

An Introduction to the Interactive Metronome

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What is the Interactive Metronome (IM)?

- Computer-based form of the traditional metronome
- Works to strengthen the brain functions (motor planning and sequencing)
- Trainee attempts to perform a variety of motor tasks in time with the beat
- Trainee's input is sent to the computer through hand and footplate switches



Demonstration

How does IM training work?

- Neuroplasticity- the brain's ability to strengthen and repair
- IM training utilizes the following activities to improve motor coordination, sequencing, and attention span:
 - timing and synchronization
 - precise physical movement;
 - consistent physical movement;
 - efficient physical movement; and
 - effective motor planning and sequencing.

Neuroplasticity

- Neuroplasticity implies that the brain is capable of long-term changes in function, neural assemblies, or regions in response to physiological or pathological stimuli (Gynther, Calford & Sah, 1998).
- The brain's ability to reorganize and repair itself has been established in numerous studies.

Physical Activity

- Numerous studies have provided support for the notion that physical activity as well can not only attenuate the decline of cognitive functioning (McDowell, Kerick & Santa Maria, 2003), but is instrumental in neuronal growth (Homer & Gage, 2002; Trachtenberg, Chen, Knott, Feng, Sanes, Welder & Svoboda, 2002).

Synchronization and Timing

- The simplest form of motor learning is a repeating a single movement.
- Sanes (2003) found that the primary motor cortex of subjects repeating a particular finger movement was altered for ten minutes or more.

Synchronization and Timing

- More complex movements require a synchronization of cognitive functions and coordinated neural processing and result in longer-term changes (Sanes, Donoghue, Thangaraj, Vankatesan & Edelman, 1995).
- Sanes (2003) points out that whether a motor skill involves the adaptation of previously learned skills, or the formation of new sensory - motor relations, new patterns of neural activity are found.

Motor Sequence

- Learning a motor sequence yields convergent processing in the neo cortex from the frontal to the parietal regions as the skill becomes better learned.
- This may indicate that the frontal cortex is involved in the acquisition of the motor skill whereas the knowledge about the sequence is primarily located in the parietal cortex (see also Marois, 2002; Karni, Meyer, Jezzard, Adams, et al, 1995).

Synchronization

- Synchronization involves different areas of the brain, as has been found in many studies. In a study of coordinated motor skill acquisition involving both the wrist and foot, Debaere, Swinnen, Beaste & Sunaert (2001) found that a distributed network was responsible.

Motor Planning

- Motor planning or praxis is expressed in the integration of selecting the best course of movement to reach the goals necessary.
- For example, taking a drink of water integrates the **visual perception** of the glass of water, the **proprioceptive** knowledge of where the glass is and the **specific motor actions** needed to activate the muscles to engage in the act of drinking (Wolbert, 2000).

Rhythmicity

- Information from the different sensory modalities is processed in separate cortical regions, and our perception of the environment relies on the integration of this input (Figelkurts, Figelkurts, Krause, Moettoenen & Sams, 2003).
- It has been found that in some circumstances, the balance of neural resources allocated to different aspects of senses may shift according to situational demands (Dromey & Benson, 2003).

The Interactive Metronome

- Interactive Metronome ® incorporates **motor planning, rhythmicity, and sensory integration** over the exercises presented. These elements have been shown through research, to facilitate neuronal stimulation.
- Consistent with theories of neuropsychological functioning and cortical organization, this treatment **can facilitate greater attention, mental processing, and cognitive abilities.**

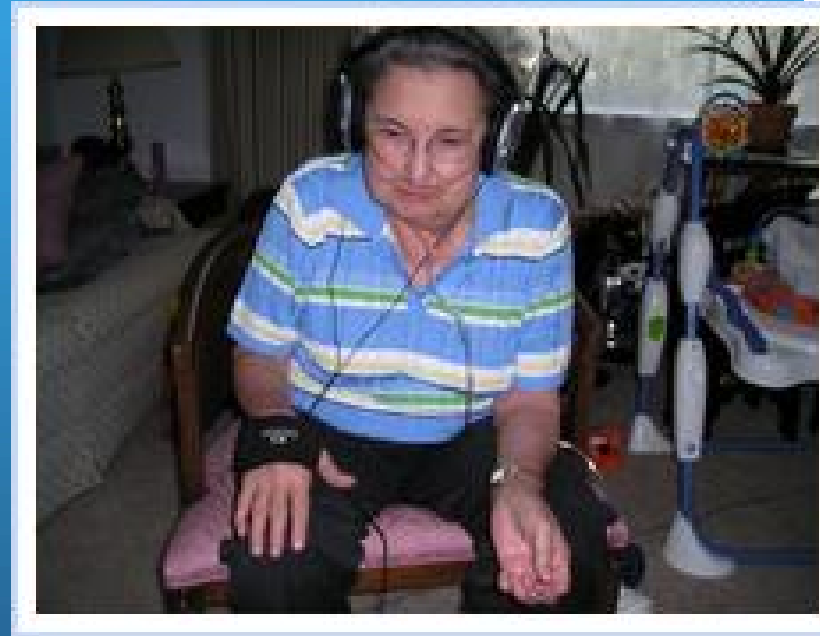
The Interactive Metronome

- The advantages that this treatment facilitates can be applied to many diagnostic populations as well as to individuals who wish to improve their concentration and performance.
- Finally, the impact that training with this system can have on other disorders that involve mental processing and attention is meaningful.

What are the expected outcomes of using IM training?

Overall, the IM training has shown improvement in

- Focus and Attention
- Control of Aggression & Impulsivity
- Overall Coordination
- Reading and Language Processing



(Interactive Metronome, 2004)

Development of current research



Does IM have positive motor movement benefits with post stroke patients?

Criteria: Post CVA diagnosis

Number in Study: 30 (15 completed, 4 in progress, need 11 more referrals)

Protocol: 8 - one hour sessions over 4 weeks

First & Last sessions involve pre and post evaluations; 9 hole peg, Jebson & IM Long Form

Interactive Metronome®

8 Session Treatment Protocol

Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7	Session 8
Long Form Assessment	Both Hands (350 reps)	Both Hands (150 reps)	Both Hands (350 reps)	Both Hands (150 reps)	Both Hands (350 reps)	Both Hands (250 reps)	Long Form Assessment
Jebsen Test of Hand Function	Right Hand (200 reps)	Right Hand (200 reps)	Right Hand (200 reps)	Right Hand (200 reps)	Right Hand (150 reps)	Right Hand (150 reps)	Jebsen Test of Hand Function
9 – Hole Peg Test	Left Hand (200 reps)	Left Hand (200 reps)	Left Hand (200 reps)	Left Hand (200 reps)	Left Hand (150 reps)	Left Hand (150 reps)	9 – Hole Peg Test
	Right Toe (200 reps)	Right Toe (250 reps)	Right Toe (200 reps)	Right Toe (250 reps)	Right Toe (200 reps)	Right Toe (250 reps)	
	Right Heel (200 reps)	Right Heel (250 reps)	Right Heel (200 reps)	Right Heel (250 reps)	Right Heel (200 reps)	Right Heel (250 reps)	
	Left Heel (200 reps)	Left Heel (250 reps)	Left Heel (200 reps)	Left Heel (250 reps)	Left Heel (200 reps)	Left Heel (250 reps)	
	Both Hands (150 reps)	Both Hands (150 reps)	Both Hands (150 reps)	Both Hands (150 reps)	Both Hands (250 reps)	Both Hands (150 reps)	

Results that I have seen

Geri - 59 yrs old female, 4 years post stroke, R CVA

Jim - 62 yr old male, 3 yrs post stroke, R CVA

Spencer - 84 yr old male, 13 yrs post stroke, R & L CVA

Ruth - 61 yr old female, 6 yrs post stroke, L CVA

Jean - 74 yr old female, 2 yrs post stroke, R CVA

Sammy - 61 yr old male, 5 yrs post stroke, R CVA

Jack - 69 yr old male, 3 yrs post stroke, R CVA

Harold - 72 yr old male, 7 yrs post stroke, L CVA

John - 53 yr old male, 3 yrs post stroke, L CVA

Kim - 45 yr old female, 1 yr post stroke, R CVA

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Conclusion

- The results of this study support the use of the IM training to be used as a tool that occupational therapists could use as a restorative intervention strategies.

Questions?

References

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