

Reflex Integration Disorder as a New Treatment Paradigm for Children with Autism

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Introduction to this Study

The MNRI® program is based on clinical observations and research on assessed reflex delays found in children and adults, especially those with neurodeficits. Many individuals with Autism Spectrum Disorder (ASD) are lacking in skills related to early motor milestones. The MNRI® program supports maturation in the neuro-sensory-motor system through specific strategies and techniques that access the innate and natural resources of reflex patterns. (Masgutova, 2011; Masgutova, Akhmatova, 2008, 2012).

The goal of this article is to introduce the basic principles of the MNRI® program and its application to the ASD population, particularly:

- Assessment of reflex patterns to evaluate the level of reflex maturation and functionality in children diagnosed with ASD (see *MNRI® Assessment for Determining the Level of Reflex Development* in this book)
- Reflex development profiles as a guide for use with each child to measure increased performance (at cognitive, physical, emotional, and behavioral levels)
- The effectiveness of MNRI® for increasing neurosensorimotor integration and restoring reflex pattern expression in a child with ASD.

The MNRI® program is based on knowledge and experience of neurodevelopment through the use of reflex patterns to develop physical and cognitive skills as well as behavioral and emotional regulation. Reflexes are genetically determined motor-behavioral patterns that must be integrated *by every child* into consciously controlled sensory-motor abilities and skills (Sechenov, 1863/1995; Sherrington, 1947; Vygotsky, 1934/1986; Myles, Huggins, Rome-Lake, et al., 2003; Masgutova, 2011). They provide an individual with the neurological foundation to process sensory input, program and control motor and behavioral actions, enhance memory and learning, and develop appropriate language and communication skills.

Statistical analysis has allowed us to calculate the number of reflex patterns that were dysfunctional/pathological or in the norm in large numbers of subjects. We have concluded that when 35% or more of reflexes were dysfunctional, we were dealing with a phenomenon of 'Reflex Integration Disorder' (RID; S. Masgutova, 2011). Analysis of reflex profiles of 3,700 children with ASD revealed that RID was typical for children with autism as 86.7% of their reflex patterns were assessed to be dysfunctional. Knowledge of the state of a person's reflex functioning can be key in choosing an effective strategy of intervention.



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Autism Study Group Description

ASD disorders develop during early childhood (Prelock, 2006; Piña-Garza, 2001, Cashin, Sci, 2006; Hall, 2012; Lemer, 2008). Current demographic information indicates that the number of identified cases of ASD are rapidly increasing in many countries, especially in technologically developed countries (Lemer, 2008; Rutter, Silberg, 2002; O'Reilly, 2013; Gutstein, 2009; Randall, Parker, 1999). The US Center for Disease Control research indicates that, in some states in the US, one out of every 68 children (one out of 42 boys) is diagnosed with ASD, a 30% increase in comparison with year 2012 (*IACC Strategic Plan for Autism Spectrum Disorder (ASD) Research*, 2013).

Dysfunctional reflex pattern expression is evident in two separate groups of children diagnosed with autism. There are those whose reflexes were immature and deeply dysfunctional from birth, and another group that seemed to develop normally but regressed suddenly into autism at age 2 or 3. Their reflexes may have been immature and thus possibly their nerve systems were not resilient enough to handle the stress that they were exposed to. Or, their reflexes couldn't mature because of asynchronicity in cortical and brain stem function development, resulting in a predisposition for neurodevelopmental disorders beginning at or after 2 years of age. A mild problem initially unrecognized can get worse with age.

To gather the data, MNRI® Reflex Assessments were administered to 3,700 children diagnosed with ASD over the last 15 years (1997-2014). The assessments, of 30 separate reflexes, were given prior to and after 6 hours a day of MNRI® therapeutic techniques, given for 8 days (total of 48 hours). Overall results of the MNRI® Reflex Assessments showed that all of these children (3,700 individuals) presented dysfunctional reflex patterns. The average percentage of dysfunctional reflex patterns found in the children was: 86.6% in those diagnosed with severe autism, 72.4% in those with moderate autism, and 63.3% in those with high functioning autism. The results of this study indicate a clear correlation of ASD with a poor level of reflex functioning.

A smaller, more focused research project focused on ASD included 480 children, aged 2-19, from Poland, USA, and Canada. The MNRI® Reflex Assessment was again administered before and after 6 hours a day of MNRI® therapeutic techniques, given over 8 days (total of 48 hours). The level of development of reflex patterns in these children with ASD improved with the MNRI® program and positive changes were found in their overall development.

The children with ASD who participated in these studies all demonstrated delays in three important areas:

- deficits in social development
- significant speech and communication delays
- behavioral rituals (such as stimming) and abnormal habits.

The typical characteristics of development in the ASD population are well documented (Lemer, 2008; O'Reilly, 2013; Gutstein, 2009; Randall, Parker, 1999).

- tactile and/or auditory hyper-sensitivity
- lack of or poor eye contact
- alimentary behavior disorders leading to a preference for a limited number of foods
- poorly developed self-defense reactions
- lack of curiosity about the world around them
- tendency to focus on the negative
- poor muscle tone
- gaps in the development of kinesthetic memory and self-consciousness
- inability to imitate and follow instructions.

MNRI® research provides a key addition to this list:

- dysfunctional and pathological reflex system development. (Masgutova, Akhmatova, 2008, 2012):

Many children with ASD skip the development of genetically given phases of unconditioned reflexes (Lemer, 2008; Masgutova, Akhmatova, 2008, 2012). These children may even appear to grow well during the first months and years of their lives. Some develop very well in the areas of gross motor coordination, intelligence, and language (and may even develop language earlier than their peers). Parents often report that they unexpectedly lose these abilities and skills, often after some significant stress. In all cases, a global delay in the formation of unconditional reflexes and the next progressive development into conditioned reflex patterns is observed. This significant delay in development of unconditioned reflex patterns may be one of the early signs of a predisposition for ASD. It is very helpful for reflex integration therapy to be offered when such a delay in

development of reflex patterns is first observed. It is the authors' premise that reflex integration should be used as a tool for early intervention for all children demonstrating developmental challenges. All children with ASD, whatever their age, can benefit from correction of motor patterns and underdeveloped or dysfunctional reflexes (Lemer, 2008; Masgutova, Akhmatova, 2008, 2012).

Aspects of Developmental Deficits in Children with ASD

Muscular disharmony and lack of muscle tone regulation beginning in infancy results in impulsive reactions that often turn into permanent behaviors as the child with ASD grows older. Impulsivity leads to other challenges, including a lack of goal orientation and inner control, hyperactivity, chaotic and disorganized behavior, inability to focus or follow instructions, impatience and irritability.

Poor muscle tone regulation further includes difficulty with motor programming, motor planning, and motor control, thus poor motor coordination. (Masgutova, 2011; Masgutova, Akhmatova, 2008, 2012). This poor regulation is caused by a lack of integration in the excitation and inhibition processes in the reflex circuits, including incorrect connections between alpha and gamma motor neurons. Typically, muscle tone disharmony in children with ASD presents as:

- hypertonic muscles in the dorsal part of the body (along the spinal column – thoracic longus, trapezius) together with hypotonic abdominal muscles and diaphragm which affect postural control. In an effort to release tension, the child with ASD frequently displays impulsive movements involving balance mechanisms.
- hypotonic extensors in the upper limbs (bracioradialis, biceps), in the back of the neck and arms, and poorly developed muscles in the palms and fingers. This muscle tone disharmony creates a tendency to keep their arms flexed and results in poor dexterity.
- hypertonic lower limb muscles (soleus, gastrocnemius, Achilles tendon, quadriceps, hamstrings) which results in toe walking, as well as frequent running and jumping.
- low tone in oral-facial muscles, which causes a tight jaw leading to decreased mobility. These tight jaw joints inhibit muscles responsible for chewing, swallowing, and articulation.

A deficit in muscle tone regulation in children and adults with ASD also increases their tendency for hyperventilation, incomplete, rapid, and shallow breathing, and holding their breath during times of stress. The tendency for hyperventilation in individuals with chronic diseases is 4 to 7 times higher than the general population and, in individuals with ASD, it can be as much as 7 to 12 times higher.

Imbalance in postural control is another challenge caused by poor muscle tone regulation. Children with ASD may also have undeveloped body structure which results in their slow overall growth (due to a growth factor hormone deficit). The deficit in muscle tone regulation can indirectly affect intellectual development because the child with ASD often does not notice important external stimuli and escapes into their own world, thus being caught in a cycle of repetition of the same stimuli over and over. Improper muscle tone regulation, shallow breathing, and slowed growth may be some of the causes for delayed development in their physical, intellectual, and emotional systems.

Challenges with postural control. Many children with ASD habitually lean forward with their heads turned downward. This posture indicates tight spinal muscles, poor abdominal and neck muscles, and tight calf muscles. Their gravity center shifts disproportionately from the back to the front, making them incapable of maintaining normal balance. In order to compensate, the brain sends an order to tighten and/or lock the tendons in order to maintain a standing position. This posture then over-activates the defensive reactions of fight or flight, which leads in turn to more impulsive movements (Masgutova, Akhmatova, 2008, 2012).

Challenges with motor coordination. Children with ASD demonstrate a lack of stability in their standing and walking patterns. Incoherent coordination within the sagittal (right-left, righting movements), horizontal (rotational, lateral extension-flexion), and dorsal planes (flexion-extension, postural control) results in impulsive, awkward or slow motor activity. Although their head righting is sometimes better developed, children with ASD have difficulty with active movements because their rotational movements are rather poorly formed. For many this leads to toe walking, jumping in the same spot with over-activation of balancing mechanisms, and running around. All this hyperactivity creates repetitious behavior that further increases their responses of either excitation or freezing. Such dissonance in a child's excitation-inhibition processes, along with chaotic motor responses, must be the target for work by parents and professionals. The re-patterning exercises given in the MNRI® programs offer a method to calm these responses. Participation in active sports such as walking,

running, skiing, swimming, and weight training can also help them to learn motor pattern archetypes and positive use of their reflexes (Masgutova, Akhmatova, 2008, 2012). The creators of the MNRI® program observe that gross muscle tone regulation also influences the development of fine motor coordination and assists with the improvement of manual dexterity, visual and auditory perception, and integration of these systems.

Challenges in visual and auditory systems. The eyes of children with ASD present as restless or immobile with dilated pupils. When their eyes appear to freeze, they typically provide a narrow limited visual span, poor visual attention and focus, and hyperactive peripheral vision. Many children with ASD demonstrate a dependence or addiction to computers, tablets, or cell phones, often with compulsive repetition of the same object or program over and over again. The individual becomes over focused, which over stimulates their static balance (vestibular system). The reactive Pupillary Reflex may become hypersensitive, over-stimulating the sympathetic system, with either hyperactive or hypoactive motor activity. Children with ASD tend to cope poorly with this chaos in their visual processing.

Auditory Reflexes and processing are also usually problematic in children with ASD (Masgutova, 2011). The majority of children with ASD have inadequate sound orientation, prioritizing, focusing and binaural perception, along with poorly developed stapedius acoustic, ATNR, and Auditory Fear Paralysis reflex patterns. This is why so many children with ASD are hypersensitive to surrounding sounds. Their auditory systems cannot prioritize important sounds, therefore they hear all incoming sound input at the same time, causing over activation of the auditory system and the resulting reactive behaviors. These children attempt to protect their auditory system by covering their ears, trying to cut down external sounds. Other behaviors often noticed with hypersensitive hearing are hitting themselves around the ears and/or rapid head turning or shaking. Problems and delays in development of auditory reflex patterns lead to poor auditory decoding/coding, sound differentiation and analysis. Dysfunctional auditory reflexes are at the root of the delays with expressive language and speech patterns experienced by so many children with ASD.

Challenges in reflex patterns development. Over the last 25 years, MNRI® has collected data from direct observation and research on children with ASD (Masgutova, 2011; Masgutova, Akhmatova, 2008, 2012). This data suggests that children with ASD have many non-integrated reflexes, each child presenting their own individual pattern of immaturity or dysfunction. Some examples are presented below.

- *Tonic Labyrinthine Reflex* is significantly delayed in children with ASD. Neurotypical infants finish the development of this reflex between 4-5 months of life (Barashniev, 2001; Masgutova, 2011). The delay in tonic reflex patterns inhibits the formation of other static (postural) and dynamic reflexes such as the Asymmetric and Symmetric Tonic Neck and Head Righting.

- *Head Righting Reflex* develops and the unconditioned pattern matures between 1½-2 months of life in a typical infant (Barashniev, 2001; Masgutova, 2011). The delay in development for children with ASD results in dysfunction of 'head-core-trunk' coordination and Trunk Extension.

- *Hands Grasp Reflex* in the neurotypical infant has matured by the end of the fourth month of life (Barashniev, 2001). The delay in maturation in children with ASD is noticeable in their inability to fully close their fingers into a fist and in an improper demonstration of phase 2 (fist) and phase 4 (hanging grasp) patterns. This delay interferes with their ability to use their hands for proper protection. The pincer and tripod grips, which support fine motor skills such as handwriting and using silverware, are also significantly delayed.

- *Hands Pulling Reflex* in a neurotypical infant has matured by the end of the second month of life (Barashniev, 2001; Masgutova, 2011). A delay in development interferes with the appropriate 'elbows-head-core' sequence of flexion, which is essential for the natural biomechanics of this reflex. A delay of this pattern negatively affects core flexion-visual convergence, trunk extension-visual divergence coordination, divergent/distance vision, and 3-D vision.

- *Asymmetric Tonic Neck Reflex (ATNR)* in neurotypical infants integrates at between 6-7 months (Masgutova, 2011). Delays in this reflex occur frequently in children with ASD, causing poor spatial orientation, poor development of monaural and later binaural auditory perception/processing, and over-all speech delays.

- *Trunk Extension Reflex* is fully integrated between 7-8 months of life in the neurotypical infant (Barashniev, 2001; Campbell, 2004; Masgutova, 2011). A delay in maturation for children with ASD results in diminished cognitive skills, toe walking, over focus on details, and limited imagination and lack of curiosity. Trunk Extension becomes hyperactive in the majority of children with ASD and is expressed with excessive jumping and

running behaviors.

- *Crawling Reflex* was found to be not integrated in 83% of the children with ASD. Many of these children were early walkers who did not crawl in infancy. Due to poor development of this reflex pattern, children with ASD are delayed in their cross-lateral gross motor skills, motor programming, planning and control, and in their ability to multitask.

- *Automatic Gait Reflex* in children with ASD is demonstrated as either a hyperactive or hypoactive-hypotonic reflex and leads to a tendency to freeze (S. Campbell, 2004; S. Masgutova, 2011).

- *Hands Supporting Reflex* is usually delayed in children with ASD and does not develop without specific training. When this reflex pattern is undeveloped, children have limited means of protection on a biochemical level in using their arms for support, most importantly to break their fall when they stumble. (S. Masgutova, 2011).

- *Bonding* in typical infants is noted from the first months of life. Almost every child tested presented signs of inadequate bonding. When it is not developed, there are delays in visual focusing on the face/eyes of their mother and other adults, limited development of a smile, inability to label objects in their environment, and limited emotional communication (S. Masgutova, 2011). Lack of bonding, of course, is directly connected to attachment disorders.

- *Moro and Fear Paralysis Reflexes* are patterns that organize the protective freeze response based on sensory stimulation (Fear Paralysis), and the fight or flight response based on vestibular or proprioceptive stimulation (Moro). Clinical observations indicate that these two reflex patterns are usually confused in children with ASD. This confusion leads to a lack of differentiation of the sympathetic (excitation) and parasympathetic (inhibition) nerve systems, which can lead to extreme hyperactivity or freezing (an absent state, indifference), panic attacks, and possibly a tendency for aggressive behaviors. An immature Moro Reflex is usually not functional in its second protective phase (closing the core of the body), resulting in an insufficient positive self-protection (Masgutova, 2011).

- *Segmental Rolling and Spinning* are reflex patterns which allow the infant to roll over and move across space by rolling. When these rotational reflex patterns are delayed or minimally expressed in a rigid way, the child with ASD uses their axis body plane for movement and posture much more than the horizontal plane. Lack of horizontal rotation results in toe walking, excessive jumping, and/or running around (Masgutova, 2011).

- *Vestibular-Ocular Reflexes* (horizontal and vertical) should support the stability of visual images. Many children with ASD have poorly developed or dysfunctional visual reflexes. A child with visual reflexes which are not integrated will present with poor equilibrium, rigidity, hyper- or hypo-active physiological nystagmus, poor vestibular-visual coordination and visual and proprioceptive disorientation (Masgutova, 2011).

- *Convergence/Divergence Reflexes* work to bring the eyes together for near focus and apart for distance. Often delayed in children with ASD, these reflex patterns affect visual focusing, decoding, analysis and, in turn, visual cognition. The delay also affects the appropriate functioning of peripheral vision, gaze, and tracking. These delays lead to poor voluntary control of eye mobility, poor visual analysis, reading, and visual comprehension (Masgutova, 2011).

- ***Acoustic Stapedial Reflex and sound prioritization.*** The Acoustic Stapedial Reflex triggers the eardrum with a sharp high frequency sound, causing contraction of the stapedius muscle in the middle ear. Children with ASD often exhibit a hyperactive Stapedial Reflex, leading to a hypersensitive auditory system, which interferes with their ability to prioritize sounds. This leads to unpleasant overlapping and over processing of sounds (Myles, et al., 2003; Pilecki, et al., 2012). Protective behaviors of ignoring or inhibiting auditory stimuli are then invoked to calm down the auditory system. Other compensatory behaviors may include self-stimulation, putting hands over or fingers in the ears, hitting their own ears, head, jaws and/or chin, vocalizing a constant sound, or talking to themselves (Masgutova, 2011; Lemer, 2008).

- ***Swallowing and Chewing Reflex patterns*** are often underdeveloped and either hypo- or hyperactive in a child with ASD (Campbell, 2004; Masgutova, 2011). Shallow breathing and/or hyperventilating accompany these patterns. Delays in the Swallowing and Chewing Reflex patterns create difficulties in eating, digestion, and appropriate development of articulation and speech (Lemer, 2008; Masgutova, Akhmatova, 2008, 2012). The Sucking Reflex also may not be integrated and can hinder the integration of the Swallowing and Chewing Reflexes because of low muscle tone in the oral cavity and tongue muscles during infancy.

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The MNRI® program offers a system to organize sensory-motor and muscle coherence through re-education of non-integrated reflexes, which helps the child to rediscover how their body should naturally sense, move, and react. This also assists in relieving any inhibited and hyperactive patterns of the child with ASD. Calming or eliminating impulsive and defensive responses, in turn, will positively affect the development of kinesthetic consciousness, postural and motor programming, and control.

Results and Discussion

The MNRI® reflex Assessment was administered to 3,700 children with ASD over the last 15 years (1997-2014) and to children in a smaller, more focused research project which included 480 children, aged 2-19, with ASD from Poland, USA, and Canada. The MNRI® Reflex Assessment was administered before and after the MNRI® intervention (see Table 1 and Figures 1 - A, B, C).

Table 1 describes:

1) The level of reflex pattern development of children with ASD (480 individuals) compared to children with neurotypical development (780). This data indicates a significant delay in children with ASD with 86.7% of their reflex patterns at the dysfunctional level; 13.3% at a functional level but of very low development; and no reflex patterns in the normal range. Children with neurotypical development demonstrated 0% in the dysfunctional range; 63.33% at a functional level but of low development; and 36.67% at the normal level indicating mature development.

2) The level of development of reflex patterns in the children improved with the MNRI® program and positive changes were found in their overall development. Changes in their level of reflex pattern integration after completing six hours a day of treatment at 8-day MNRI® Family Conferences (compare pre- and post Assessment data) demonstrate the positive result of the MNRI® intervention (see Figures 1 - A, B, and C). The results were validated statistically using data on a level of synthesized function $z = f(x)$ (by NewKreffft algorithm, A. Krefft, 2007) as well as the nonparametric comparison of two variables by Wilcoxon Matched Pairs test ($p > 0.001$; Statistical Program). The statistical evaluation of the data demonstrates significant change in all reflex patterns and a high degree of effectiveness of the MNRI® program.

The majority of the reflex patterns (86.7%) evaluated by the Reflex Parameter Assessment fell at the dysfunctional level (below the transitional point of 10-11.75), which in the MNRI® model indicates RID (Reflex Integration Disorder); 35% of these dysfunctional reflex patterns were linked to officially diagnosed disorders according to clinical observation of over 30,000 children by MNRI® specialists. After MNRI® treatment the level of development of reflex

Reflex #	Reflex pattern	Children with ASD (480 individuals)		Neurotypical Control Group (780 individuals)
		Before Program	After Program	
1	Core Tendon Guard	12.99	13.32	15.5
2	Robinson Grasp	9.6	11.31	15
3	Hands Pulling	9.54	11.07	17
4	Babkin Palmomental	8.11	10.02	16
5	Babinski	8.11	10.02	16.5
6	Leg Cross Flexion Reflex	12.07	13.52	17
7	Asymmetrical Tonic Neck	9.19	10.97	15
8	Abdominal	7.33	8.76	16
9	Bonding	9.86	10.68	15.5
10	Foot Grasp	8.55	9.79	16.5
11	Thomas Automatic Gait	12.16	13.89	17.5
12	Bauer Crawling	9.23	11.01	15.5
13	Moro Embrace	8.93	11	15.5
14	Fear Paralysis	8.88	10.65	14.5
15	Hand Supporting	8.64	10.75	15.5
16	Segmental Rolling	7.67	9.21	15
17	Landau	8.52	9.75	15
18	Flying and Landing	9.01	10.66	14.5
19	Grounding	9.78	11.14	16
20	Head Righting	8.58	10.44	16
21	Trunk Extension	12.38	13.88	17.5
22	Symmetrical Tonic Neck	9.58	11.13	15.5
23	Spinal Galant	7.1	9.19	15.5
24	Spinal Perez	8.12	10.3	14.5
25	Tonic Labyrinthine	8.59	10.37	15.5
26	Foot Tendon Guard	7.31	9.27	15
27	Spinning	7.85	10.29	15
28	Locomotion	7.44	8.14	14.5
29	Balancing	8.14	10.54	16
30	Pavlov Orientation	9.96	11.84	16
Level of reflex development (criteria)	Dysfunctional reflexes (6-9.75points)	86.7% (26 patterns)	23.33% (7)	0
	On boundary of dysfunctional and functional state (10-11.75)	0	63.33% (19)	0
	Functional but very low level of development (12-13.75)	13.3% (4)	13.3% (4)	0
	Functional though lower level of development (14-15.75)	0	0	63.33% (19)
	In norm (16-17.99)	0	0	36.67 (11)

Table 1. The level of reflex pattern development in 480 children with ASD compared to a group of children with neurotypical development and dynamic changes in reflex patterns of children with ASD before and after completing treatment at MNRI® conferences/camps.

At right, Figures 1– A, B, C. Reflex profile patterns for children with ASD (age 2-19; 480 children) and for those with Neurotypical Development (Age4-20; 780 children).

Figure 1-A. Reflex group 1: Sagittal Plane of the Body

Figure 1-B. Reflex group 2: Horizontal Plane of the Body

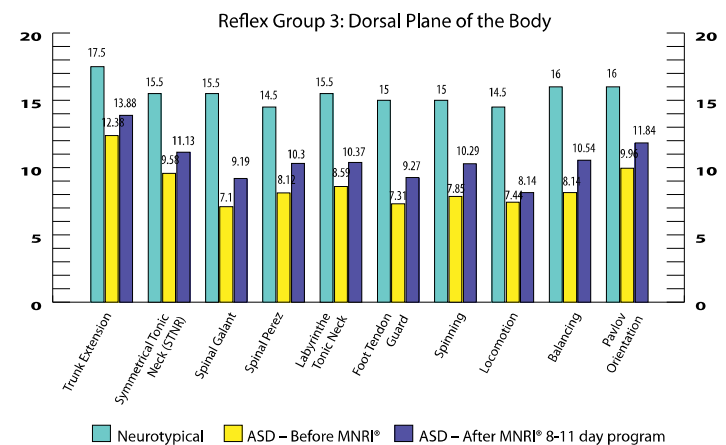
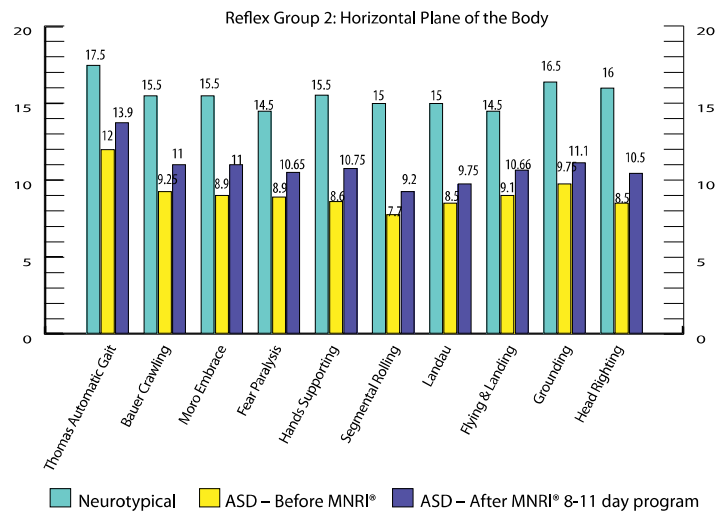
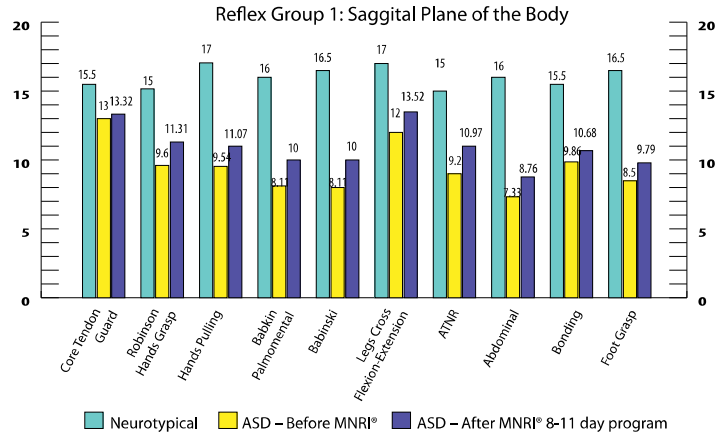
Figure 1-C. Reflex group 3: Dorsal Plane of the Body

patterns improved significantly for 86% of assessed reflexes (26 reflex patterns out of 30; the coefficient of change is valid - 0.49 before the MNRI® program and 0.61 after the intervention at the $p < 0.001$).

When using the MNRI® programs to re-educate non-integrated reflexes of a child with ASD, the time for correction may be longer than for children facing less severe developmental challenges. Work oriented at facilitation of these reflexes should begin at an earlier age, when automatic and voluntary motor performance can improve in a shorter amount of time. As the child with ASD exhibits a multi-dysfunctional disorder, the therapy program should provide a multi-directional approach based on the individual pathological characteristics of the child. A priority of MNRI® therapy for a child with ASD is to improve their neurodevelopment, emotional, social, and cognitive functioning through reflex integration and neuroplasticity. Some of the MNRI® programs that address these needs are *MNRI® Repatterning of Dysfunctional Dynamic and Postural Reflex Integration*, *MNRI® Neuro-Structural Reflex Integration*, *MNRI® Neuro-Tactile Reflex Integration*, *MNRI® Archetype Movement and Lifelong Reflex Integration*, *MNRI® Birth & Post-Birth Reflex Integration*, *MNRI® Oral-Facial Reflex Integration*, *MNRI® Proprioceptive & Cognitive Reflex Integration*, *MNRI® Visual & Auditory Reflex Integration*, and other programs.

The MNRI® Reflex Assessment provides a reflex profile for children with ASD and the opportunity to use their unique individual differences in reflex patterns to create an individualized MNRI® program. The individualized program offers a blueprint for the correction of sensory-motor dissonance and neuro-facilitation of reflex circuits and parameters. It is oriented toward the integration of tactile, visual, auditory, vestibular, and proprioceptive systems for proper functioning.

A more in-depth analysis of reflexes within their five parameters: circuit, direction, inten-



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sity, timing and symmetry has shown more detailed aspects of RID in children with ASD (see Table 2 and Figure 1-A). Reflex patterns have been grouped into nine main clusters for this in-depth analysis of tendencies for these reflexes to influence different areas of functioning in the child with ASD.

In Table 2, the red colored areas signify difference/dominance levels, whereas yellow areas show it to be even with other parameters. This table provides the data for each of the five parameters evaluated for each reflex. Each reflex has been assigned to a Reflex Pattern Cluster. Interestingly, notice the dissonance in sensitivity, for example, which is hypo in the upper limb reflexes, while hyper in the lower limbs. Also motor reflexes (upper limbs, lower limbs, head righting) are hypo while protective responses are hyper, which can be interpreted as poor motor development that triggers more defense mechanisms since the means for protection on a physical level are not developed or sufficient. Also interesting is the lop-sided symmetry parameter in responses, which trigger the right and left sides of the body with 100% asymmetry. Note: symmetry is an important indicator in the neurological evaluation of reflex responses. Asymmetry can show as asynchronicity for muscle tone, speed of response, and uneven biomechanics (different in the right and left sides of the body).

#	Reflex Patterns/ Clusters	Parameters of Reflex Patterns – total in %														
		Sensory-Motor Circuit			Direction of Movement			Intensity			Latency			Symmetry		
		Norm	Hyper	Hypo	+	-	+/-	Norm	Hyper	Hypo	Norm	Hyper	Hypo	+	-	+/-
1	Upper Limb	10.2	13.3	76.5	16.3	7.5	8.7	18.6	33.3	48.1	18.5	34.4	47.1	2.5	91.3	6.2
2	Tonic	16.8	15.7	67.5	20.4	66.7	12.9	21.3	30.6	48.1	21.3	31	47.7	5	91.7	3.3
3	Righting	17.3	14.4	68.3	56.3	11.7	32	20.2	30.6	49.2	20.2	30.6	49.2	7.2	88.8	4
4	Lower Limb	16.8	81.3	1.9	52.1	15.8	32.1	15.8	52.1	32.1	15.8	52.1	32.1	5.6	89.8	4.6
5	Gross Motor	1.5	28.3	70.2	60.4	17.9	21.7	21	30.6	48.3	20	31.7	48.3	6.5	90.4	3.1
6	Oral-Facial/Visual and Auditory	0.0	20.4	79.6	25	47.7	27.3	22.9	47.7	29.4	20.4	47.7	31.9	6.9	90.2	2.9
7	Protection and Survival	0.0	70.0	30.0	18.8	72.9	8.3	0.0	75	25	0.0	78.7	21.3	3.1	94.6	2.3
8	Curiosity/Cognition supporting	20.6	44.2	35.2	62.9	16.7	20.4	12	26.1	61.9	12.1	40.2	47.7	5.8	90.4	3.8
9	Emotional Stability, Maturation supporting	0.0	11	89	16.5	56	27.5	16.5	27.5	56	15.6	28.3	56.1	5	89.4	5.6
	Average Total:	9.2	33.2	57.6	36.5	42.3	21.2	16.5	39.3	44.2	16	41.6	42.4	5.3	90.7	4

Table 2. The parameter of reflex patterns in the Reflex Profile of 480 children with ASD; MNRI® pre-assessment values (in percentages).

Assessment of reflexes and their dynamics in nine clusters (according to their effect on different sensory systems, behavioral and emotional patterns, their protective role, and affect on cognitive functions) can help to identify some general tendencies of reflex patterns that impact different aspects of an individual's functioning. Our long-term work with children with ASD and research on their reflex profile assessments allows us to hypothesize about the possible neurophysiological causes of RID. They often have:

1) poor prenatal development of proprioceptive tactility (deep touch, pressure, and stretching receptors) and, in infancy also, improper differentiation of tactile from proprioceptive sensory stimuli

2) hypersensitivity in the auditory and/or visual system and also dissonance in the sensitivity of these two systems

3) confusion between nociceptive and proprioceptive ascending pathways (this increases sensitivity and over-protection, or the opposite – hyposensitivity and inability to protect personal boundaries, including one's own body, and even destructive tendencies such as self-aggression)

4) confusion and improper function in different components of the reflex circuit: sensory receptors, electrical conductivity in the neurons, neurotransmitter production, possibly also metabolic processes in the cells. For example: when too many sensory neurotransmitters (substance-P or glutamate) are present as the result of hypersensitivity and too few interneuron neurotransmitters are released into gamma motor neurons (GABA and dopamine). Or, there could be a lack of coordination between alpha and gamma motor neurons and their connection with muscle fibers (too few or too many acetylcholine neurotransmitters), affecting regulation of muscle tone and the movement biomechanics.

5) improper function in the stress-axis of the organism caused by some traumatic experience (acute or chronic stress) Our MNRI® Parents Support Group (over 1,600 parents and professionals) sent a questionnaire to parents to identify factors causing post-traumatic experiences in children with neurodeficits. In a group of 870 parents having children with ASD, 86.9% stated that their children (ages 3½-19) had a history of traumatic experience, which turned into post-traumatic stress.

A comparison of changes in reflex parameters before and after MNRI® intervention shows the effect of MNRI® especially in improvement of: circuit (restoration of sensory-motor links), direction (the coordinated work of the alpha and gamma motor neurons to create first proper tone followed by appropriate movement), and symmetry (processing on the extrapyramidal and then lower motor neuron level – in this order; not predominantly in the cortex).

The data above show that children diagnosed with ASD need early intervention based on MNRI® reflex integration processes as early as possible for timely facilitation of their postural and motor development, fine motor coordination, receptive and expressive language, thinking and learning skills. MNRI® re-patterning exercises address neurologically developmental mechanisms, resulting in:

- 1) physical growth (often in height and weight)
- 2) activation of natural mechanisms of development
- 3) reduction in stress from learning
- 4) development of positive attitude and motivation
- 5) motor, emotional and cognitive development

Conclusion

Children with ASD demonstrate significant delays in reflex pattern development, which typically is linked to their muscle tone deregulation and hyperactive protective behavior. ASD is a serious disorder characterized by immature and poorly functioning reflex motor patterns. Lack of reflex integration in infancy or within the first two years of life affects neurodevelopment in a negative way and can interfere with the development of conscious motor-cognitive skills and cause all of the features of ASD. As the alarming number of children diagnosed with ASD continues to grow, this crucial problem needs proper attention from professionals and scientists.

MNRI® assessments of children with ASD show that most of their reflex patterns (86.7%) are at the dysfunctional level, which in this model indicates Reflex Integration Disorder. Among these dysfunctional reflex patterns 36% are linked to official diagnoses of ASD. MNRI® research provides statistically valid data in formatting the hypothesis that RID is an important underlying cause of ASD.

MNRI® programs used for children with ASD show significant improvement in development of their reflex patterns, leading to corrective effects in motor coordination, muscle tone regulation and bringing a sense of calm and safety to their system. Reflex re-patterning exercises for children with ASD have provided integration of their sensory-motor-muscular system, building harmony and coherence in the foundation of their neurodevelopment.

After MNRI® treatment the level of development of reflex patterns improved significantly in 86% of assessed reflexes (26 reflex patterns out of 30; the coefficient of change is valid - 0.49 before the MNRI® program and 0.61 after the intervention at the $p < 0.001$). Statistical evaluation of the data demonstrates significant changes in all reflex patterns and a high degree of effectiveness of the MNRI® program applied to children with ASD during 8 days of 6 hour daily intervention.

A comparison of changes in reflex parameters before and after the MNRI® intervention showed specifically positive change occurred in: reflex circuit (restoration of sensory-motor links in a reflex circuit), direction (the coordinated work of the motor neurons to create the proper tone and movement), and symmetry in the response. These changes can be interpreted as a positive achievement in 'rerouting' and bringing the reflex pattern back to its 'genetically given place' in the nervous system profoundly supporting a tendency toward normal development, integration of all systems. In other words, the MNRI® program 'teaches and retrains' the brain to improve its own sensory-motor links and functions on the level of primary unconditioned reflex responses.

MNRI® Assessment provides unique reflex profiles of children with ASD and can orient professionals in creating individualized therapy programs depending on their specific developmental challenges: tendencies for fear and phobias, and aggressive behavior, obsessive compulsive problems, routine and repetitive behavior, poor learning motivation, chronic school failure and dyslexia, hyperactivity (ADD and ADHD), and delayed intellectual and emotional development, regardless of their diagnosis.

MNRI® reflex repatterning exercises and other programs for children with ASD open up the possibility of easier learning, creativity, and the development of their own unique personality.

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We thank all the children who helped us reach our conclusions by participating in this study. We wish you increased focus, learning, and friendships through continued reflex integration. – Authors