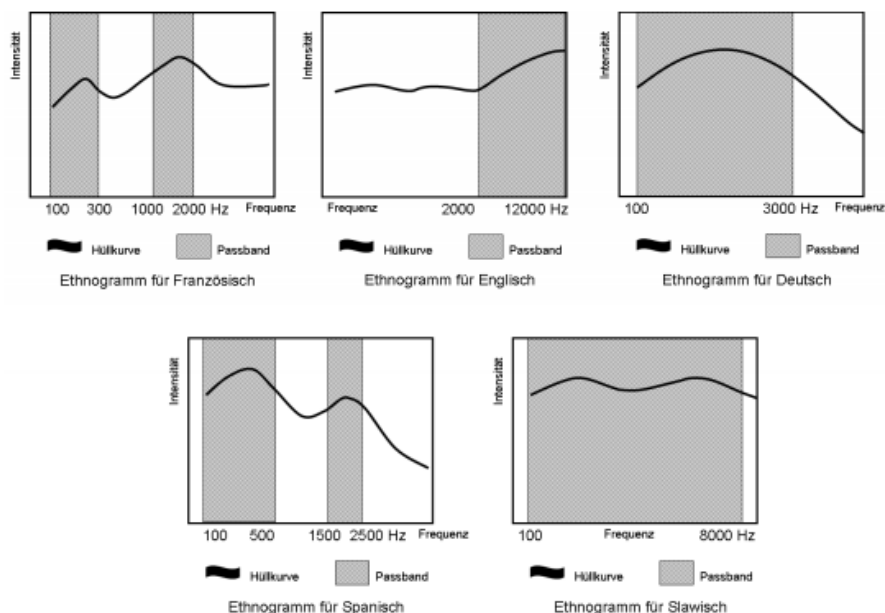
Tatum (2004) at the Optimum Health & Learning Centre in Florida, USA, reported on the effects of Tomatis therapy on two cases with autism. A 14 year old girl had developed no speech after eight courses of speech therapy, since the age of 4. Following Tomatis treatment she exhibited many improvements in social skills and had functional use of 34 words. A 9 year old boy progressed from a 2nd grade to a 5th grade level in his phonemic awareness, which is faster than the normal progression.

Nel (2005) at the university of Potchefstroom, South Africa, reported a case study with a 14 year old boy with Aspergers in which qualitative data were gathered through semi structured interviews. Results were reported indicating improvement in interpersonal communication and all six domains of psychological well being according to RyfT (1995), resulting in better family relationships.

Studies on Learning Foreign languages

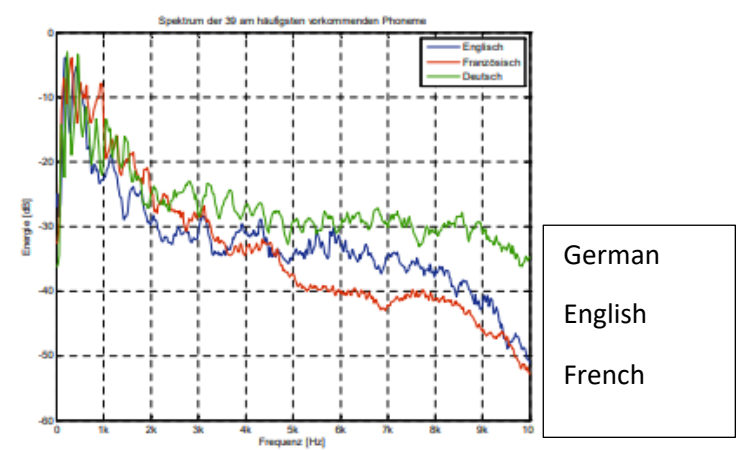
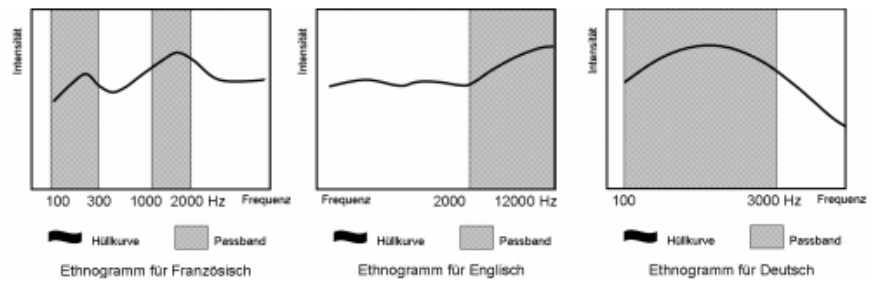
Tomatis identified a different frequency range for each language. His theory of “speech ethnograms” postulated that each language has an intrinsic vocal footprint of frequency spectra. He suggested that we naturally develop sensitivity to the frequencies of our own language but are, in effect, “deaf” to the frequencies of other languages. One of the aims of Sound Therapy is to open the ear to a greater range of frequencies, thereby making it easier to understand and learn foreign languages. According to Tomatis’ first law, as the hearing is opened, this creates the capacity for the voice to reproduce the new sounds. Therefore, the process of Sound Therapy will also improve the ability to speak in a foreign language.

The graph below shows the ethnograms Tomatis developed for five European languages.



Sereinig 2010

Sereinig (2010) at the Institute for Broadband Education in Germany tested this theory and did find different spectra between French, English and German speakers, which although the differences are more subtle, does reflect the variance in the ethnograms created by Tomatis. The difference of degree of variance in the spectra was attributed to methodological differences.



Sereinig 2010

Syam (2012) studied the effect of Tomatis therapy on 26 tenth grade students elementary students.

Measures included the Listening Test, and an observation sheet, which charted the following skills: recognising phrases test, listening to the dialogue, active participation. The scores were classified by poor, fair, good, excellent.

Improvement of the students listening achievement in recognising phrases.

The value improvement of the students' listening achievement from D-Test to cycle I and also from cycle I to cycle II (54.11<64.55<73.93),

Describe content of cycles and what the listening skills were.

Mean score for listening skill		
Baseline	Cycle I post test	Cycle II post test
54.11	64.55	73.93

This shows improvement over time in both cycle I and cycle II. Its about active engagement with the material (or something)

Table 9: The Result of the Students' Activeness in Each Meeting

Cycles	Meetings				Average Score
	I	II	III	IV	
I	59.02%	65.97%	70.83%	73.61%	67.35 %
II	69.44%	75.69%	79.16%	81.25%	76.38 %

The table above explains about the average of the students' activeness in teaching and learning process through observation sheet by observer. The table above shows the process the students' activity in each meeting.

Concepcio Torres Sabate (2012) undertook a study which investigated three areas within an elementary school in Catalonia. These were

1. active listening and attention and concentration to improve academic performance
2. intervention in the treatment of learning disorders
3. integration of sounds typical of a foreign language--English

The school concluded that the method had a significant effect on some of the students with specific educational needs.

The treatment also brought about many improvements for students in learning the English language.

Unable to do a more detailed interpretation as the paper was not available in English.

Olminkhof (2007) at the University of Groningen in the Netherlands, studied 34 children. In 22 cases, the children's language skills improved.

44 children aged 3 to 12 were monitored using the listening test. The study set out to investigate whether Tomatis treatment would have a positive impact on speech problems, language and learning of primary school children.

Results were analysed based on listening tests and interviews. 34 of the children participating had language, speech and learning problems.

The parents noticed positive results in 90% of cases. Parents perceptions of improvement in learning abilities were greater than measured improvements on the Listening test. 22 out of 34 children

improved learning and language skills. In particular, the 9 children with speech problems all showed positive results following Tomatis therapy.

Kaunzner and Gianni (2002) The Audio Language Project Improvement of Auditory Comprehension and Oral Expression of a Foreign Language. <http://tomatisassociation.org/the-audio-language-project-improvement-of-auditory-comprehension-and-oral-expression-of-a-foreign-language-with-the-tomatis-method/> cited on 21/11/2018

Kaunzner at the University of Bologna, Italy, in collaboration with five other universities, studied 164 language students who were studying German, Italian, Dutch and Spanish. 69 of the students received Tomatis training, a Control group of 49 students received extra pronunciation training and the third group, of 17 students, called “zero” received no extra assistance. The participants came from a range of different mother tongues, including Italian, Spanish and Dutch. Table shows the results in increased perception and pronunciation. The gains of the Tomatis group were approximately three times greater than the other two groups.

Table 5.9 from Kaunzner (2001)

Group	Nr. Participants	Increase
Tomatis	69	0.432
Control	49	0.141
Zero	17	0.122

Vervoort, 2018

	N	Increase
Tomatis	69	+ 0.432
Control	49	+ 0.141
Zero	17	+0.122

**Table 15: Kaunzner Study:
Increase in Ability Score**

Gerritsen 2010

Murase (2004) undertook a pilot study on Japanese high school students learning English. 40 students received Tomatis treatment and were compared to a control group of 120, while both groups had standard English lessons. Sonograms were taken before and after the Tomatis treatment. Improvements in acuity were noted, particularly in the auditory communication domain of 2000 Hz to 4000 Hz. Significant improvements were also noted in fluency, pronunciation and intonation.

Those in the treatment group progressed from the 8th to the 5th rank on the rating scale, while the control group advanced from the 11th to the 10th rank.

	Pre	Post
Fluency	3.25	3.50
Pronunciation	2.98	3.57
Intonation	2.98	3.82
Average	3.08	3.80
Standard Deviation	0.78	0.57
Table 16: Murase Study: Ability ratings on a 5 point scale. N = 40		

Gerritsen 2010

Eurocopter in France is one of the world's leading producers of helicopters. The company has used the Tomatis method to assist in training its employees in foreign languages since 1989. The progress of 580 of their people was monitored and reported at their 1995 conference. They reported that the Tomatis training reduced the study time from 700 hours to 520 hours, which is a reduction of 180 hours or 26%.

Eurocopter presentation at the 1995 Tomatis Conference in Neufchatel. Cited in Gerritsen, 2010.

Studies on Voice

Escera et al (2018) studied 32 healthy adults in their 20s to determine the effect on voice quality of listening to their voice filtered through the Forbrain device. As inclusion criteria they were first screened for speech and language disorders and tested for hearing loss using pure tone audiometry in the range of 250-4000Hz, to ensure hearing was within normal range.

The Forbrain device allows the listener to hear their own voice filtered with a process based on Tomatis's design for his Electronic Ear, designed to activate the middle ear muscles and stimulate auditory rehabilitation.

A double-blind randomized study design was used, with half of the participants being randomly assigned to a treatment and half to a control group. Gender was the only trait that was controlled for in the selection of the two groups.

Three one-minute recordings were made of each subject speaking through the Forbrain device. Six acoustic parameters were used to measure the output.

Six quantitative vocal parameters were measured, and two of them yielded statistically significant results when comparing the two groups. These parameters were reduced breathiness, and strengthening of voice quality.

Experimenters concluded that Forbrain could be considered as a low cost option in treatments with AFF (altered auditory feedback) on a range of speech, language and communication disorders.

While this was a very thorough and scientifically designed study, it was limited in its relevance of demonstrated outcomes. Tomatis treatment is designed to be used over an extended time period for clients with speech and language disorders. In this study the method was applied for only a few

minutes with healthy young adults exhibiting none of the relevant symptoms for treatment. The researchers in no way attempted to address or investigate the potential of rehabilitation with regard to auditory and nervous system integration that has been accepted as the primary objective of the Tomatis Method. Therefore it could be surmised that the results that were seen only pertain to a small fraction of the potential of this treatment.

Stillitano et al, (2017) tested the impact of Tomatis training on the artistic voice. The “Tomatis Effect”, that the voice contains only those frequencies that the ear can hear, postulates that if treatment can improve the subject’s listening curve, then the voice will change and reach its full expressive potential. (Stillitano, 2017).

Subjects were first medically examined and those who had any organic diseases which could affect the voice were excluded. 19 subjects between the ages of 27 and 53 were selected. Testing was done with the Multi-Dimensional Voice Program MDVP, and analysed with Praat software.

Pre testing measured hearing acuity through air and bone conduction, selective discrimination of tones and dominant ear (laterality).

In the production of sound by the human voice, the fundamental frequency (F0) is produced by the larynx. The higher harmonics, which are quiet reflections of the F0, at a lower amplitude, occur at specific frequency intervals above the fundamental. The relative intensity of the harmonics gives sound its unique character, or tone, which is called ‘formants’. In this study the first four formants were measured. The voice’s formant structure was analysed to identify changes in vocal output. In particular the energy density of formants 2, 3 and 4 was measured.

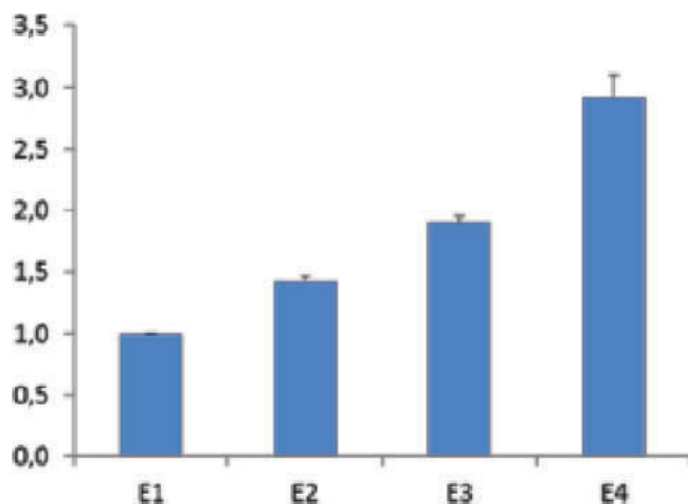


FIGURE 2. The Figure 2 indicates how many times the energy increases in F2 (E2), F3 (E3), and F4 (E4) compared to the first formant (E1). E1 value has been established on 1. The significant increase of energy occurs on F3 (E3). Error bars represents standard error of the mean (SEM).

This Figure is a summary of the change in density of energy in the first four formants. Intensity is measured in decibels.

Interestingly, when the singers' vocal energy increased, there was a corresponding increase in their bone conduction listening. The authors surmise that this is due to these subjects developing more attention to the inner resonance of their sound, as is normal with trained singers.

Analysis further indicated a greater ability to maintain a consistent intensity of vocal emission, and other measures which indicate a correct movement of the vocal chords, leading to better control of the voice.

Each harmonic is produced at a different point in the vocal tract. F0 is produced by the larynx. F1 is formed by resonance within the pharynx. F2 is formed by the oral cavity, determined by the tongue, teeth and lips. F3 is amplified more specifically at the lips. Therefore when the energy of F3 increases, articulation improves. F4 is similar, and both F3 and F4 add to the timbre of the voice, creating a voice which sounds fuller, and is richer in high harmonics.

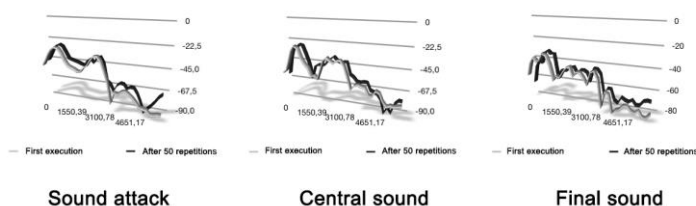
This study showed an increase in energy density on average at F3 in relation to F1. The enhancement of the voice in the 3kHz zone leads to clearer articulation, reduced nasality and greater expressive power to the human voice. Observers noted that the difference was like listening to a voice that had been uncapped.

Cuppola, (2016) an Italian opera singer, conducted an experiment on two singers using the Tomatis Electronic ear vocal retraining system. Singer 1 listened to his voice played back without any added filtering. He performed 50 executions of a sound and the changes were recorded on a vocal graph. Some minor variations were recorded, mostly, it is surmised, as a result of improved capacity to focus through repetition.

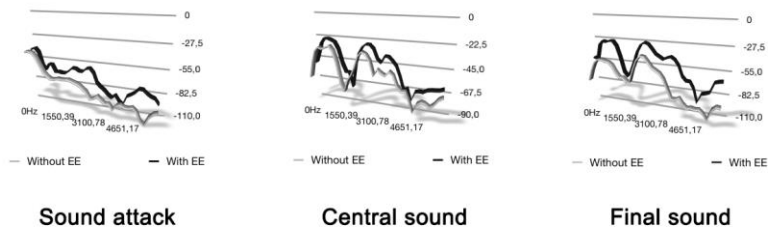
Singer 2 performed the same sequence of vocal exercises, but this time his voice was filtered using the ideal filtering parameters designed by Tomatis to create proper vocal emissions with enhanced perception of fundamental formants and of those harmonics between 2,000Hz and 4,000Hz.

The results for the second singer showed a substantial increase in vocal energy for the formants between 2,000Hz and 4,000Hz, the range which augments the control and quality of the singing voice.

Singer 1



Singer 2



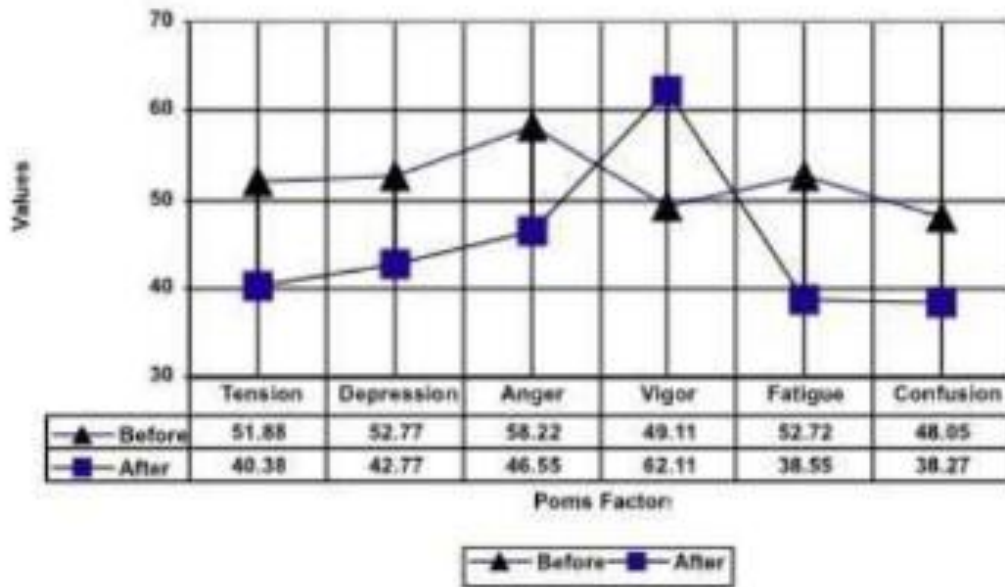
Vercueil, et al (2009) studied piano students to see how the Tomatis treatment would improve performance and musicality.

A two-group pre-post assessment, mixed-method design was used. It involved thirteen sophomore-to-postgraduate student pianists. Qualitative results indicated improvement in all but one participant.

Results suggest that the Tomatis Method enhanced psychological well-being, particularly regarding autonomy, interpersonal relationships and self-confidence in experimental group participants. Both quantitative and qualitative findings strongly suggest that the participants benefited in the area of piano performance. Specific benefits included enhanced listening skills and statistically significant anxiety reduction during music performance. Practically no change occurred among the control group.

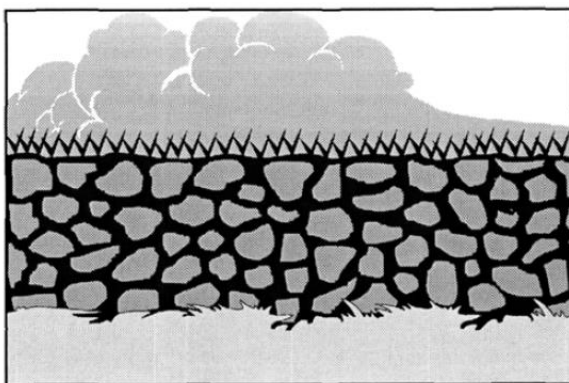
du Plessis et al (2008) present a small group study of a multicultural group of musicians case study of a black African male musician, conducted in 1998 to explore the impact of Tomatis training on musicians. In a two group pre-post investigation of 28 students, comprising two treatment groups and a control group. In the treatment groups there was significant enhancement of listening aptitude, psychological wellbeing, and positive mood states, plus vocal enhancement. These changes were not seen in the control group.

POMS: Pre-and post-programme mean scores - experimental group

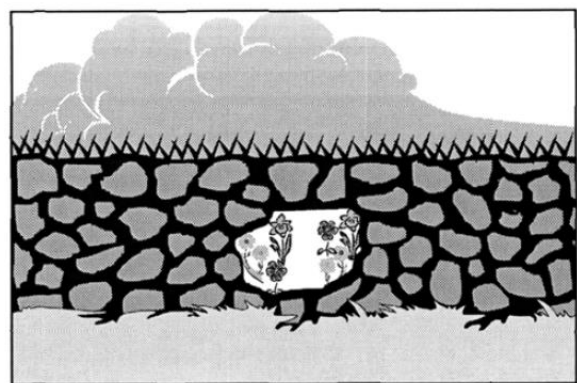


In this study the authors also described a detailed case history of one student who underwent significant change through the treatment after a personal crisis of confidence. This was Bogani, a black male singer, who one day decided to walk out of treatment due to his despair over its futility in the face of his real life situation, living in the townships, and the hopeless outlook for black musicians in South Africa. He agreed to continue on after feeling his dilemma had been heard by the clinicians. He went on to experience significant gains in his vocal quality and self confidence. It is suggested that the Tomatis treatment may have facilitated Bogani's capacity to recognise and articulate his feelings, to rise through this crisis and progress into greater self actualisation. Drawings that Bogani completed before and after treatment indicated an opening up and a sense of hope and possibility after treatment. Bogani went on to develop a successful international singing career, including choir leading and composing an African opera.

Drawing 1. Computerized representation of a wall drawn by a male, black student singer



Drawing 2. Computerized representation of wall with flowers, visible through a hole – final drawing by the same student.



Hesse et al (2002) at the University Mozarteum in Salzburg undertook a study to document the effect of the Tomatis method on musicians. Seven healthy male subjects age 20 to 30 took part.

A test battery was used including vocal analysis, audiometry, self-perception and independent observations of others. Testing included personality questionnaires, blood pressure and relaxation, brain hemisphere dominance, equilibrium, the Tomatis Listening Test, standard audiometry and voice analysis.

The researchers concluded that the Tomatis treatment improved the vocal qualities of timbre, tone and vibrato. The overall results showed that hearing ability improved by about 10dB for all of the subjects. The hearing threshold was lowered and the air bone gap decreased. Vocal quality of timbre and sound complexity was noted and an increase in harmonics for some subjects. Five of the seven subjects felt that their voices had improved and six of seven felt their musical ability had improved.

Four of seven subjects felt their equilibrium had improved. All seven felt an increased desire for physical movement. Six felt an enhanced ability to communicate, and five registered a positive change in their overall personality.

Despite the small sample, these experiences were reflected in the objective tests.

du Plessis et al (2000) studied a group of music and voice students who underwent the Tomatis treatment. The experimental group consisted of 18 students from either the music department at Potchefstroom University or Pretoria Technikon's Opera School. A control group of 5 singers and 5 instrumentalists was also recruited. Both groups were screened for hearing and functional voice deficits. A reasonable degree of equivalence was established between the two groups.

Tests included the POMS profile of mood states, a 65 item questionnaire, and the Constructive Thinking Inventory, a 108 item questionnaire. The results indicated enhanced psychological wellbeing and enhanced coping skills. A LTAS (Long Term Average Spectra of Speech) analysis was done. In some cases an enhanced clustering was seen in the F3-F5 region, which coincides with the concept of the singer's formant. This could be an indicator of enhanced vocal quality, which was paralleled by subjective experiences, which in particular noted enhanced intonation.

Weiss (1985) at the University of Ottawa, Canada, (1985) studied the effect of Tomatis audio-vocal training on three theatre students. Results for all three was a significant increase in vocal energy, particularly in the higher frequencies. Specifically (1) Decrease in energy in the 50- to 200-Hz zone; (2) increase in energy in the 800- to 1200-Hz zone; (3) different individual overall energy shifts; (4) larger and wider formantic peaks in the long-term average spectra; (5) increase in global energy; (6) greater pitch and power variability; and (7) increase in average pitch. They also had improved vocal tone and better articulation, plus an increase in loudness. Their vocal output was measured using the objective LTAS (Long Term Average Spectrum). Results point to increased pressurisation of the voice, less breathiness and reduced glottal turbulence.

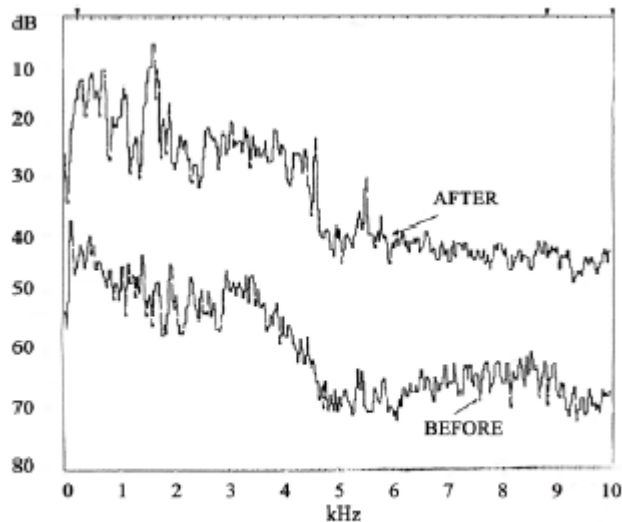


Fig. 3: Long Term Linear Average Spectrum, Before and After Tomatis Intervention

Gerritsen 2010

Studies on Pregnancy and child birth

The impacts on women giving birth was explored in a study by D'Orthy and Monnet in 1991 at the Foch hospital near Paris, which achieved similar results to the earlier studies by Michon and Salaün. D'Orthy compared the labour time of all babies born in 1991. Fifty three of the mothers had received a shortened version of Tomatis treatment, while a control group of 683 had not. In the treatment group labour time was reduced by 53 minutes from 8 hours 12 minutes to 7 hours 19 minutes. The percentage of women who gave birth in less than 4 hours was 17% in the treatment group compared to 6% in the control group. Again the Hamilton test showed decreased anxiety among mothers in the control group. The AGPAR test rating babies' adaptation after birth showed that the Tomatis babies adapted faster and had better body weight.

Michon and Salaün (1990) undertook a comparative study of pregnant women at Vesoul and Foch, two French hospitals, to explore the different ways in which the Tomatis treatment assisted mothers in preparation for the birthing experience.

This is a comparative study between results achieved at two different hospitals where mothers receiving Tomatis therapy were compared to a control group.

The most significant difference between the two groups was that at Vesoul the majority were rural dwellers while at Foch the majority were urban dwellers.

Being more relaxed, the mothers were better prepared and able to approach the birth process in a peaceful, confident state.

Different areas where significant results were observed

Cesarean Forceps

Dr Klopfenstein who oversaw the Tomatis program at Vesoul, explained that when a woman is more dilated, it is possible to use forceps to extract the baby and therefore avoid a C section. However, even the need to use forceps was found to decrease to zero in the last month that was being studied at Vesoul.

Presentation

There was no difference in the rate of different presentations (position) of the baby between the Tomatis and control groups. However, breech births decreased from 4% to 2% in the Tomatis group. Health workers noticed that the mothers undergoing the treatment were completely relaxed, and therefore manual turning of the foetus by the doctor succeeded 99% of the time for this group.

Length of Labor

There was a significant reduction in labor length at both Vesoul and Foch hospitals, so much so that the staff at Vesoul declared it "spectacular!" In addition very quick births of under three hours increased in the Tomatis group.

Anaesthesia (epidural)

At Vesoul only, there were significantly fewer epidurals given in the Tomatis group. 17% as opposed to 28%. This was not the case at Foch.

State of the peritoneum

At Vesoul only, there was a 10% decrease in women needing an episiotomy.

Decrease in anxiety

Reductions in labor pain were estimated from using the Hamilton Scale of Anxiety. A decrease of 9.15 points was observed at Vesoul. At Foch the rate decreased from 5.73 to 3.95 points.

Other results were recorded through testimonials gathered from the mothers, including the following comments.

At Vesoul the women responded that:

- The quality of their dreams were peaceful and positive
- They did not have the usual feeling toward the end of pregnancy of being handicapped
- The disappearance of back pains
- A normal walk
- A better listening
- An increase in creativity

- A great spontaneous interest manifested for their child
- The fact that the “psyche was on top of things”.

At Foch the following comments were gathered

- The appearance of a feeling of responsibility, associated with independence regarding one therapy or ideology
- The phenomenon of conviviality living together with the fact tht the quality of the work of the group
- The calm of the babies
- The well-being of the mothers following the deliveries, without apprehension of returning to the house
- The quality of the mother/child relation.

The researchers concluded that there was substantial consistency in results between the two hospitals. This was principally in seen in a decrease in labor time by about 45 minutes, superior birth weight, faster recovery on the APGAR and less frequent mechanical intervention.

Studies on Child birth used a two group pre-post program design

Tomatis reported in his book, *Neuf Mois au Paradis*, on the work of Klopfenstein (1988) at the Gynecology department of Vesoul General Hospital, France. Klopfenstein conducted a study of 170 randomly selected pregnant women. Dilation time was reduced by 34% relative to the control group. Caesarean sections were reduced by 69% and perineum tears by 200%. In addition, the Hamilton self-administered anxiety test indicated a decrease in anxiety for the treatment group, which is contrary to the normal patterns for anxiety before giving birth.

Vesoul Hospital (1988) - 170 women	Traditional preparation	Tomatis treatment group	
Average labour time	3:30	2:22	-34%
Average rate of spontaneous deliveries	46%	60%	+ 30%
Caesarean sections	13%	4%	-69%
Perineum intact	8%	24%	+200%

Cited on: <http://www.hermione-app.com/les-applications-de-la-methode-selon-le-pr-tomatis/accompagnement-de-la-grossesse-maternite-preparation-accouchement.html>

Studies on Developmental Delay

De Bruto (1983) studied 30 residents of the Witrand Care and Rehabilitation Centre in South Africa, aged from 4 to 14 years. The subjects were severely developmentally delayed but had the ability to sit and walk. The subjects were divided into three groups, one receiving Tomatis treatment, one receiving unfiltered music and one receiving no treatment. The two treatment groups also received a motor-sensory stimulation program. Participants were tested for an increase in mental age using the Bailey Scales of Infant Development and a measure of responsiveness. An improvement was found in the two treatment groups, and was significantly higher in the Tomatis group. These subjects significantly increased their responses to others while reducing their self-directed responses.

Studies on Brain Damage

Jingjing and Changxiang undertook three studies on the impact of Tomatis listening therapy on the stroke patients.

In each of the three studies they selected 80 patients from the Rehabilitating Department in Tangshan Gongren Hospital. These were randomly assigned to a treatment group (n=40) and a control group (n=40). The two groups received the same amount of treatment at the same time. Both groups also received occupational therapy, physical therapy, transcutaneous electrical nerve stimulation, neural network plasticity therapy and acupuncture. The control group received conventional music without the Tomatis filtering. They received the same amount of treatment at the same time.

Executive dysfunction study 2016.

Executive dysfunction is the most common cognitive impairment after stroke, affecting up to 66% of cases. (Jingjing and Changxiang, 2016) This functionality includes concentration, processing unfamiliar conditions, selective participation, planning and implementation, cognition, movement and emotion. Executive function is closely related to functionality within the limbic system, basal ganglia and prefrontal cortex, areas which are known to be affected and stimulated by sound.

The testing method used was BADS Behavioural Assessment of Dys-Executive Syndrome, which includes six subtests. There were significant differences between the two groups following treatment (all $P < 0.05$), with no change occurring in the control group. This suggests that Tomatis training can effectively improve executive function in patients with stroke.

Summary results table			
	Before treatment	After treatment	Change score
Treatment	7.0	11.0	4.0*
Control	8.0	8.0	0

Jingjing 2016 change in Executive dysfunction syndrome

*($P < 0.05$)

Cognitive function study 2015.

Jingjing et al (2015) studied stroke patients to assess the impact of Tomatis training on cognitive function. 75% of stroke survivors suffer cognitive impairment (Jingjing and Changxiang, 2015)

The testing method used was MoCA, the Montreal Cognitive Assessment. The control group received conventional music without the Tomatis filtering.

Cognitive impairment is caused by local brain damage from stroke and is usually manifested as deficits in learning, memory and executive functioning. This results in difficulties with daily activities and limits capacity for rehabilitation. When patients experience chronic stress in reaction to the stroke, this can produce monoamine neurotransmitter, which influences the functioning of the prefrontal cortex. (ref 13 from jingjing) Since the function of such damaged tissues are highly plastic in the central nervous system, impaired cognitive function can be restored and strengthened by retraining. (ref3 from Jingjing)

The greater improvement seen in the scores of the treatment group on all measures indicates that compared to conventional music therapy, Tomatis training can significantly improve cognitive functions in stroke patients.

Summary results table						
	Tomatis Group			Control Group		
	Before treatment	After treatment	Change score	Before treatment	After treatment	Change score
Attention & Concentration	2.20	2.60	0.40	2.15	2.20	0.05
Memory	2.38	2.85	0.50*	2.20	2.30	0.10
Executive Function	1.33	1.85	0.52*	1.20	1.38	0.18
Language	1.35	1.80	0.45*	1.35	1.40	0.05
Visiospatial ability	1.50	2.10	0.60*	1.53	1.73	0.20
Abstract thinking	1.00	1.53	0.53*	1.08	1.23	0.15
Numeracy	1.53	2.00	0.47*	1.48	1.53	0.05
Spatial orientation	2.15	2.70	0.55*	2.20	2.23	0.03
Overall Condition	13.48	17.43	3.95*	13.25	14.05	0.80

Jingjing 2015 change in Cognitive Function comparison of MoCA scores

The negligible ($P>0.05$) difference between all MOCA scores before the training gained statistical significance ($P<0.05$) after the training.

Memory study 2015.

Jingjing and Changxiang Jingjing et al (2015) studied stroke patients to assess the impact of Tomatis training on memory.

Memory is a function of the brain's ability to recognise, identify, remember and reconstruct objects and events. It forms the basis of higher cognitive activities such as thinking and imagining. It is closely related to an array of different chemical structures and processes in the human brain. (Jingjing ref 10) Cognitive impairments caused by stroke result in difficulties with memory recall.

For this study the test used was the RBMT-II River-Mead Behavioural Memory Test

Results showed that scores for the experimental group were significantly increased after treatment compared to the control group, indicating enhancement of recall for names, appointments, recognition of pictures and faces, spatial awareness and delayed recall of stories etc. Researchers concluded that Tomatis training can enhance memory for patients with stroke.

Summary results table			
	Before treatment	After treatment	Change score
Treatment	10.51	16.16	5.65*
Control	11.06	13.10	2.04
Jingjing 2015 change in Memory function			

*(P <0.05)

Following the Tomatis training the overall difference as well as the changes in each aspect measured were statistically significant compared to the control group.

Coppola et al (2015) tested a group of 11 outpatients with epilepsy between the ages of 1.5 years and 21 years, to determine the effects of Tomatis treatment. The subjects all had drug resistant epilepsy and a severe intellectual disability associated with cerebral palsy.

Participants had been experiencing at least four epileptic seizures a week during the 6 months before the study. Some patients were also on anti-epileptic drugs or a ketogenic diet.

A treatment period of 15 days was applied. During treatment the reduction in seizures overall compared to baseline was 51.5%. while two patients had a reduction of 75-89%. In the two weeks following the trial, the reduction for the group overall was 20.7%.

Sleep was improved in 4 patients. All responders had behavioural improvements according to relatives. This included improved attention and participation in the environment. Better night time sleep, fewer awakenings, reduced aggression and irritability, less frequent crying.

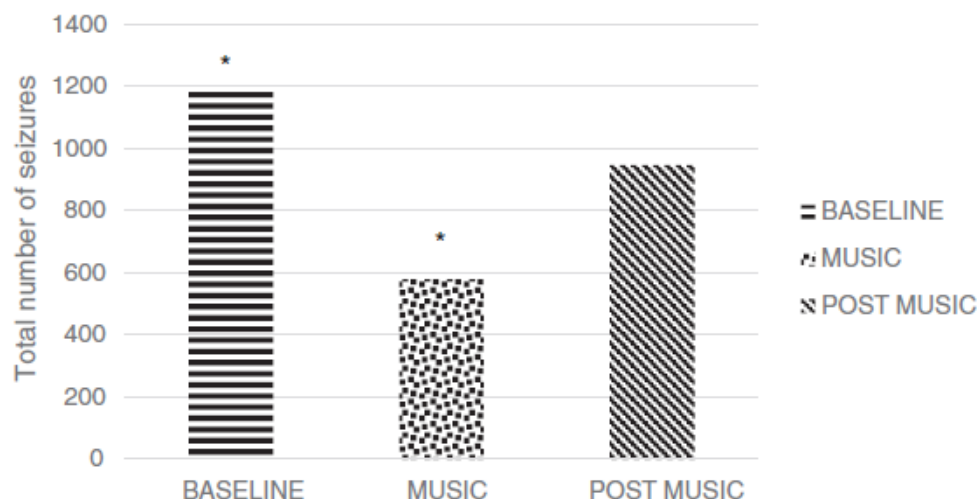


Fig. 1. Total number of daily seizures among the enrolled patients (N = 11) prior to music exposure and during and after music therapy. *, p = 0.02 (Student's t-test).

Having seen the long term results of Sound Therapy on an adult listener using the Joudry method, where there was gradual improvement over a period of several years, it seems likely that the results seen in this study were limited by the short treatment span of only 15 days.

Przybek-Czuchrowska et al (2015) described a case history of a boy with Cerebral Palsy.

Cerebral Palsy (CP) is a developmental disorder caused by damage to the parts of the brain that control movement, balance and posture. Visual disorders occur in 50% of children with CP. Hearing disorders occur in 25% causing distortion in sound reception.

The child in this case history was born at 38 weeks by caesarean section, He had a heart defect and had difficulty suckling. The child had visual disabilities which were treated with light stimulation. Movement exercises were used to try to reduce muscle tone, but there were no significant improvements after two months. Cross patterning stimulation was done at home. Some vision improvement occurred by the age of 6 months. The child began to sit and crawl at 7 months, but had a hunched back. At 10 months a possible diagnosis of autism was given. At this point muscle tension had normalised.

A detailed neurological assessment was done by a multi-disciplinary team at this point. Hearing problems can sometimes be confused with autism, so due to the child's delayed speech development, hearing tests were done. A therapeutic program was developed with multiple activities. The main problem remaining was the lack of speech, despite normal oral function. There were problems with inflammation of the bronchi and lungs which required medical care focused on increasing the child's immunity. The child also received sensory integration therapy. A new specialist confirmed the diagnosis of CP and added hyperviral psychomotor deficit with ADHD. At age 5 the child was diagnosed with hypothyroidism and was given medication for this. The child began attending a special education class.

In 2009 the child received Tomatis therapy including passive listening to music, Gregorian chants and the mother's voice, plus an active process where the child underwent training of his own voice through the Electronic Ear. The aim was to treat a host of communication processes, including: receptive listening, correct interpretation of verbal communication, expressive language, tonal expression, use of vocabulary, auditory attention, energy levels and tolerance for frustration.

A response to the treatment was observed quite quickly.

The baseline test indicated left ear lateralisation, hypersensitivity of the right ear, deferred auditory responses, weak concentration, disturbed emotional reactions, impaired hearing and movement coordination.

The parents observed that after stage 2 of the treatment there was improved concentration and articulation, with decreased hyperactivity. After the third stage there was a correction of auditory sensitivity, correct processing of auditory stimuli, very good concentration and a positive change in the overall functioning of the child.

While not all the symptoms of Cerebral Palsy are reversible, it is nevertheless possible to significantly improve a child's physical and emotional wellbeing with the right interventions. This study indicates that the Tomatis method can be an important element of the treatment approach, in addressing cognitive and auditory functioning.

Le Roux 2008

Le Roux (2008) described the case of a young boy diagnosed with cerebellar ataxia, a disorder that occurs when the cerebellum becomes inflamed or damaged, causes unsteadiness of gait. Prior to starting Tomatis treatment, the boy had been discharged from a physical therapy program because he was not making enough progress.

Sam's condition was caused by meningitis which he contracted at age 10 (whether viral or bacterial was unknown.) Sam underwent a combined Tomatis and physiotherapy program, aimed at enhancing sensory integration. Prior to treatment he was wheelchair bound and was on medication for vertigo and nausea. He had poor coordination for fine motor tasks, blurred vision and was only able to walk with a walking frame.

After 15 days of treatment, Sam was no longer using a wheelchair. At the beginning of treatment, an underactive air conduction curve was evident in both ears, indicating poor performance of the middle ear system. This was improved in all except the very high frequencies by the end of treatment. Sam also reported that his tinnitus was significantly reduced.

The Sound Therapy consultant concluded that adding the Tomatis training to the sensory integration therapy was responsible for the remarkable progress that was achieved.

Trumps (2004) investigated the impact of Tomatis treatment on patients with TBI. When patients suffer traumatic brain injury (TBI) only 37% are employed two years later, and often in lower paid positions, according to studies cited by Trumps. For the patient known as TR at the Centre for Head Injury Rehabilitation, the Tomatis Method was incorporated into his multi-disciplinary recovery plan in order to speed recovery.

After falling on his head from a height of 30 feet after an electric shock, TR had suffered TBI. He was in a coma for 48 hours. Having been an agile athlete and cyclist in the Tour de France, he became unable to walk steadily or get himself out of the bathtub. He had facial paralysis, headaches, right arm muscle atrophy, facial hypersensitivity, visual tracking and perceptual deficits, (including double vision) tinnitus, poor background noise discrimination, vestibular disorders, and numerous falls, plus poor performance on household tasks and numeric calculations. During 36 months of treatment, a shift occurred to right ear and right arm dominance. Due to the proximity of several cranial nerves to the auditory nerve, the Tomatis treatment is attributed with recovery in tactile sensation, motor control and facial symmetry. TR recovered most of his abilities and was able to return to driving and his recreational activities of fishing, boating and small engine repair. Within three years of injury he became gainfully employed in the new field of computer networking, far surpassing the documented average of seven years post injury.

Although it was one of many treatment modalities that were used, the researchers believed that the Tomatis Method played a significant role in TR's recovery.

Studies on Speech Problems and Stuttering

Tomatis attributed stuttering to three potential causal factors. One was a decreased hearing acuity in the speech range of 1,000 Hz to 2000 Hz. (Gerritsen, 2010) Another was possible left oriented laterality (Tomatis, Conscious Ear) which he theorised would cause a split-second delay in incoming sound reaching the primary auditory cortex in the left hemisphere, due to the fact that the majority of our auditory efferent nerve fibres are contralateral. The third factor was the psychological element. (Tomatis Conscious Ear). Tomatis claimed an 80% success rate in treating stutters.

Escera et al (2018) studied the effect of Forbrain on six different measures of speech quality. They argue that the parameters measured and been proven to have clinical significance in a variety of vocal issues and are also pertinent to those who stutter. Unlike other studies on the Tomatis method on stuttering, this study does not seem to investigate or discuss the lasting or long term impact of the treatment on the severity of stuttering. What it does do is deliver very precise statistical evidence to show that use of the Forbrain device has immediate observable effect on two of the vocal parameters being measured. These were reduced breathiness and strengthening of the voice. The results obtained are said to have revealed compelling significant effects of the treatment on voice production. It is therefore suggested that such treatment would be of benefit to stutters.

Kurkowski (2014) did a study to investigate the role of sound perception in speech production, an aspect that, the authors argue, gets too little focus in the realm of speech therapy. Tomatis focussed not just on hearing, but on our capacity for listening and auditory processing.

Asha identifies auditory processing as a combination of the following processes of the central auditory processing system

- Location and laterality of sound
- Hearing discrimination (differentiation)
- Recognizing of hearing pattern characteristics
- Time aspects of hearing including
 - Time differentiation
 - Time masking
 - Time integration
 - Time arrangement
- Ability to recognise acoustic signals
- Ability to recognise degraded acoustic signals

The identification of auditory processing at the present time includes both evaluation of biological processes (through electrophysiological studies) and mental processes (through psychoacoustic studies). Many different testing methods are used to identify the various components of auditory processing disorders.

Dr Tomatis was one of the first practitioners to discuss auditory processing, as he was aware of the significant impact of such disorders on language and academic skills.

The Tomatis Method has had widescale application in Poland where Kurkowski has attempted to align the Tomatis terminology with that of audiophonological professions to support its greater acceptability. "Listening" was redefined as "auditory attention" while "Auditory selectivity" was redefined as "auditory discrimination".

In recent decades, advances in awareness of auditory processing disorders and its progressive inclusion into audiological practice has facilitated awareness of Tomatis' pioneering actions in this field.

In the field of speech disorders, Tomatis work often tends to be framed more in educational terms rather than in speech research. Kurkowski suggests that the role of speech therapy is broader in Poland than in many other countries as it includes linguistic improvement and auditory perception. Kurkowski aimed to include audiological diagnostic tests which measure disturbance in central auditory processing in Tomatis research studies.

He offers a review of published research around the world with a special focus on Poland, where the method has been trialled in 200 special schools. He states that the results from some of the key studies in Poland were not fully developed.

In the Mularzuk (2003) study, including 776 school children, according to Kurkowski, 50% of the children had better scores in the control tests after treatment.

In discussing the limitations of sound perception, he asserts that frequency perception is the most important aspect of speech perception as it enables the recognition of formants (harmonic structure), and this is confirmed by studies.

Poorly developed auditory self-monitoring also affects speech acquisition skills. Application of Tomatis treatment to improve self-listening a frequency perceptions, would therefore certainly be expected to improve these aspects of speech development.

The author also suggests that Tomatis treatment would likely be a valuable component of therapy for stuttering as it is likely caused at least in part by unformed laterality. Kurkowski noted that this is confirmed by Ratynski and others in 2003, who found 68% left ear domination in a group of 122 stutterers, while similar results were found by Kurkowski in 2013 in a group of 200 stutterers. (These Polish articles could not be located). Cited in Kurkowski, 2014.

Mojos et al (2011) studied forty seven children, aged 3 to 15, who had a range of neuropsychological impediments, and had been identified as having speech impediments as their main deficit. All subjects underwent a two stage Tomatis treatment program.

Assessment included reaction time, verbal fluency and sound localisation. Results showed a statistically significant improvement in most of the parameters measured, Subjects demonstrated greater hearing sensitivity and better ability to localise sounds. Verbal fluency was found to be enhanced, though these changes were not statistically significant. They concluded that the Tomatis treatment is a useful way to stimulate development and treat speech impediments.

Nicoloff, (2007), a Sydney based Tomatis therapist, explains that auditory processing disorder is not linked to impaired hearing but to the ability to process the meaning of sound. It is a dysfunction in decoding language. Children with this disorder are seen as different which can lead to buying and social isolation which may lead to behaviour problems. Nicoloff points out that treating underlying auditory processing problems is a key to successful intervention for many developmental disorders.

She describes the case of Sue, who needed things repeated endlessly by her mother, and had very unclear speech, though she could concentrate very well on some tasks. She was born premature and

had a history of ear infections including ruptured eardrums. Frustration and anger was worsening between ages 3 to 4.

Sue had reduced air conduction and left ear laterality. Despite a further ear infection following Tomatis therapy, Sue's hearing improved along with her writing and ability to complete tasks. Her verbal expression improved and she became less angry. Sue became more compliant, happier, and her speech improved dramatically, along with her posture. Teachers, her mother and speech pathologist noted her huge improvements.

After this improvement Sue's speech clarity declined again so she was referred for an ear candling treatment, ostensibly to remove wax. The treatment had an immediate and dramatic effect, increasing her hearing acuity and restoring speech clarity. She said to her mother "you speak so loudly!" While the author attributed this effect to wax removal, that is unlikely as the suction of ear candling is not strong enough to remove wax (conversation with Jo Olly, ear candle manufacturer). However, what ear candling does do is to apply a gentle, consistent vacuum to the outer ear canal and ear drum. It is likely that this restored equal pressure to the middle ear cavity on that occasion, reinforcing the overall repair to Eustachian tube dysfunction that the Tomatis program would have effected over the course of treatment.

Nicoloff (2004) reported on two case studies of young boys with developmental dyspraxia. Both had delayed language development and many associated behaviour and social adjustment issues. They responded very quickly to the treatment, according to reports from parents, teachers and speech therapists.

Tim Verbal Dyspraxia results, reported by parents, teachers and speech therapist: language development delayed 12 to 18 months. Beginning after four hours of listening, increased sentence length, more appropriate sentence structure, better comprehension, improved drawing and writing, enjoyment of language, understanding instructions easily, improved linguistic memory.

Chris Verbal Dyspraxia and poor muscle tone and fine motor difficulties, poor socialisation with peers. At age 4 had never really formed a meaningful sentence, suddenly started speaking after 4 days of treatment. Reading and motor skills improved, developed vocal control, better coordination, hand writing, climbing, dramatic change in confidence, normal social interactions.

In summary, there were significant improvements in sentence structure, comprehension, expressive language, engagement in learning, reading, writing, better co-ordination and improved social relationships.

The researcher concluded that the Tomatis program improves Dyspraxia associated with Motor Planning Disorder, enabling greater ability to use and control the muscles of the tongue and mouth in order to produce specific speech sounds. It enables children to move the tongue more quickly to achieve correct pronunciation. It increases the ability to understand instructions and to learn. Grammatical comprehension improves as new brain pathways are created for speech production and comprehension. Auditory processing improves with the creation of new neural connections. The auditory system is re-patterned if there was a lack of appropriate formation through accident, illness or trauma.

Kurkowski et al (2004) studied ninety four Polish children aged seven to fourteen years, all of whom had been identified as having dyslalia—difficulty speaking due to structural deficits in their speech organs. The physical deficits included hampered performance of vertical and horizontal movement of tongue, reduced precision and speed of tongue movement, malocclusion of the teeth and shortening of the tongue tie.

The aim of this study was to determine the role of auditory control in the articulation process. In particular they wished to assess the role of auditory attention and selection. In 51 percent of the children in this study there were no identified motor difficulties or phonemic hearing deficits. Standard hearing tests detect only exogenous speech perception (hearing others) but do not evaluate the ability to control one's own articulation.

The authors suggest that the emphasis in Tomatis therapy on alignment between exogenous and internal self-listening may be key to interpreting and treating many speech disorders. The Tomatis listening test identifies such issues as asynchronicity between air and bone conduction. Such issues pertain to perception disorders of sound pitch discrimination and auditory lateralisation disorders. These are key skills in the accurate perception and monitoring of one's own speech. Eighty eight of the children examined in this study displayed incorrect auditory attention in these areas, most often in the left ear. Disorders of sound pitch discrimination in the speech band were identified in 82.9% of cases, and above 2,000 Hz in 98.9% of cases. Authors note that left hemisphere dominance is essential for accurate speech control. By uncovering the aspect of impaired sound discrimination and self listening in children with dyslalia, the paper points to the essential importance of Tomatis treatment to rehabilitate these children.

Zdzisław et al produced a preliminary report in 2002 giving two selected case histories discussing diagnosis and treatment of children with hearing, speech and voice disorders plus reading and writing difficulties. The paper includes audiograms showing the differences before and after treatment. This paper was not obtained in English.

Kurkowski (2000) conducted a comparative analysis of the behaviour of people with right sided versus left sided deafness. 110 children aged 6-15 years were analysed. In this group forty-eight children had right-sided and sixty two had left-sided deafness. The author evaluated their achievements in school, their emotions and linguistic communication using six different tests. Tomatis postulated that left ear dominance may result in speech disturbances and difficulties in reading and writing.

The right ear, directly stimulates the left hemisphere, and is associated with traits: linguistic, analytic, rational, linear, sequential and arbitrary. The left ear directly stimulates the right hemisphere and is associated with traits: non-linguistic, holistic, emotional, spatial, successive and automatic.

Results indicated that in persons with right sided deafness 48.3% showed emotional disorders. They also had more serious problems with language skills and school performance.

In persons with left sided deafness, 87.1% exhibited emotional imbalance. In school these children preferred science, as information was more directly conveyed to the left hemisphere, responsible for rational thinking.

This study is interesting in light of Tomatis's emphasis on the importance of right ear dominance for language proficiency, which seems to be confirmed by these results.

Kurkowski (2000) studied forty five people who stutter, ages 8 to 32 years.

Subjects were tested for auditory laterality using Tomatis' audiolaterometer. Testing revealed left-sided auditory laterality in 12 cases, right-sided in 13 cases and indefinite laterality in 20 cases.

Some scientists believe the right hemisphere to play a larger role in speech functions in people who stutter. (Tomatis is clear that the right ear should lead, supporting the left hemisphere to be the primary processing centre for language.)

Tonic stuttering = blockage of speech, clonic stuttering = repetitions. Left-sided lateralisation resulted in tonic (blockage) or tonic-clonic (repetition) stuttering. Indefinite lateralisation resulted in clonic (repetition) stuttering.

Laterality was also tested for eye, hand and leg. Homogeneous Right sided laterality was found in 8 cases. Homogeneous left-sided laterality was found in 1 case. Mixed laterality was found in 36 cases. Those with mixed laterality exhibited the most severe stuttering.

The author concludes that the diagnosis of stuttering should include an evaluation of auditory lateralisation and that appropriate therapy should be given in cases of left side or mixed laterality. In left auditory dominance, information is delivered first to the right hemisphere, hence emotional state or disturbance is known to affect speech fluency. Stuttering is four times more prevalent in boys than in girls. This may be due to speech being more lateralised in both hemispheres in women.

Van Jaarsveld, (1973, 1974) conducted two studies on stuttering at the University of Potchefstroom, South Africa. The first study, involving 43 participants, was evaluated through observations of family members and people very familiar with the subjects speech patterns. All clients reported symptom relief with more fluent speech and 82% of the participants were observed to have significant symptom relief. In a follow up after 12 months, 54% had maintained their improvement, despite the fact that the treatment period has been shorter than recommended.

A follow up study (Van Jaarsveld 1976 and 1988) tested 30 young adults who were severe stutterers. Several tests were used to evaluate severity of stuttering, speech fluency, oral reading, attitude towards stuttering, improved hearing in speech range in right ear and vocal output.

Improvements were noted on all of these measures, as summarised in the table below.

	Pre	Post
Lanyon Stuttering Severity Scale	72	42
Johnson Disfluency Index: Reading	16	6
Johnson Disfluency Index: Speech	27	12
Rate of Reading (wpm)	99	118
Rate of Speaking (wpm)	88	111
Attitude Toward Stuttering	2.5	1.7

Table 18: Van Jaarsveld Study:
Impact of Tomatis on the severity of stuttering

Gerritsen, 2010.

Szkiełkowska et al (2003) studied 30 children aged 6 to 12 with vocal fold nodules and accompanying dysphonia. Abnormal listening ability and laterality according to the Tomatis listening tests, were used as additional criteria for inclusion in the study. Re-testing was performed after the treatment period and again seven months later. Following treatment, 83% (25 out of 30 children) no longer had detectable vocal nodules. A significant improvement in listening attention was found in 88% of the subjects, and improved laterality was found in 90% of participants. In 80% of participants, frequency and amplitude voice parameters returned to normal, and these results were sustained on re-testing 7 months later.

The researchers concluded that, in children with vocal nodules, there may be co-existence of emotional factors and disturbed auditory perception. The Tomatis method was found to be an effective treatment which could complement other measures.

Studies on Anxiety and Wellbeing

The client, 'Mandy' had a background of developmental delay and family trauma. She was diagnosed with ADD and was on medication.

In her Tomatis treatment at first Mandy was withdrawn and didn't want to engage. She reported feeling confused and that she thinks slowly. And if her brain was scrambled. She felt alone and unable to voice her feelings. Her speech and writing was very disorganised.

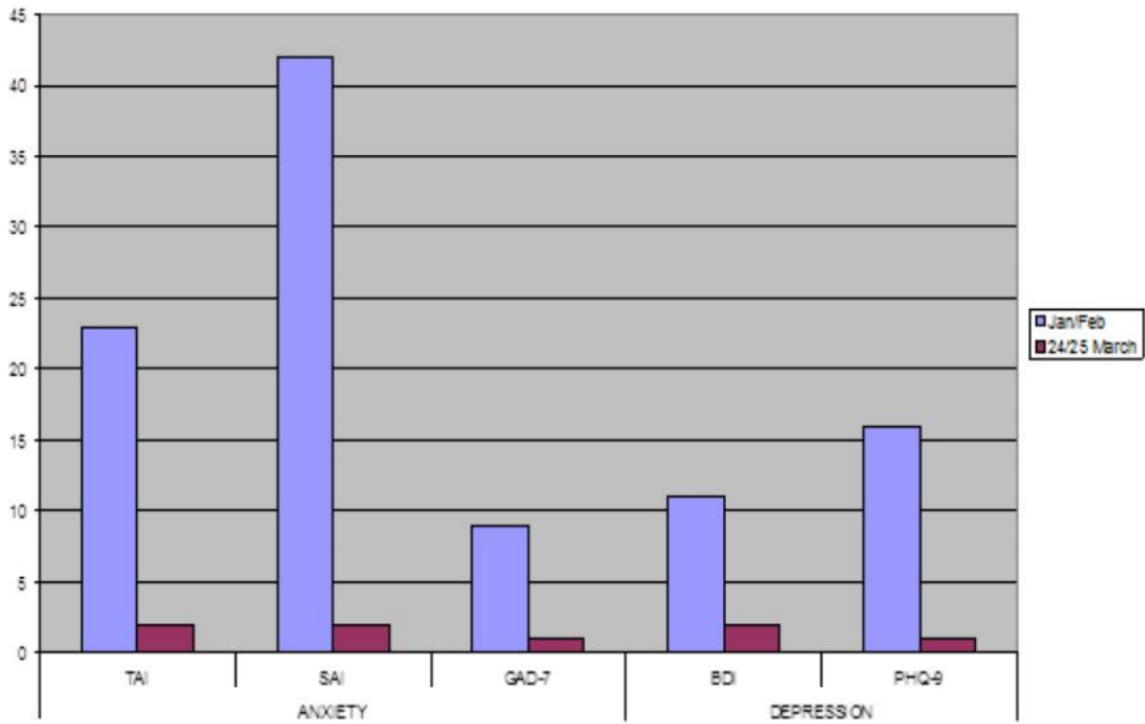
As treatment progressed observations from family and therapist were that she began to initiate conversations, engaged and made eye contact. She gained in confidence and her thinking and concentration improved.

Her sentences were more coherent, her thinking more organized, her writing improved. The doctor was happy for her to stop taking her medication.

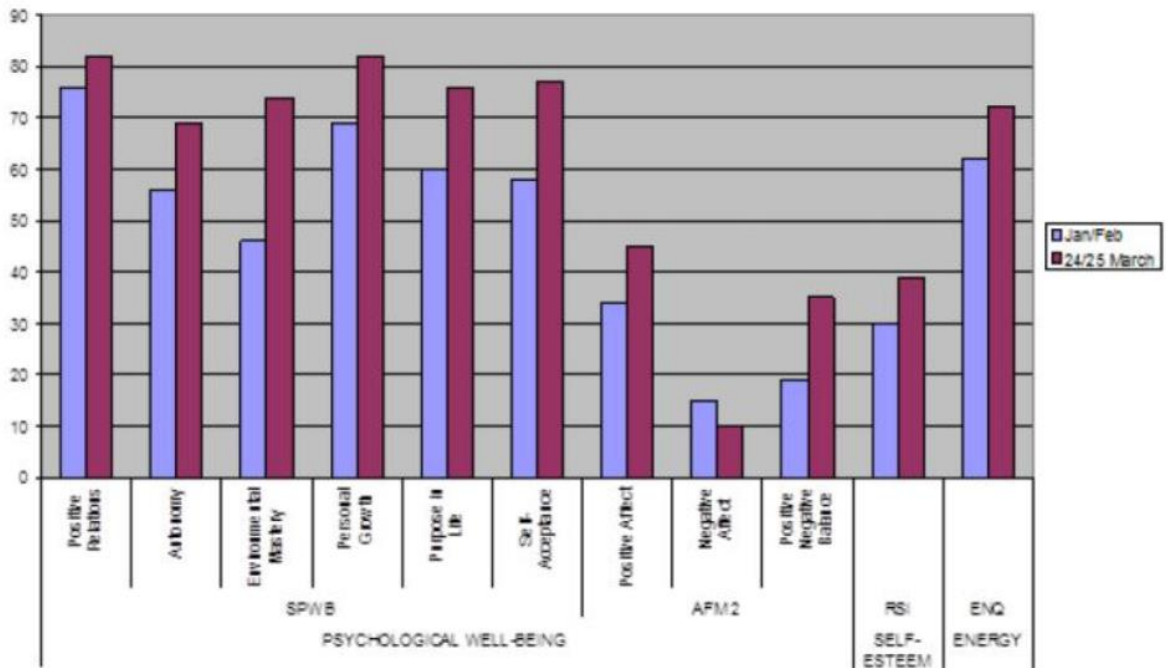
Questionnaires used before and after Tomatis treatment confirmed a very large reduction in anxiety and depression and an overall improvement in psychological wellbeing.

Graphs of Questionnaires Before and After Tomatis Program

Anxiety & Depression



Psychological Wellbeing



The aim was to investigate reductions in negative mood states, enhancement of psychological wellbeing and reduction of Body Mass Index.

Measures used were a self-designed questionnaire, the Profile of Mood States, Tennessee Self-Concept Scale and Sense of Coherence Scale.

A three group pre-post assessment design was used.

- Group 1 Tomatis and LEP (Lifestyle Enhancement Program (n=10)
- Group 2 LEP only (n=10)
- Group 3 non-intervention (n=9)

The study was designed in reference to taking a broad approach to weight management encompassing exercise, diet, self-concept, stress management, problem solving, decision making, assertiveness and insight.

Overall the results showed enhancement of psychological well-being and self-concept, but BMI remained unchanged. The outcomes of group 1 did not significantly exceed group 2. The results highlighted limitations in design, such as BMI being an inadequate measurement of weight reduction.

Coetzee (2001) completed a dissertation on the effect of the Tomatis Method on depressed young adults, as Tomatis asserted in 1974 that Sound Therapy can help those with neurotic depression.

Depression is currently the world's 4th largest health problem with an estimated prevalence of 10.7% (Murray and Lopez, 1996).

The study worked with an experimental group of 9 and a control group of 9. Sound Therapy was explored as an alternative to the standard treatment of CBT, ECT and medication. While psychological treatments have been found to have the best long term effects, recent attribution has been extended to neuropsychological structures. For example, Bruder et al (1997) found CBT to be twice as effective in clients with Right ear dominance.

Tomatis hypothesized that we are motivated to listen by a desire to communicate with the mother through hearing her voice in utero. Traumatic events may result in a closing off of the ear and thereby closing off external relationships. Such isolation leads to anxiety and potentially depression. The aim of the Tomatis method is to expose individuals to a simulation of their pre-natal sound world and thereby rekindle the desire to communicate.

Participants were screened via the DSM IV criteria for depression, and had to achieving a minimum score of 8 on the Beck Depression inventory (BDI), indicating at least moderate depression.

Pre and post measures included expressive drawings and the Profile Of Mood states (POMS), the Beck Depression Inventory (BDI), the Affectometer 2 (AFM2), the Sense of Coherence Scale (SOC), Purpose in Life Test (PIL), Revised NEO Personality Inventory, (NEO PI-R), and Profile of Mood States (POMS).

Participants also received 7 one hour psychotherapeutic interviews.

Results indicated that the treatment in combination with psychotherapy is associated with reduced depression and enhanced psychological wellbeing.

Severe depression was reduced to mild depression

Neuroticism and negative affect were significantly reduced. These results both confirm and more clearly define the results of earlier studies.

Participants also reported improvement in general mood, reduced feelings of inadequacy and hopelessness. They felt more relaxed, indicating a reduction in anxiety as seen in other studies, and reported feeling they had more energy. Purpose In Life scores indicated that life was more meaningful than before.

The researcher noted that participants became increasingly talkative and spontaneous during the course of the program, and many made positive life-changes, overcame procrastination and made important life decisions.

Coetzee

Variable	Mean Pre	Mean Post	Mean Difference	p
Beck Depression Inventory (BDI)	16.889	4.222	-12.667	0.004*
Positive Affect	26.000	37.889	11.889	0.004*
Negative Affect	32.000	20.444	-11.556	0.004*
Sense of Coherence (SOC)	102.222	126.778	24.556	0.018*
Purpose in Life (PIL)	83.556	108.000	24.444	0.018*
NEO personality inventory neuroticism	120.444	104.000	-16.444	0.020*
NEO personality inventory Anger	17.778	16.889	-0.889	0.257
Profile of mood States (POMS)				
Depression	31.556	14.000	-17.25	0.023*
Anger	28.000	14.750	-13.25	0.031
Tension Anxiety	24.444	14.125	-10.375	0.023*
Confusion	18.667	10.500	-8.750	0.007**
Fatigue	17.778	8.375	-10.26	0.031*
Vigor	10.667	18.500	7.875	0.015*

*p ≤ 0.05 **p ≤ 0.01 ***p ≤ 0.001

There were no significant pre-post changes in the control group.

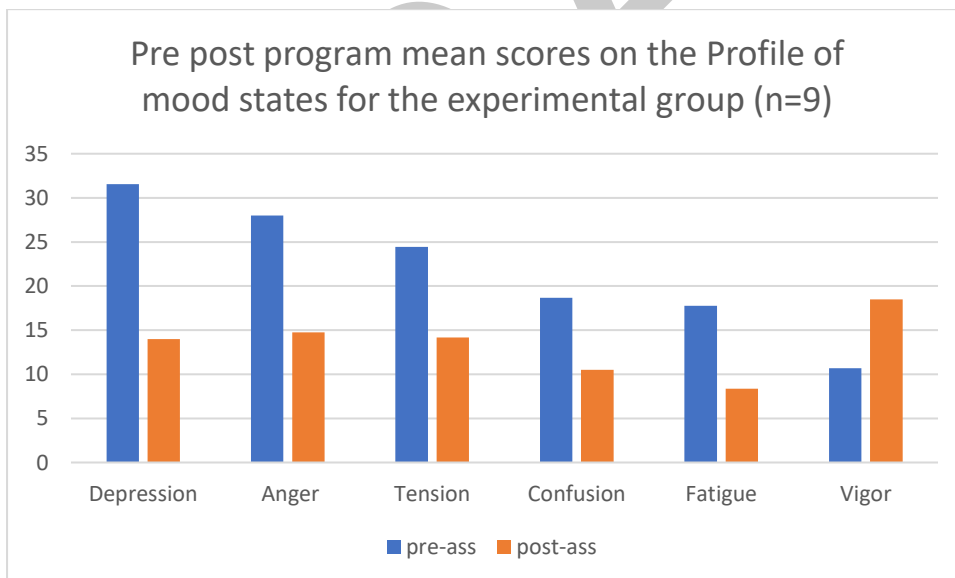
Table 5

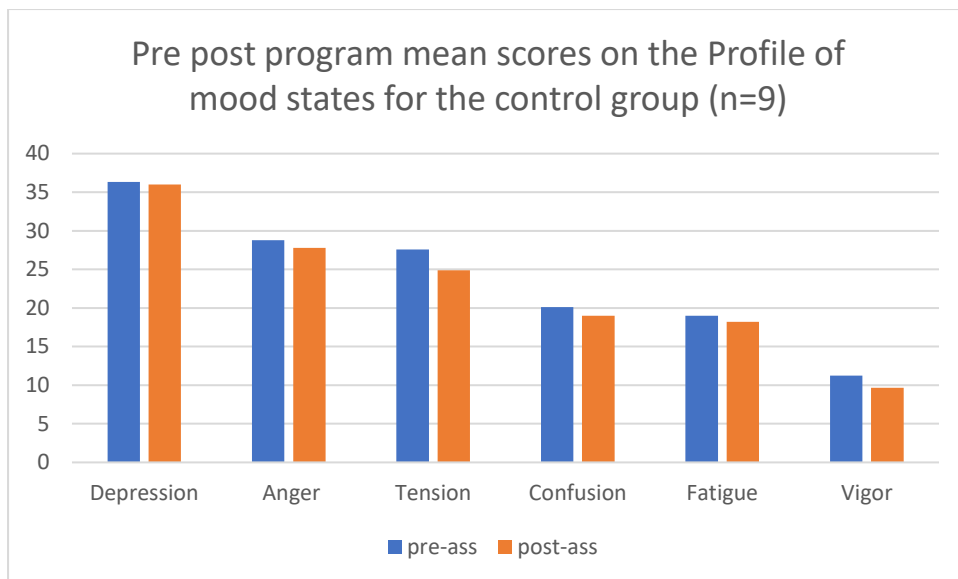
Significant post-assessment differences between experimental and control group
--

Variable	Experimental Group (n=9)	Control Group (n=9)	
	Mean	Mean	p
Beck Depression Inventory (BDI)	4.222	19.222	0.0003***
Positive Affect	37.889	24.556	0.002*
Negative Affect	20.444	31.444	0.002*
Sense of Coherence (SOC)	126.778	94.444	0.009*
Purpose in Life (PIL)	108.000	71.667	0.021*
NEO personality inventory neuroticism	104.000	125.556	0.093*
NEO personality inventory Anger	16.889	21.667	0.722
Profile of mood States (POMS)			
Depression	14.000	36.000	0.016*
Anger	14.750	27.778	0.024*
Tension Anxiety	14.125	24.889	0.080*
Confusion	10.500	18.778	0.009**
Fatigue	8.375	18.222	0.451*
Vigor	18.500	9.778	0.005**

*p≤ 0.05 **p≤ 0.01 ***p≤ 0.001

Graphs comparing the results of the experimental group versus the control group on the POMS are shown below.





Replicate

Peche (1975) at the University of Potchefstroom, South Africa, studied a group of 10 anxious female students. Clinical observations and test results showed that the Tomatis treatment, in combination with psychotherapy, helped to alleviate anxiety and remove psychic blocks. There was a significant decline in neurotic and hypochondriac behaviour patterns. Peche concluded that the Tomatis treatment can be a significant aid to psychotherapy.

Botes (1979) at the University of Potchefstroom, South Africa, undertook an in depth study of three clients with neurotic depression. She found improved relationships and self-concept, with improved scores on several standard measurement scales.

Du Plessis (1982) at the University of Potchefstroom, South Africa, undertook a long term study over 14 months with subjects carefully selected from a survey of 424 people. Participants received Tomatis treatment plus regular therapeutic interviews. The study showed improved mental health and self-actualization for both 10 anxious and 10 non-anxious people as compared to a control group. After treatment the subjects demonstrated a significant increase on a measure of self-actualisation. They had enhanced mental health, were using their time more constructively and found they were functioning in greater alignment with their motives and needs.

Du Plessis (1988) later did a study of primary school students with anxiety. A treatment group was compared to two carefully selected control groups which received either psychotherapy or no treatment. Two anxiety tests were used, and the Tomatis group demonstrated statistically significant improvements on both scales compared to the other groups.

	Pre / Post Anxiety Scores		
	Tomatis	Psychotherapy	Control
N	10	9	10
CAS	9.6 / 7.6	11.0 / 11.3	8.4 / 7.7
STAIC Trait	42.8 / 32.9	41.2 / 37.1	37.2 / 37.6
STAIC State	32.8 / 27.6	30.7 / 28.1	31.3 / 30.0

Table 19: Du Plessis (1988) Study. Differences in the shades cells are statistically significant.

Gerritsen 2010.

Spaggiari (1995) a psychiatrist and Tomatis practitioner in Reggio Emilia, Italy, treated 409 people with mental disorders using the Tomatis method. He achieved a high success rate with anxiety disorders, both psychosomatic and those related to panic attacks. Success rates were noted on a 4 point scale, ranging from no impact to very large impact. Anxiety disorders received the highest rating, at 72%, while Obsessive Compulsive Disorder and Anorexia had the lowest ratings, at 43% and 42%. The success rate for other psychological disorders was around 50%.

Disorder	Sample Size	Ave Rating	Failure %	Success %
Anorexia	7	2.4	29	43
Psychosomatic Anxieties	71	3	6	72
Anxieties with Panic Attacks	45	2.7	2	73
Obsessive Compulsive Behavior	31	2.2	29	42
Bipolar / Manic Depressions / Cyclotomia	97	2.6	5	58
Severe Depressions	30	2.6	7	53
Schizophrenia (with or without paranoia)	68	2.4	16	47
Personality Disorders (paranoia, schizotypic and borderline)	39	2.4	8	46
Neurological and Cerebral Disorders	21	2.5	10	52
Total	409	2.5	10	57

Table 20: Spaggiari , Success Rate of Tomatis Therapy on psychological disorders
Failure = 1 rating; Success = 3 or 4 rating

Gerritsen, 2010

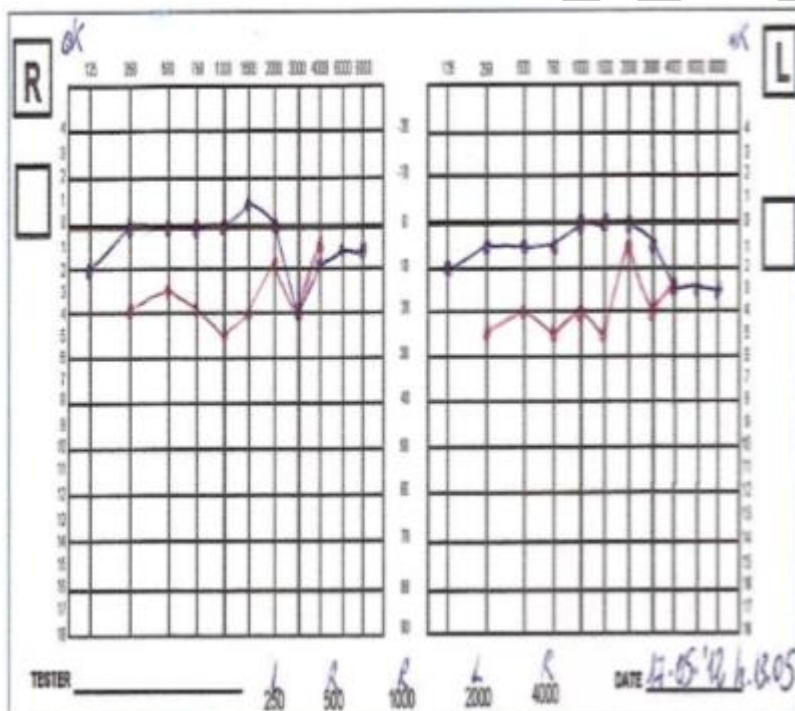
Stillitano changes before and after treatment			
	Baseline	70 hours	105 hours
Tinnitus Handicap Inventory	34 (grade2)	6 (grade 1)	2 (grade 1)
Tinnitus loudness at 3000Hz	30dB HL	18dB HL	12dB HL
Loudness discomfort level	Bilateral mild hyperacusis in high frequencies		Normal

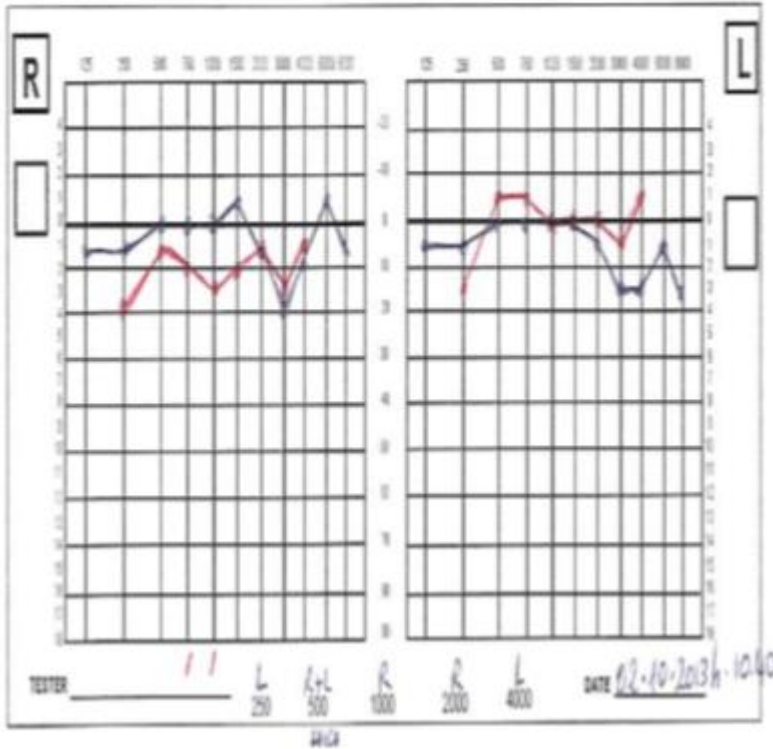
Stillitano et al studied a young male patient who had experienced tinnitus since the age of 6, to see if the Tomatis Method would be an effective treatment.

The tests applied were: Tinnitus Handicap Inventory (THI), Tinnitus Sample Case History (TSCH), psychological questionnaires, Pure Tone Audiometry (PTA), pitch and loudness of tinnitus, and loudness discomfort level.

The hearing was normal and the tinnitus was prevalent in the left ear at a pitch of 3,000H with a loudness level of 30dB HL.

The patient's tinnitus was triggered by high stress levels and negative emotions related to family problems.





Studies on Mental Focus

In Sweden Olkiewicz studied 119 persons—63 adults and 56 children

Main presenting problem areas identified by client

- Intellectual
- Motor skills
- Emotional
- Speech and voice
- Energy level

Adults the majority reported that the largest problem area was emotions, the second was intellectual, which was dominated by concentration and attention.

Parents reporting for their children, the largest area of problems was intellectual, dominated by concentration and attention.

Almost half of the children had diagnoses of conditions such as ADHD or autism.

It is interesting that in this group of children were over represented in some difficult background issues as follows

- 13 percent were adopted
- 18 percent were premature
- 32 percent had a history of frequent ear infections

In spite of the severe difficulties, backgrounds and developmental issues experienced by the children, results indicated substantial progress as the result of the treatment.

A before and after questionnaire covering 38 questions for adults (41 for children) was divided into five areas, being:

1. Attention
2. Motor skills
3. Expressiveness
4. Level of energy
5. Behaviour and Social Adaptation

From self ratings before and after treatment, the greatest progress for adults was found in attention and level of energy.

In children the greatest progress was found in attention, with motor skills and behaviour and adaptation coming second.

Olkiewicz, 2012 Mean differences in Indices before and after training according to self-Ratings			
Results for adults			
Areas in self rating	Before	After	Diff
Total change for all five areas:	41	27	14
Attention	51	31	20
Motor Skills	35	23	20
Expressiveness	31	20	11
Level of Energy	51	35	16
Behaviour and Social Adaptation	40	27	13
Number	63		

Differences within groups are significant at the 1% level

Olkiewicz, 2012 Mean differences in Indices before and after training according to Self-Ratings by parents of children			
Results for children			
Areas in self rating	Before	After	Diff
Total change for all five areas:	45	32	13
Attention	59	39	20
Motor Skills	37	25	12
Expressiveness	38	28	10
Level of Energy	47	36	11
Behaviour and Social Adaptation	46	34	12
Number	56		

Differences within groups are significant at the 1% level

The researchers concluded that Tomatis treatment appears to have a beneficial effect on concentration and attention difficulties plus social adaptation in both adults and children.

Donatini and Dahan, 2012

Donatini and Dahan (2012) compared the success of medical students who were given Tomatis Therapy and *Hericum Erinaceus* (a nutritional mushroom known to promote brain function) vs a control group which had no treatment. 26 students who received the treatment were compared to 42 in the control group.

16 students were allocated to the treatment group and given the opportunity to have the treatment, but did not participate. These students had results similar to the control group.

Donatini comparison of treatment with Tomatis and HE vs control				
	Treatment group	control	difference	p
	69.2%	51.2		P<0.05
Tried first time	66.7%	25%		P<0.001

The researchers concluded that treatment with HE plus Tomatis therapy increases the success rate in comparative medical examinations if the students are motivated.

Research on other forms of activated sound

Some sound therapy developers have created methods which have certain similarities to Tomatis's work but claim no association. It is likely these scientists did derive some of their ideas from Tomatis, but have diverged considerably from his theoretical base, and chosen a somewhat different

approach to filtering sound. These specialists do not seek to align with Tomatis or claim to be replicating his work in any way.

Research on Tomatis Based Derivatives

While Joudry was the first to adapt Tomatis Sound Therapy into a portable system (Joudry, P., 1984) several other systems have since developed their own various adaptations of Tomatis's discoveries, using a variety of portable delivery methods and sometimes combining the treatment with other elements, such as variations on filtering, portable systems, incorporating body exercises, planetary frequencies or counselling. It is not within the scope of this paper to analyse these other Tomatis derivatives.

Restricting listening time was a factor of cost and convenience in clinic based programs. Following Joudry's initiative, other programs have followed in making the method more portable. Many studies document the number of hours listened. However, with the portable, Joudry method, where unlimited, long term listening is much more feasible and is encouraged, this restriction becomes much less of a factor.

It is readily apparent from an observation of the published research that each of the Tomatis based methods is working effectively and achieving similar results. Cost and convenience therefore become key factors in choice of program for an informed client.

Research on the Joudry method

Generally known simply as "Sound Therapy" or "Sound Therapy SYNERGY" the method developed by Patricia and Rafaele Joudry has some key distinctions from other programs.

The Joudry's were the first group to develop an alternative delivery system for the Tomatis method and as such were simply aiming to make the method portable, accessible and affordable.

Since the development was made by a Sound Therapy listener who had benefitted significantly herself, as an adult, Patricia Joudry designed the method from the user's perspective, trialling and proving that the therapy was just as effective if used on portable equipment, while engaged in normal daily activities or sleep. This has since always distinguished the Joudry method from others, as there is no requirement to be in a clinic, sit still or focus on the sound while listening.

Concomitant with this, long term, ongoing lifelong listening was proven to be of benefit, and became the norm for treatment. In addition, the largest population using the Joudry method has always been adults, who used it for hearing related issues, rather than children with learning difficulties-- as is the case with all the other Tomatis based and related programs.

Tomatis researchers make the point that it cannot be assumed that other derivatives achieve the same result as the official Tomatis Method, since protocols, technology and treatment vary. By the same token, each Tomatis study varies in factors such as length of listening, number of sessions and combination with other treatments.

It should also be acknowledged that, since its inception, the effects of the Joudry method have been observed to produce very similar results to the Tomatis Method in all the health conditions that have been observed, so it seems reasonable to assume that at least a portion of the effects observed in Tomatis studies would also apply when using the Joudry Method.

Concomitant to this, the longer treatment time possible and the convenience and lesser cost of the Joudry method give it sufficient advantages to warrant its serious consideration as a treatment option in many situations.

Sound Therapy International has, since the 1980s undertaken and supported several studies using the Joudry recordings, equipment and protocols.

Neurological theories which substantiate Tomatis

Porges (2011) identified the evolution of dual neural circuits in our vagal system which help to explain our physiological reactions and behaviour under stress.

He identified an ancient reptilian circuit involved in defensive strategies of immobilization—fight or flight—versus the newer part of the vagus nerve, dubbed the “great calming nerve” which is part of the parasympathetic nervous system, and is of central importance in the effect of Tomatis therapy. Its activation promotes a receptive, attentive attitude towards ourselves and others.

Similar to Tomatis, Dr. Porges’ research focused on the two muscles in the middle ear – the tensor tympani and the stapedius. Porges emphasised that the same nerves which control these two muscles also control vocalization, facial expression, heart rate and breathing. Like Tomatis, Porges found that enhancing the function of these muscles in turn impacts our health so that communication, relationships and quality of life improve.

Conclusion

As our understanding of the complexity of the nervous system, its level of integration, its importance to human interactions deepens and gains scientific foundations, a more receptive environment is once again developing to appreciate Tomatis’s momentous discoveries about the role of sound in our neural health.

Extensive clinical research on the Tomatis Method has continued over the past five decades, driven by the dedicated, pioneering, integrative practitioners who were inspired by their personal observations of how clients’ lives were being transformed by the method.

Since the addition of the many discoveries within the new disciplines of neuroscience and neuropsychology, there is potential now for Tomatis’s work to gain greater traction and recognition for the truly ground-breaking discoveries that he made six decades ago.

References

AbediKoupaiea, M., Poushaneh, K., Mohammadi, A. Z., Siampour, M. A., 2013, Sound Therapy: an Experimental Study with Autistic Children, *Procedia: Social and Behavioural Sciences*, cited on 19/11/2018 on <https://www.sciencedirect.com/science/article/pii/S1877042813016893>

Bonthuys et al (2016) Bonthuys A, Botha K, Breytenbach W. The effect of the Tomatis® Method on self-regulation in a sample of South African university students. *J Psychol Cognition*. 2018;3(1):16-23.

Botes, C. E. (1979). Audio-psycho-phonology with neurotic depression. Unpublished masters thesis, North-West University, Potchefstroom, South Africa (written in the Afrikaans language). Cited in Jaarsveld and Du Plessis, 1988

Callahan, C., 2009, Results of the Tomatis Program First Grade Self-contained Setting, Baker Victory Services early Childhood Centre, cited on https://issuu.com/tomatisdoc/docs/the_baker_academy_results_of_the_to

Chastain, A. (2008) Effectiveness of Listening (Auditory) Therapies, Rocky Mountain University of Health Professions, cited on <http://tomatisassociation.org/effectiveness-of-listening-auditory-therapies/>

Chou, P, 2012, A pilot study on the potential use of the Tomatis Method to improve L2 reading fluency, *Teaching English with Technology*, v12 n1 p20-37 2012. Cited on 15/11/2018, on <http://www.tewtjournal.org/issues/past-issue-2012/past-issue-2012-issue-1/>

Coetzee, J. O., 2001, The effect of the Tomatis Method on depressed young adults, Mini Dissertation, Potchefstroom University for Christian Higher Education, cited on <https://tomatisassociation.org>

Concepcio Torres Sabate, 2012, Application and analysis of the Tomatis Method with primary children in public schools, Universidad Rovira i Virgili, <http://tomatisassociation.org/aplicacion-y-analisis-del-metodo-tomatis-en-escuelas-publicas-de-infantil-y-primaria/>

Coppola, G., Toro, A., Operto, F. F., Ferrariolo, G., Pisano, S., Viggiano, A., Verrotty, A., 2015, Mozart's music in children with drug-refractory epileptic encephalopathies, *Epilepsy and Behaviour*, 50 (2015) 18-22. Cited on 28/11/2018 <https://www.ncbi.nlm.nih.gov/pubmed/26093514>

Corbett, B. A., Shickman, K., Ferrer, E., 2008, Brief Report: the effects of Tomatis sound therapy on language in children with autism, *J Autism Dev Disord*. 2008 Mar;38(3):562-6. Epub 2007 Jul 3.

Corbett, B., Shickman, K., Ferrer, E. (2007), The Effects of Tomatis Sound Therapy on Language, Cognition and behaviour in Children with Autism, *Journal of Autism and Developmental Disabilities*, 28 (3), 562-566.

Cuppola, W., 2016, The Tomatis Effect with Professional Opera Singers. A Pilot Study, *GESTALT THEORY*, Vol. 38, No.2/3 (ISSN 0170-057 X) http://www.tomatis-italia.ovh/images/PDF/A_PILOT_STUDY cited on 22/11/2018

D'Orthy, C. and Monnet, B. (1991), La Methode Tomatis: preparation phonique a l'accouchement a Foch en 1991, Travail de fin d'etudes. Cited in Gerritsen, 2010.

Davies, C., and Smith, D., 2016, Case study 18 year old client diagnosed with Aspergers, OCD and anxiety, Fit 2 learn UK, cited on 19/11/2018 on <https://tomatisassociation.org/case-study-18-year-old-client-diagnosed-with-aspergers-ocd-and-anxiety-using-the-tomatis-method/>

Davis, D., (2005) The Results of 100 Autistic Children Pre and Post the Basic Tomatis Program, the Davis Centre, cited on http://www.thedaviscenter.com/uploads/7/9/1/5/7915458/38_tomatis_ai_pre-post-iarctc_5-05_5-08.pdf

Davis, D., (2005) A Review of Various Abilities Improved after the Basic Tomatis Method Program for Autistic, Williams Syndrome and AD/HD clients, presented at the 2005 Educational Audiology Association Summer Conference, cited in Gerritsen 2010.

De Bruto, C. M. E. (1983), *Audio-psycho-phonology and the mentally retarded child: An empirical investigation*. Paper presented at the First Congress on Audio-Psycho-phonology. Potchefstroom. Cited in Van Jaarsveld, P. E. and Du Plessis, W. F. Audio-psycho-phonology at Potchefstroom: A review, *S. Afr Tydskr. Seilk.* 1988, 18 (4), 136-143.

Donatini, B. & Dahan, J. C., (2012) Prospective and randomized study on 84 students with Hericium/Tomatis Method. Quick learning and better success rate to medical competitive examination, *Phytotherapie*, October 2012, Volume 10, Issue 5, pp 324 – 326.

du Plessis, W., Burger, S., Munro, M., Wissing, D., Nel, W., Multimodal Enhancement of Culturally Diverse, Young Adult Musicians: A Pilot Study Involving the Tomatis Method, *South African Journal of Psychology*, August 1, 2001. <https://journals-sagepub-com.simsrad.net.ocs.mq.edu.au/doi/abs/10.1177/008124630103100305> cited on 26/11/2018

du Plessis, E., Munro, M., Wissing, D., and Nel, W., 2008, Enhancing psychological well-being and musical proficiency: Experiences of a Black South African singer during a Tomatis study of student musicians and at follow-up, seven years post program, *Ricochet*, January 2008. https://issuu.com/tomatisdoc/docs/enhancing_psychological_well-being cited on 22/11/2018

Du Plessis, W., Munro, M., Wissing, D., and Nel, W., (2000) Peer-reviewed Article Holistic Singer Empowerment: Tomatis as myth or multi-modal stimulation, *Voice and Speech Review*, 1:1, 271-284, DOI: 10.1080/23268263.2000.10761422

Du Plessis, W.F. (1982). Beangste en nie-beangste eerstejaardamestudente: 'n Klinies-psigologiese verkenning. Ongepubliseerde doktorsproefskrif, Potchefstroom Universiteit vir CHO: Potchefstroom. Cited in Jaarsveld and Du Plessis, 1988

Du Toit, I, 2011 Educational Interpreters and the Tomatis Method: a mixed methods study at the North-West University, Masters Thesis, Potchefstroom, South Africa. cited on 13/11/2018 on https://repository.nwu.ac.za/bitstream/handle/10394/4844/duToit_I.pdf?sequence=2

Escera, (2015) Scientific validation of the Tomatis effect: EEG recordings of sound encoding from brainstem to cerebral cortex - Pilot Phase, University of Barcelona, Spain. Cited on 12/11/18 on <https://www.tomatis.com/en/research-and-resources>

Escera, C., Gorina-Careta, N., Lopez-Caballero, F., 2018, The Potential Use of Forbrain in stuttering: A single case-study, *Anuario de Psicologia*, (2018) 48, 51-58.

Escera, C., Lopez-Caballero, F., Gorina-Careta, N., The Potential Effect of Forbrain as an Altered Auditory Feedback Device, *Journal of Speech, Language and Hearing Research*, Vol 61: 801-810, April 2018.

Gerritsen, J., (2010) The Effect of Tomatis Therapy on Children with Autism: Eleven Case Studies, Dr Jan Gerritsen, *International Journal of Listening*, USA. Cited on <https://www.tandfonline.com/doi/abs/10.1080/10904010903466378?src=recsys&journalCode=hijl20>

Gerritsen, J., A Review of Research done on Tomatis Auditory Stimulation, *International Journal of Listening* 24(1):50-68 · January 2010

Gillis, J.S. & Sidlauskas, A. E., (1978), The influence of differential auditory feedback upon the reading of dyslexic children, *Neuropsychologia*, 16, 483-489.

Gillis and Sidlauskas, 1977, The influence of differential auditory feedback upon the reading of dyslexic children, *Neuropsychologia*, Vol. 16 pp 483-489, cited on <http://tomatisassociation.org/the-influence-of-differential-auditory-feedback-upon-the-reading-of-dyslexic-children/>

Gilmor, T., (1999) the Efficacy of the ATomatis Method for Children with Learning and Communication Disorders: A Meta-Analysis, *International Journal of Listening*, Volume 13, 1999 – Issue 1. <https://doi.org/10.1080/10904018.1999.10499024>

Hesse, H-P., Balzer, H-U., Bachmann, K., Ferstl, E., Fritz, F. M., Schid, I., 2002, Tomatis Hearing Treatment Study, University Mozarteum, Salzburg. <http://tomatisassociation.org/tomatis-hearing-treatment-study-on-musicians/> cited on 16/11/2018

J. Vervoort, M. J. A. de Voigt & W. Van den Bergh MD (2008) The Improvement of Severe Psychomotor and Neurological Dysfunctions Treated with the Tomatis Audio-Psycho-Phonology Method Measured with EEG Brain Map and Auditory Evoked Potentials, *Journal of Neurotherapy*, 11:4, 37-49, DOI: 10.1080/10874200802169621

Jingjing, Z. and Changxiang, C., 2015, Auditory Training on Memory Disorder of Patients with Stroke College of Nursing and Rehabilitation, North China University of Science and Technology, Hebei, China.

Jingjing, Z. and Changxiang, C., 2016, Effect of Audio Training on executive dysfunction in patients with stroke, College of Nursing and Rehabilitation, North China University of Science and Technology, Hebei, China.

Jingjing, Z. and Changxiang, C., Shuxing, L., Min, Z. and Na, D., 2015, Effects of Auditory Training on Cognitive Function in Patients with Stroke College of Nursing and Rehabilitation, North China University of Science and Technology, Hebei, China. DOI:10.3760/cma.j.issn.1674-6554.2016.

Kati, F., 2002, Preliminary study on the effectiveness of the A.A. Tomatis Audio- Psycho-Phonological Method for the treatment of children with reading disorders, University of Padua, Italy. Cited on <https://tomatisassociation.org/preliminary-study-on-the-effectiveness-of-the-a-a-tomatis-audio-psycho-phonological-method-for-the-treatment-of-children-with-reading-disorders/>

Kaunzner, U. A., (2001). Das Ohr als Schlüssel zur Fremdsprachenkompetenz, Julius Groos Verlag, Tübingen, PhD thesis. Cited in Gerritsen, 2010.

Kershner, J., Cummings, R., Clarke, K., Hadfield, A., and Kershner, B., (1986/1), Evaluation of the Tomatis Listening Training Program with learning disabled Children, *Canadian Journal of Special Education*, 2, 1 – 32.

Kershner, J., Cummings, R., Clarke, K., Hadfield, A., and Kershner, B., (1986/2), two year Evaluation of the Tomatis Listening Training Program with learning disabled Children, *Learning Disability Quarterly*, 13, 43 – 53.

Klopfenstein, D. (1988), Preparation des accouchés sous oreille électronique, 2 Symposium International sur l'éducation prénatale, Saint Raphael, cited by Tomatis in *Neuf Mois au Paradis*, Ergo Press, 1989, p 144. Cited in Gerritsen, 2010. And on <http://www.hermione-app.com/les-applications-de-la-methode-selon-le-pr-tomatis/accompagnement-de-la-grossesse-maternite-preparation-accouchement.html>

Konarski, R. and Ratynska, J., 2014, Attention and Tomatis, Method for Success: Results of the Project Made in Poland from 2010 to 2013, Institute of Physiology and Hearing. Cited on 15/11/2018 on <http://tomatisassociation.org/attention-and-tomatis-method-for-success-results-of-the-project-made-in-poland-from-2010-to-2013/>

Kurkowski Z. M., 2013, Audiogenne uwarunkowania zaburzeń komunikacji językowej, Wyd. UMCS, Lublin. Cited in Kukrowski 2014.

Kurkowski, M. K. (2014) The Tomatis Method applied in the diagnosis and speech therapy, Maria Curie-Skłodowska University in Lublin, Department of Logopedics and Applied Linguistics. Cited on, https://issuu.com/tomatisdoc/docs/tomatis_method_applied_in_the_diagn

Kurkowski, Z. M., Szkielkowska, A., and Ratynska, J., 2004, The Role of Auditory Control in the Articulation Process, *IJTM*, May 2004, Vol 1 No 1. Pp 75—79.

Kurkowski, Z., 2000, Psycholinguistic Consequences of Right-Sided Versus Left-Sided Deafness, Institute of Physiology and Pathology of Hearing, Warsaw, Poland. Cited on 14/11/2018, on <https://tomatisassociation.org/psycholinguistic-consequences-of-right-sided-versus-left-sided-deafness/>

Kurkowski, Z.M., 2000, Auditory lateralization vs speech disorders, Institute of Physiology and Pathology of Hearing, Poland, 2000

Kurkowski, Z.M., 2000, Psycholinguistic Consequences of Right-Sided Versus Left-Sided Deafness, Institute of Physiology and Pathology of Hearing, Warsaw, Poland.

Le Roux, M., 2008. Sam's incredible journey: A case of cerebellar ataxia, *Ricochet*, July, 2008. <http://tomatisassociation.org/sams-incredible-journey-a-case-of-cerebellar-ataxia-tomatis-method/>

Lozano, S., 2009, Follow-up study on the effects of Tomatis Method in communication, linguistic, cognitive and emotional skills in children aged 6 -7. Cited on 15/11/2018 on <http://tomatisassociation.org/follow-up-study-on-the-effects-of-tomatis-method-in-communication-linguistic-cognitive-and-emotional-skills-in-children-aged-6-7/>

Malak, R., Mojs, E., Ziarko, M., Wieche, K., Sudol, A., Samborski, W., The role of tomatis sound therapy in the treatment of difficulties in reading in children with developmental dyslexia, *Journal of Psychology and Cognition* (2017) Volume 2, Issue 1. Cited on 14/11/2018, on <http://www.alliedacademies.org/articles/the-role-of-tomatis-sound-therapy-in-the-treatment-of-difficulties-inreading-in-children-with-developmental-dyslexia-6318.html>

Maudale, P., 1997 Listening Training for Children: Method, Application, and Outcomes By Paul Madaule Published in the Proceedings of the Interdisciplinary Council on Developmental and

Learning Disorders, 1997. Cited on 20/11/2018 on <http://www.listeningcentre.com/UploadedFiles/Articles/Articles/Listening-Training-for-Children-Method-Applications-and-Outcomes.pdf>

Michon, R., & Salaün, O. (1990). Accompanying Pregnant Women: a comparative study at Vesoul and Foch, French hospitals, International Association. (Translated from the French by S. Andrews). www.iarctc.net.

Mojs, E., Nowogrodzka, A., Piasecki, B. and Wolnowska, B., *Neuropsychiatria i Neuropsychologia*, Poland, (2011) Effect of Tomatis Method on cognitive functions in children with speech disorders, *Neuropsychiatria i Neuropsychologia* 2011; 6, 3-4: 108-112.

Mojs, Ewa & Sudol, A & Samborski, W. (2017). The possibilities of the improvement language competencies in children with dyslexia. The evaluation of the Tomatis therapy in children aged 6–10 years of age. *European Psychiatry*. 41. S790. 10.1016/j.eurpsy.2017.01.1514.

Mould, P., (1985), An Evaluation of dyslexic boy's response to the Tomatis Listening Training Program: Interim Report. Brickwall House, Northiam, East Sussex.

Mularzuk, M., Czajka, N., Ratynska, J., Szkielkowska, A., (2012) The analysis of the auditory attention and hearing lateralization of pupils who received Tomatis therapy, Instytut Fizjologii i Patologii Sluchu, Warszawa, *Nowa Audiofonologia*, Poland, cited on 12/11/18 on <https://www.tomatis.com/en/research-and-resources>

Murase, K. (2004), Year 1 Pilot study: Use of the Tomatis Method with Japanese High School Students learning English as a Foreign Language, *International journal of Tomatis Method Research*, 1 (1), 51-53.

Nel, L., (2005) Asperger disorder and the Tomatis Method: a case-study, Mimi Dissertation, North West University, Potchefstroom. Cited on: <http://tomatisassociation.org/asperger-disorder-and-tomatis-method-case-study/>

Neysmith-Roy, (2001) The Tomatis Method with severely autistic boys: Individual case studies of behavioral change, *South African Journal of Psychology*, March 1, 2001, <https://doi.org/10.1177/008124630103100105>

Nicoloff, F., (2007) A Case of Auditory Processing Disorder, OR Sue's discovery of speech clarity, F. Nicoloff, *IARCTC*, Australia, 2007

Olkiewicz, E., (2012) An Evaluation of The Tomatis Method on 119 persons in a center in Nordisak, Cited on: <http://tomatisassociation.org/the-tomatis-method-in-sweden-an-evaluation-of-sound-stimulation-training-on-119-persons/>

Olminkhof, L., 2007, Tomatis Method: effective for learning, language and speech problems, University of Groningen, Netherlands. <http://tomatisassociation.org/tomatis-method-effective-for-learning-language-and-speech-problems/> cited on 21/11/2018

Peché. Anne-Marie. (1975). Die effek van Oudio-psigofonologiese opleiding op ang. Ongepubliseerde M.-graad-verhandeling. Potchefstroom Universiteit vir CHO: Potchefstroom. Cited in Jaarsveld and Du Plessis, 1988

Porges, Stephen W (2011). *The Polyvagal Theory: Neurophysiological Foundations of Emotions, Attachment, Communication, and Self-regulation*. W. W. Norton & Company. [ISBN 978-0-3937-0700-7](https://doi.org/10.1002/9780470317070).

Pralong, M., Espinosa, E., Trigo, E., 2014, The impact of the Tomatis Method on an autistic child, University of Technology, Equinoccial, Ecuador, cited on 19/11/2018, on <https://tomatisassociation.org/the-impact-of-the-tomatis-method-on-an-autistic-child/>

Przybek-Czuchrowska, I., Mojs, E., Urna-Bzdega, E., 2015, Case study of a child with organic damage within the central nervous system treated with the Tomatis Method, *Neuropsychiatria i Neuropsychologia*, Poland, 2015

Ratynska J., Szkielkowska A., Kurkowski Z. M., Markowska R., 2003, Zastosowanie testu uwagi sluchowej i lateralizacji sluchowej A. Tomatisa w diagnostyce i terapii osob jakajacych sie „*Audiofonologia*”, 24, s, 137-143. Cited in Kukrowski 2014.

Rourke, B. P., & Russel, D. L., (1982) The Tomatis Method applied to older learning disabled children: An evaluation. Paper presented at the Opening of the Communication Conference, Toronto, November 1982. Cited in Gerritsen, 2009.

Roy, R. T. (1980) Perceptual Processing ASbilities and Academic Skills: Intensive case studies of audio-psycho-Phonological Remedial Training with five dyslexic boys, Doctoral Dissertation, University of Ottawa.

Sacarin, L., (2013) Early Effects of the Tomatis Listening Method in Children with Attention Deficit. Dissertations & Theses. 44. <https://aura.antioch.edu/etds/44>

Sereinig, A., 2010, Das Hörmodell nach Alfred Tomatis und die Untersuchung sprachspezifischer Spektraleigenschaften von Deutsch, Englisch und Französisch, Institut für Breitbandkommunikation.

Shiedeck, D. E. (2000), Die auswirkungen des Tomatis – Gehortraining auf Motorik, visuelle Wahrnehmungsfähigkeit und Lautbildung leicht autistischer Kinder und Jugendlicher im Alter con 4 – 18 Jahren mit IQ-Minderungen (IQ<50% - 80%) und mit Sprache, S. Roderer Velag, Regensburg, cited in Gerritsen, 2010.

Skrodzka, E., Furmann, E., Bogusz-Witczak, and Hojan, E., 2015, Comparison of Effects of Auditory and Music Training of Blind or Visually Impaired Young People on Performance in Selected Auditory Tasks, *Acoustical Engineering* 2015, Vol. 128. DOI: 10.12693 / APhysPo1A.128.A-29

Spaggiari, G., Luppi, L.G., Spaggiari, P., (1995) “Validità del metodo Tomatis su oltre 400 casi clinici di pazienti con problemi psicologici e psichiatrici” presented at the October 1995 International Tomatis Congress in Neuchatel, Switzerland.

Stillitano, C., Rosati, N., Cisternino, S., Fioretti, A., Iaconelli S., Eibenstein, A., (2017) The Effects of the Tomatis Method on the Artistic Voice, *International Journal of Listening*, 31:2, 113-120, DOI: 10.1080/10904018.2016.1174935

Stillitano, C., Fioretti, A., Cantagallo, M., Eibenstein, A., 2014, the Effects of the Tomatis Method on Tinnitus, *International Journal of Research in Medical and Health Sciences* June. 2014. Vol. 4, No.2.

Stutt (1983) The Tomatis Method: A Review of Current Research, McGill University, 1983, 06-23.

Swain, D. R. (2007) The Effects of The Tomatis Method of Auditory Stimulation on Auditory Processing Disorder: A Summary of Findings, *International Journal of Listening*, Vol. 21, Number 2, 2007.

Swain, D.R., (2007), the Effects of Auditory Stimulation on Auditory Processing Disorder: A Summary of the Findings, *International Journal of Listening*, Volume 21, 2007, Issue 2.

Syam, U. K., 2012, The use of Tomatis Method to improve students' listening skill, University of Makassar, Indonesia.

Szkielkowska, A., Ratynska, J., Kurkowski, M., Senderski, A., Skarzynski, H. and Markowska, R., 2008, Coherence between Tomatis test and central auditory processing audiologic test battery in Children with Dyslexia, *Polish Journal of Environmental Studies*, cited on https://issuu.com/tomatisdoc/docs/coherence_between_tomatis_test_an

Szkiełkowska, A., Ratyńska, J., Barański, B., Kurkowski, M. and Markowska, R., 2003, The results of audio-psycholinguistic stimulation in children with vocal fold nodules, *Otorynolaryngologia*, 2003, 2(4), 180-184.

Tatum, J. M., Oelfke, J. K., McCauley, C. P., 2004, Tomatis-Assisted Speech Therapy, *IJTMR*, May 2004, Vol 1. No 1, pp37- 42

Tinkle, H., 2011 The Effects of the Tomatis Listening Training on the Spatial Sense, University of Vienna, cited on https://issuu.com/tomatisdoc/docs/tinkl_-_effect_of_tm_an_spatial_sen

Tomatis, A. A., (1991) *The Conscious Ear*, Station Hill Press, New York.

Torres de Carrell, N., 2009, The Tomatis Method and its impact on children with echolalia in the autism spectrum, cited on 20/11/2018, on <http://tomatisassociation.org/the-tomatis-method-and-its-impact-on-children-with-echolalia-in-the-autism-spectrum/>

Trumps, M. 2004. Tomatis Method: Integrator of Rehabilitation in a Traumatic Brain Injury (TBI) Case Study, *IJTMR*, May 2004 – Vol. 1 No 1. <https://tomatisassociation.org/tomatis-method-integrator-of-rehabilitation-in-a-traumatic-brain-injury-tbi-case-study/>

Van Jaarsveld, P. E. and Du Plessis, W. F. Audio-psycho-phonology at Potchefstroom: A review, *S. Afr Tydskr. Seilk.* 1988, 18 (4), 136-143.

Van Velze, 2016, Case Studies 6 Children From 5 Years To 7 Years Using The Tomatis® Method To Develop Learning And Academic Skills, Secunda Christian academy South Africa. Cited on 14/11/2018, on https://issuu.com/tomatisdoc/docs/case_studies_6_children_from_5_year

Van Velze, 2016, Case Studies 6 Children From 5 Years To 7 Years Using The Tomatis® Method To Develop Learning And Academic Skills, Secunda Christian academy South Africa. Cited on 14/11/2018, on https://issuu.com/tomatisdoc/docs/case_studies_6_children_from_5_year

van Wyk, S., 2003, A combined Tomatis and Lifestyle enhancement program for overweight female students. Honours Thesis, Potchefstroom University for Christian Higher Education.

Vercueil 2016, Case Study: 20 years old client diagnosed with communication disorders, sensory issues and anxiety using the Tomatis Method, Case study submitted to the International Tomatis Convention, 2016 in Paris.

Vercueil, A., Taljaard, H., du Plessis, W., 2009, The effect of the Tomatis Method on student pianists' piano performance and psychological well-being. South African Music Studies Vol 31
<https://www.ajol.info/index.php/samus/article/view/80756> cited on 22/11/2018

Weiss, W. (1985) Long-term average spectra of continuous speech before and after Tomatis audio-vocal training, *The Journal of the Acoustical Society of America* 78 (S1), p 507-523.

Wilson, Iacoviello, Metlay, Risucci, Rosati and Palmaccio (1982) the Tomatis Project/ Final Report, Neuropsychology Section, North Shore University Hospital, Cornell University Medical Centre, N Y and Hofstra University Dept of Psychology N Y. Paper presented at the Opening Communication Conference, Toronto, Ontario.

Young, 2013, School Pilot Research Project with the Tomatis Method in Chicora Elementary, *Listening Clarity*, Cited on 12/11/18 on <https://www.tomatis.com/en/research-and-resources>

Zdzisław M. Kurkowski, Agata Szkiełkowska, Joanna Ratyńska, Renata Markowska, Marzena Mułarzuk, *Audiofonologia*, Poland, 2002, Application of Tomatis Method in patients with language communication disorders. Preliminary report, *Audiofonologia*, Tom XXII, 2002 pp 203-210

DRAFT