Let’s Interact

• Please ask any questions throughout and let’s make this discussion interactive...

Objectives

• Present our findings of a highly experiential creature
• Discuss the importance of patient motivation, therapeutic alliance, and realistic goals
• Learn how various inputs can enhance or inhibit motor control
• Learn how motor planning is a precursor to movement
• Discuss the role of a therapist as the mentor or guide towards learning new and desired movements
Our Voyage…

Our Destination…

First Landing…
Signs of life!

An Amazing Discovery!

- Humans are a highly evolved life form
- Ability to experience the world
- Very interactive creature
- Expressive, creative, and extremely social
- Awesome moves

INPUT (AFFERENT)
Visual, Olfactory, Vestibular

States of Conscious Perception
Movement Planning & Goal Oriented Movement

Three Things to Consider about Movement and Motor Control...

1. Why do we move?
2. When and why do movement patterns change?
3. When movement patterns change, can and should we attempt to alter them (and how do we do it)?

1. Why do we move?
Movement and Motor Control

- **Movement** is simply the act of changing physical location or position
  - **Motor Control** is the generation and coordination of movement patterns to produce function; it may function either to control movements of the body in space or stabilize the body in space.

Why do we move?

- Survival
- Interact with Environment
- Social Connection
- Exercise
- Defense
- Enjoyment

Why do we move?

- Human movement is unique and socially expressive
- We can intuitively determine when movement is that of a human
  - And when the movement is for survival vs. social
- Will a robot ever dance like Dr. Tony Ingraham (www.bboystscience.com)?
Why do we move?

- Human movement is unique and socially expressive
- We can intuitively determine when movement is that of a human
  - And when the movement is for survival vs. social
- Will a robot ever dance like Dr. Tony Ingraham (www.bboyscience.com)?

Why do we move?

- We move different based upon social context
  - The Haunted House Effect
  - We move differently based upon fear and emotion
- What does this mean clinically?
  - What type of environment do we create?
  - Are our patients movements defensive?

How do we teach people to move?

- We do this...
- And expect this...

When attempting to alter motor control, we become fixated on contractions, when in essence, it involves biological, psychological and social factors.
2. When and why do movement patterns change?

When and why do movement patterns change?

- **Motor neurons** get input from many different parts of the brain, not just primary motor cortex
- The **expectation of pain** can alter stabilizing muscle activation
  - beliefs about back pain seem to relate to altered postural adjustment strategies
  - The altered trunk muscle activation patterns can exist with and without pain

When and why do movement patterns change?

- Many **corticospinal** projections run to many motor neurons
  - “I think this is interesting too because it fits with the whole brain as an orchestra idea – each musician contributes to many tunes, just like brain motor cells contribute to lots of different movements.” – Lorimer Moseley, www.bodyinmind.org
- The system is highly dynamic and can be relatively easily modified
  - It’s plastic and ever changing...
Can Motor Control be an affected Output?

• Does pain alter movement?
• Does movement cause pain?
• Are pain and movement concurrent, separate events?
  – We suspect all three to be potentially true

People are aware that pain can interact with motor performance, but pain-related motor dysfunctions are complex, and in a recent review paper (Mercier & Léonard, 2011; see also Bank et al. 2012) they discuss several examples of the complex interactions that can exist between pain and motor control.
Can Motor Control be an affected Output?

- Ex: Amputees
  - Virtual representation is still there
    - Some move the missing limb easily and others its more challenging
    - Some have pain and others do not
    - Those with pain, move their phantom limb much slower (Gagné et al. 2009)

Can Motor Control be an affected Output?

- Pain. Hodges & Tucker, 2011
  - Proposed that the adaptation to pain:
    - (1) involves redistribution of activity within and between muscles;
    - (2) changes the mechanical behavior such as modified movement and stiffness;
    - (3) leads to protection from further pain or injury, or from threatened pain or injury;
    - (4) is not explained by simple changes in excitability but involves changes at multiple levels of the motor system, and these changes may be complementary, additive, or competitive
    - (5) has short-term benefit but has potential long-term consequences due to factors such as increased load, decreased movement, and decreased variability.

3. When movement patterns change can and should we attempt to alter them? (And how can we do it...)
Can and Should we attempt to alter motor control?

- We often focus on improving the activation of stabilizing musculature to assist with the control of the joints, but is this the best approach?
  - Is it about the muscle?
  - Is it about the individual?

Can and Should we attempt to alter motor control?

- MacDonald et al. attempted to identify why certain patients have a higher reoccurrence rate of low back pain
  - They investigated whether neuromuscular control of the short and long fibers of the deep back muscles differs in patients who have a history of unilateral low back pain, who currently are asymptomatic, versus healthy counterparts
    - EMG onset of the short fibers of the deep back muscles relative to the deltoid in the nonsymptomatic group was delayed in the symptomatic group compared to the asymptomatic group.
    - This delay was higher on the previously painful side as compared to the non-painful side.
    - The alteration in timing may reflect changes in motor planning which could be due to inaccurate or ignored sensory information from the spine OR a change in strategy by the central nervous system. This actually may be a way of attempting to avoid pain provocation.

Can and Should we attempt to alter motor control?

- Macedo et al. assessed Motor Control Exercises vs. Graded Activity in patients with chronic NS-LBP
  - Motor Control: Focus on stabilizing and training deep muscles such as TA and multifidus
  - Graded Activity: Focus on activities the participant noted as problematic. Cognitive-behavioral principles used
  - Similar results in both groups

Can and Should we attempt to alter motor control?

- Is our current model working?
  - Up to $635 billion dollars on the treatment of pain in 2010
    - We are spending 4x the amount of money treating pain, compared to 15 years ago
    - In 2010 we spent $309 billion dollars treating heart disease, $243 billion dollars treating cancer and $188 billion dollars treating diabetes

M.I.P Algorithm

- Before presenting the algorithm, we would like to admit that while this algorithm makes sense to us, it still needs to undergo further research and analysis
- The algorithm is broad and rather non-specific, and should be utilized to help a clinician consider variables which impact movement, prior to the occurrence of movement

M.I.P Algorithm

- We suspect three ingredients are necessary for success for altering motor control
  - The patient needs to be Motivated and the have the expectation that it will help them
  - The clinician should provide Input(s) that are clinically meaningful to the patient
    - Would you manipulate someone who believe the manipulation would hurt them?
    - Will this alter movement? (The Haunted House Effect)
  - You need to work on the formulation of Preparation and Planning of movement, prior to movement
    - Does a virtual representation exist?
Motivation

- A broadly used term we are utilizing to consider psychosocial aspects prior to providing somatosensory or other interventions
- **Motivation** is defined as: “giving of reason to act: the act of giving somebody a reason or incentive to do something”

Motivation

- Will a patient improve, if they do not expect they can?
  - A 2006 study assessed 1,068 individuals who had submitted Worker’s Compensation disability claims for low back pain. It was found that those who had ongoing disability were those with low expectations for recovery, and fears that work-related activities may increase pain or cause further harm to their back.
  - Is this Malingering?

---

Motivation

- If a patient is not motivated, or hold the expectation to improve, what do we do?
  a) Begin contractions of the Multifidus
  b) Apply moist heat
  c) Manipulate the spine
  d) Attempt to better understand their beliefs and motivate them for an expectation for recovery

Motivation

- Clinical Considerations
  - Motivating an individual should be the attempt to create the desire or willingness to move, to achieve a goal which is important to them
  - We need to promote the concept that movement is generally safe and healthy, and set the expectation that the more they move, the more efficient their motor planning and control may become
  - Educate, Educate, Educate
    - Re-create the desire to move

Further Considerations of Motivation

- What if a patient does not have the physiological ability to become motivated to move differently?
Motivation

• It has been demonstrated that the neurotransmitter dopamine (DA) plays an integral role in motivational control
  – DA is found in the ventral midbrain, located in the substantia nigra pars compacta and ventral tegmental area.
  – A proposed mechanism for how it reinforces motivation is that it allows someone to learn the optimal choice of actions to gain rewards, given sufficient trial-and-error experience. This leads to the notion of its influence on synaptic plasticity in numerous brain regions.

Motivation

• Clinically, we have observed that those with disorders characterized by the degradation or lack of dopamine (ie. Parkinsons disease), motor and perceptual timing difficulties arise.
  – In those with Parkinson’s, it is suspected that the progressive loss of the ascending dopaminergic projections in the basal ganglia leads to the loss of normal automatic control leading to a distortion of output signals from habitual control circuits, which impedes the expression of goal-directed action.
Input

• “The Noise”

Input

• We categorize this as:
  – Clinician Directed Input
  – Non-Clinician Directed Input

Clinician Directed Input

• Our hands
• Our confidence
• Our words
• Our appearance

Are RCTs generalizable to your practice, if your clinician directed input varies from that of the researcher?
Clinician Directive input

- Using the word “instability” sounds like something is “out,” “unstable,” “requires surgery to fix”
- “Spur”, “Bulging Disc”, “Ruptured Disc”, “Tear”
- Why do we use these words?
  — I’m never that certain...

What does the patient conceptualize?

Non-Clinician Directed Input

- The **sounds** in the clinic
- The **lighting** in the clinic
- The **appearance** of your clinic
- The **grimacing** of the other patient on the plinth
- Etc.
Input

- Optimize the noise to meet the patients needs
  - It’s not just about our hands
  - Alter clinician and non-clinician directed input to the best of your ability

Input

- Our input can influence:
Sensorimotor Incongruence

- Input from eyes, muscles, joints, skin and vestibular system continuously inform the brain about actual movements.
- Simultaneously, this information is compared with the motion program (that what was predicted) in the brain, which is important for adjusting motor plans and ensuring smoothness of motor action.

Plan

- Once an individual holds the motivation to move (as well as the expectation that moving will improve their condition) and the practitioner has provided meaningful, individualized, afferent input, the last part of our algorithm (prior to beginning motor control activities) emphasizes the motor preparation and representation for movement.
Plan

- A 2011 article, highlighted this concept in individuals with recurrent LBP. The investigators compared the location of cortical representation and motor excitability in individuals with recurrent LBP, with those who are healthy. They found that LBP was associated with a loss of discrete cortical organization of inputs to back muscles.

Plan

- “Smudging” of the cortical representation of these muscles, may reduce one’s ability to control their activation and thus leading to reoccurring pathology.
- We need to alter the input, before the action can change (hence why Input is proposed prior to Plan)

Plan

- Can the patient imagine themselves doing what you want them to do?
  - Does it make sense?
  - What is the cortical representation like for the low back and neck, compared to the hand?
Plan

Relevance

Voyage Conclusion

• We have a job where we get to interact with complex human beings
• We must move past models of care that simply focus on tissues for blame and tissues for treatment
  – Is my TA contracting while giving this lecture?
Voyage Conclusions

• So much input designed to experience the world...
• As Movement Facilitators, we can learn about how many inputs or “noise” can influence output “motor control”
  — Positively or Negatively
• Manipulation is an input along with dry needling, IASTM, Kinesiotape, graded mobs...
• We have to understand and interact with all these receptors including the visual and auditory (social aspect)
• The goal is desired functional movement by the patient

An OMT as Diagnostician...

• Not in the sense of a medical doctor...
• What dosage of input will help a patient move better?
  — How about words you use or your non-verbal presentation?
• The “movement dosage expert” must apply clinical reasoning and be interactive

References

• Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health, Seventh Edition.
  © 2003 by Saunders, an imprint of Elsevier.
<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
</table>