Understanding Autism and the Unique Role of NMT Interventions

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Course Outline

- Exploration of Autism Spectrum Disorders
- Current Research and Practices
- Clinical Examples of NMT Techniques
- Active Involvement in Techniques
- Attendee Client Examples & Solutions

Course Objectives

- Participants will gain an understanding of:
  - autism as a psychomotor/perceptual motor regulation disorder
  - current research and literature related to the etiology of autism
  - how rhythm is processed in the brain
  - the impact of rhythm on the sensory system
  - the pairing of rhythm with other sensory input
  - the application of NMT techniques for persons with autism

Autism Spectrum Disorders: Current Diagnostic Criteria

DSM-IV

- (1) Qualitative impairment in social interaction
- (2) Qualitative impairments in communication
- (3) Restricted repetitive & stereotyped behaviors

DSM-IV

- (1) Qualitative impairment in social interaction
  - Marked impairment in the use of multiple nonverbal behaviors such as eye to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
  - Failure to develop peer relationships appropriate to developmental level
  - A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
  - Lack of social or emotional reciprocity

DSM-IV

- (2) Qualitative impairments in communication
  - Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gestures or mime)
  - In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
  - Stereotyped and repetitive use of language or idiosyncratic language
  - Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

DSM-IV

- (3) Restricted repetitive and stereotyped patterns of behavior, interests, and activities
  - Encompassing preoccupation with one or more stereotyped patterns of interest that is abnormal either in intensity or focus
  - Apparently inflexible adherence to specific, nonfunctional routines or rituals
  - Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
  - Persistent preoccupation with parts of object

Autism Spectrum Disorders: A Behavioral Perspective

Behavioral Approach

- Identifies non-functional behaviors:
  - disruptive
  - self-injurious
  - ritualistic
  - repetitive
  - aggressive
- Teaches alternative pro-social behavior

Behavioral Approach

"Autism and the other disorders in the autism spectrum are behaviorally defined syndromes that are now generally regarded to be of neurobiological origin."

"…early, intensive behavioral programs can eliminate completely the symptoms of autism in some children and greatly improve the lives of many others."

Cambridge Center for Behavioral Studies

Autism Spectrum Disorders: A Neurologic Perspective

The Neurology of Autism

- Autism is defined as a severe pervasive developmental disorder with onset in infancy or childhood characterized by a "triad" of deficits including:
  - Impaired social interactions
  - Impaired Communication
  - Restricted, Repetitive, and Stereotyped Behaviors

The Neurology of Autism

- Recent autopsy and MRI studies have identified several functional and structural brain anomalies involving one or more of the following:
  - brain stem
  - limbic system (specifically the amygdala)
  - basal ganglia
  - frontal and parietal lobes
  - cerebellum

The Neurology of Autism

- The findings that have been the most replicated and consistent include anatomical abnormalities of the cerebellum:
  - Hypoplasia or Hyperplasia of the hemispheres and vermis-specifically vermal lobules VI and VII
  - Reduction of Purkinje Neurons

About the Cerebellum

- It is the largest structure of the hindbrain
- It has an extremely high input to output axon ratio
- It is one of the most widely connected structures in the human brain

About the Cerebellum

- The Cerebellum is involved in:
  - Motor adaptation
  - Motor habituation
  - Motor skill acquisition
  - Motor coordination
  - Perceptual motor responses/Psychomotor
  - Temporal processing
  - Executive functions

About the Cerebellum

- The Cerebellum is involved in (cont.):
  - Behavioral inhibition; goal directed behavior
  - Sensory acquisition and discrimination
  - Anticipatory monitoring/learning
  - Attention
  - Processing and modulation of sensory information
  - Motivation and modulation of emotional responses

Autism & the Cerebellum

- Hypoplasia is a reduction in size of the cerebellum due to arrested development.
- The posterior parts of the cerebellar vermis and hemispheres are the most severely affected, specifically vermian lobules VI-VII; anterior regions are least affected.

Autism & the Cerebellum

- Purkinje Cells:
  - Large neurons that carry all information out of the cerebellum after the cortex processes sensory and motor impulses from the rest of the nervous system
  - Exert strong inhibitory influences on the cells they target

Deficits in the Cerebellum

- Motor adaptation
  - Impaired visuomotor adaptation; inability to orient to stimuli
- Motor habituation
  - Impaired acoustic startle reflex
- Motor skill acquisition
  - Disturbance in anticipatory movement implementation
- Motor coordination
  - Uncoordinated and erratic movements
- Perceptual motor responses/Psychomotor
  - Difficulty initiating, sustaining, and/or inhibiting movement

Deficits in the Cerebellum

- Temporal processing
  - Impairment judging the relative duration of time intervals that can affect motor & speech
- Executive functions
  - Difficulty problem solving, reasoning, shifting attention between modalities
- Behavioral inhibition; goal directed behavior
  - Perseverative, repetitive behaviors and reduced exploration in environment
- Sensory acquisition and discrimination
  - Reduced understanding and exploration of the environment; lack of 'central coherence'

Deficits in the Cerebellum

- Anticipatory monitoring/learning
  - Deficient movement preparation and execution of simple tasks; inability to predict sequences based on prior learning and respond accordingly
- Attention
  - Slow, inaccurate attention shifts; attention deficits
- Processing and modulation of sensory information
  - Defensiveness (Tactile, oral, visual, or auditory); Over or under responses to sensory information; poor integration
- Motivation and modulation of emotional responses
  - Deficiencies in motivation and overshooting or undershooting of emotions

Therefore…

"…cerebellar pathology will lead to significant impairments in a variety of neurobehavioral domains. Without the preparatory aid provided by the cerebellum, other systems can continue to perform their prescribed function. However, they will do so suboptimally in situations where prediction and preparation might aid performance."

- Allen & Courchesne (1998)

Disturbances of Movement in Autism

Opposition

The existence and role of movement disorders in autism has been quite controversial as Rimland, for instance, has stated (1993):

"It has been widely recognized for many decades that the vast majority of autistic persons are quite unimpaired with regard to their finger dexterity and gross motor capabilities. They have in fact often been described as especially dexterous and coordinated. The literature abounds with stories of young autistic children who can take apart and reassemble small mechanical devices, build towers of blocks and dominos higher than a normal adult can, assemble jigsaw puzzles, and climb to dangerously high places without falling...The idea that autism is, or typically involves, a "movement disorder" is simply ludicrous..."

Research & Literature

- Kanner (1943)
- Damasio & Maurer (1978)
- Vilensky, Damasio & Maurer (1981)
- Leary & Donnellan (1995)
- Teitelbaum (1998)
- Rubin, Biklen, Kasa-Hendrickson, Kluth, Cardinal, & Broderick (2001)
- Biklen & Burke (2006)
- Biklen & Kliewer (2006)

Support

There are two impediments, Dr. Teitelbaum explained, to recognizing movement problems in autism. The first is that "the act gets done"-- that is, the child succeeds in crossing the room, climbing the ladder, etcetera, so there is nothing immediately recognizable as a failed attempt to perform an action. Only to the trained or very observant eye is it clear that the components of that movement are poorly integrated or disconnected. (1995)

Psychomotor Regulation…

…is defined as the ability to use cognitive processing to control the degree of motor output.

Psychomotor Regulation Involves…

- Initiation (starting)
- Inhibition (stopping)
- Sustaining (continuing)
- Switching
- Combining

….of movement

Psychomotor Regulation Can Impede…

- Actions
- Postures
- Speech
- Emotions
- Thoughts, Perceptions, Memories

Motor Subsystems

Standard Motor
-motor behavior controlled by what you see and attend to in the external world

Prefrontal
-deals with maps in the head

Ocular Motor
-deals with eye movement, particularly involving control of attention

Emotional Motor
-deals with facial expressions, postures, emotional movements of all kinds

Emotional Motor Dyskinesia

Any time you have emotion paired with movement, you will have an increase in the inability to initiate, inhibit, and/or sustain movement.

My Greatest Fear is Myself -D. Woodhouse

My greatest fear is myself.
Control is not absolute: a constant struggle to maintain it drains my strength.
I am always tired: I never get enough sleep.
Events beyond my control happen around me: I do
things that scare me. If I'm confused or angry or tired,
I slip up and my body takes over.
Watching your life like a void is scary. It takes an effort of will to take control again and not just let it happen.
I'm afraid of what I feel. Emotion weakens my control,
Making its grip easier to break.
When I think, I sometimes think of letting go, just letting it all slip away. It hurts fighting all the time.
I just want peace and rest.

Donna Williams- Autism: An Inside Out Approach

Autism cuts me off from my own body, and so I feel nothing.

Autism can make me so aware of what I feel that it is painful.

Accommodations -Donnellan and Leary

- Visual
  - utilize a strength, allow for input to system without emotion (white boards, index cards, phrase boards, letter boards)
- Touch
  - facilitates initiation, inhibition, sustaining (least to most strategy, not directing the movement)
- Proprioceptive
  - facilitates improved body sense and promotes sustaining (sensory input, backwards resistance)
- Vestibular
  - facilitates improved sensory registration and integration
- rhythm……

Accommodations

With all accommodation types, continuously keep in mind the use of the least to most strategy (i.e. maximize independence, minimize assist or dependency on cues)

Neurologic Music Therapy

Neurologic Music Therapy

- "Neurologic music therapy is defined as the therapeutic application of music to cognitive, speech, and motor dysfunctions due to neurologic disease of the human nervous system."
- "Neurologic music therapy is based on a neuroscience model of music perception and production and the influence of music on non musical brain and behavior functions."

(Thaut, 2005)

Neurologic Music Therapy

A research-based system of Standardized Clinical Techniques used for

-Sensorimotor Training
-Speech/language Training
-Cognition Training

focusing on rehabilitative goals, developmental goals and adaptive goals.

Rational-Scientific Mediating Model

- Scientific "method" of studying the effect of music on the brain
- Comprised of 4 levels
- Premise that the scientific foundation for music therapy is in the foundation of music perception and production
- Natural course of information

R-SMM

- Level I: Musical response models
- Level II: Nonmusical parallel models
- Level III: Mediating models
- Level IV: Clinical Research Models

(Thaut, 2001)

Transformational Design Model

- Translates the R-SMM into functional music therapy applications
- Helps to create functional goals and objectives
- Helps the music therapist to avoid music that is activity-centered

TDM

5 steps:

1. Diagnostic and functional assessment
2. Development of therapeutic goals and objectives
3. Design of functional nonmusical exercises
4. Translation into functional therapeutic music experiences
5. Transfer into functional nonmusical real-world applications

(Thaut, 2001)

Music, Affect & Arousal

- Musical stimuli can create a physiological change in arousal
  - Changes Measured in:
    - Central responses (Electroencephalogram)
    - Motor Responses
    - Sensory changes
    - Autonomic responses (heart rate)

Rhythm & the Brain

- Rhythm is:
  - Time ordered
  - Structured
  - Predictable

Rhythm & the Brain

- Activation of:
  - Subcortical Areas
  - Auditory Cortex
  - Prefrontal Cortex
  - Cerebellum

Rhythm & the Brain

- Motor Entrainment
  - No single cortical “area” activated during motor entrainment
  - Hypothesis:
    - Integrated directly into motor system via auditory cortex

Research on Rhythm & the Brain

- The brain actually processes the space *between* the beats [Temporal Templates]
- Rhythm assists in anticipation of movement and fluency of movement
- Rhythm acts as a priming mechanism to the motor system
- PET Scan Studies

"Internal Tempo"

- Idea of internally regulated motoric output appears as early as 1921 (Coleman)
- The term "internal cadence" is utilized and studied by the human movement sciences
- Studies on motor tempo and mental stress
- Variances in motor tempo

"Internal Tempo"

- Motor tempo attributed to:
  - Arousal level
  - Heart Rate
  - Central Pattern Generators (neuronal)
  - Internal oscillator

Functional Arousal Cadence

The rhythm to which one is able to optimally regulate initiation/inhibition of motor output in order to functionally demonstrate abilities and engage in tasks/relationships.

Clinical Data in Autism

- Increased independence and maintenance of attention with decreased need for touch accommodations
- Varying cadences for upper body, lower body, voice
- Mathematical relationships between cadences
- Rhythm can be detrimental as well as beneficial
- Mahraun Study (Thaut and Mahraun, 2004)

"The brain that engages in music

is changed by engaging in music."

-Dr. Michael Thaut, PhD.

Neurologic Music Therapy Techniques

The NMT Training Course MUST be attended before utilizing any of the following NMT techniques.

Clinical Protocol with Autism

- NMT Clinical Protocol
  - Identify arousal level
  - Identify regulation difficulty
  - Stabilize output
  - Modify based on response
  - Evaluate integration of functional responses

NMT Techniques: Cognition

NMT Techniques

- Cognitive Training
  - Auditory Perception Training (APT)
  - Musical Attention Control Training (MACT)
  - Musical Executive Function Training (MEFT)
  - Musical Mnemonics Training (MMT)

Auditory Perception Training

APT

- Train <u>independent</u> success with:
  - Initiating
  - Sustaining
  - Inhibiting
  - Switching
  - Combining

APT

- Video Examples
- Large Group Examples
- Break-out Groups

Musical Attention Control Training

MACT

- Train independence success with
  - Attending (sustaining)
  - Transitioning (inhibiting and initiating)

MACT

- Video Examples
- Large Group Examples

Musical Executive Functioning Training

MEFT

- Video Examples
- Group Examples

Musical Mnemonics Training

MMT

- Video Examples
- Group Examples

Neurology of Speech

Speech vs. Language

- Speech
  - Motor act of producing sounds
  - Speech Problems often have to do with oral motor, tongue, or breathing problems
- Language
  - Knowledge and use of a symbol system to communicate
  - Involves visual or auditory input and motor output

Language

- Components of language:
  - Understanding verbal expression
  - Facial and manual gestures
  - Tone of voice
  - Body orientation

Communication

- Understanding of language system
- Attention
- Integration of auditory/visual information

Speech Production

- Involves the integration of:
  - Auditory infromation
  - Somatosensory information
  - Motor information

Motor Speech Production

- Cortical Areas Include:
  - Premotor cortex
  - Primary motor cortex
  - Broca's Area
  - Anterior region frontal lobe
  - Perisylvian cortex

(Love, 2000; Guenther, 2006)

Motor Speech Production

- Subcortical Involvement:
  - Basal Ganglia
  - Cerebellum
    - Receives sensory input for processing
    - Two known pathways for speech motor

(Love, 2000)

Motor Speech Production

- Interruption of cerebellar speech pathways:
  - Ataxia, dyspraxia, apraxia
  - Excessive speech stress
  - Distorted vowels
  - Monopitch
  - Monovolume
  - Inaccuracy of movements

(Love, 2000)

Autism and speech

Blanc (2004). When Speech Gets Stuck: A Hierarchy of Practical Supports for Dyspraxia in Children with ASD – Part 1. *Autism Asperger's Digest*

40% of children with autism show speech impairments

The same 40% have apraxia of speech

Common Speech/Language Issues

- Echolalia
- Lack of prosody
- Unintelligible speech
- Lack of functional speech pace
- Inability to initiate, sustain, inhibit speech

Communication characteristics

- Inability to Initiate/Inhibit
  - Low reciprocity
  - Egocentric
- Inability to Sustain
  - Conversational turns
  - Topic maintenance
  - Output duration
- Other Difficulties
  - Tone
  - Affect

NMT Techniques

- Speech and Language Training
  - Symbolic Communication Training Through Music (SYCOM)
  - Oral Motor and Respiratory Exercises (OMREX)
  - Speech Stimulation (STIM)
  - Therapeutic Singing (TS)
  - Developmental Speech and Language Training Through Music (DSLM)

Symbolic Communication Training Through Music

SYCOM

- Video Examples
- Group Examples

Oral Motor and Respiratory Exercises Through Music

OMREX

- Video Examples
- Group Examples

Musical Speech Stimulation

STIM

- Video Examples
- Group Examples

Therapeutic Singing

TS

- Video Examples
- Group Examples

Developmental Speech and Language Training Through Music

DSLM

- Video Examples
- Group Examples

Remember…

"The brain that engages in music

is changed by engaging in music."

-Dr. Michael Thaut, PhD.

For more information:

The Center for Biomedical Research in Music
- *www.colostate.edu/depts/cbrm/*

Neurologic Music Therapy Services of Arizona
- *www.nmtsa.org*

Kris' Camp
- *www.kriscamp.org*

Summit Music Therapy Services
- *www.summitmusictherapy.com*

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Post-test

Please turn over your pre-test paper. Please number and answers the following questions. Please write your name on your paper.

1. Name one explanation of Autism Spectrum Disorders (ASD) that is based on current theories *and* empirical findings.
2. What is one possible explanation of why people with ASD have "stereotypical" behaviors?
3. What NMT techniques can be used to facilitate communication with persons with ASD?
4. How does Auditory Perception Training apply to persons with ASD?
5. Name at least one accommodation to aid in psychomotor regulation.
6. Describe how would you address off-task behavior with one of your current clients with ASD.