There should be 4 components to each treatment session:

- **Release** – directed to the primary driver
- **Align** – cues to ensure alignment gained with release can be maintained with self-release practice
- **Connect**
- **Move** – use the principles of neuroplasticity to rewire brain maps and create more efficient strategies for function & performance

Treatment is distributed according to primary and/or secondary drivers.

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**Goal - Getting to ‘Wow’**

1. **Experience**
2. **Firing of Neurons**
   - “neurons that fire together, wire together”
3. **Memory = New Map**

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**“I want to surf”**

Creating the “buy-in” – meaning and value in the rehab process
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Treatment & The Integrated Systems Model

- **Release the Non-Optimal Strategy & Restore Alignment**
- **Teach a New Strategy for Function & Performance**
- **Remove Barriers**
- **Based on Meaningful Task**
- **Release** - Home practice cues
- **Align** - Self-RWA

Connect & Move

Principles for treatment according to the Integrated System Model for Pain & Disability

- **Release**
  - Applied to cognitive, emotional, social, and physical barriers, using a variety of techniques - release overactive muscles and adhesions (myofascial, articular, neural & visceral impairments)
  - Cues/corrections to align the body both within and between regions
- **Align**
  - Find the best position and cue for release, activation and co-ordination of the deep and superficial muscle systems of the trunk
- **Connect**
  - Use the principles of neuroplasticity to rewire brain maps and create more efficient strategies for function & performance
- **Move**
  - Use the principles of neuroplasticity to rewire brain maps and create more efficient strategies for function & performance

What tools do you have in your toolbox for each of these components?

Cognitive & Emotional

- **Explain problem** - provide a logical hypothesis that explains both their pain experience and their disability
- **Create a safe environment**
  - To explore barriers such as fear, belief systems (“I’ll never get better”)
- **Meditation, breathing practice** - autonomic system effects

Treatment Principles

Cognitive & Emotional

- **Explain problem** - provide a logical hypothesis that explains both their pain experience and their disability
- **Create a safe environment**
  - To explore barriers such as fear, belief systems (“I’ll never get better”)
- **Meditation, breathing practice** - autonomic system effects

Create new options for movement

Delete the current “wiring of the neural network”
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Treatment Principles

Systemic / Total Body
- Breathing, relaxation
- Movement programs
- Nutritional support, hydration
- Hormone health - neuroendocrine and neuroimmune systems
- Medications – desensitize NS

Create new options for movement
Delete the current “wiring of the neural network”

Physical Impairments - the rest of the puzzle - “Manual Magic”
- Muscle energy, PNF, Contract - relax
- Neuromyofascial release techniques, positional release, counterstrain, direct fascial techniques, massage

Release the Non-Optimal Strategy by Addressing Barriers

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Treatment Principles

Physical Impairments - the rest of the puzzle - “Manual Magic”

- Oscillatory mobilizations, manipulation

Release the Non-Optimal Strategy by Addressing Barriers

Part 1

- Monitor the area of increased tone with gentle pressure
- Initially, move the joint so as to shorten the origin and insertion of the hypertonic muscle, then shorten the fascicle
- Wait for the efferent spinal cord response to the reduced afferent input from the primary muscle spindle

Part 2

- Cue the patient to ‘release’ or soften the muscle with cues to let it go, melt, release
- Move the joint in various combinations to maximally release the muscle as you cue (with words and touch) the patient to be aware of the softening and release
- Once maximum release is obtained, gently take the muscle through a full stretch listening to its response and avoiding any recurrence of hypertonicity

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An Integration of Release Techniques

Treatment Principles

Physical Impairments - the rest of the puzzle – what other tools do you use?

- Dry Needling (IMS)
- Ball/foam rolling
- Graston technique
- Active Release Techniques
- Kinesiotaping
- Yin Yoga?? ‘Restorative Yoga’

After Release → Train

R = Release
A = Align
C = Connect
M = Move

Teach a New Strategy for Function & Performance
Based on Meaningful Task
How do we train strategies for optimal function & performance?

Does 'Core Stability' = Beautiful Movement

How do we train strategies for optimal function & performance?

What is causing the non-optimal strategy?

How do we Change Strategies?

It depends on what is "driving" the strategy...

Treatment is prescriptive, based on the underlying impairments.
What is “Core Stability”?

Google searches

June 2010 4,680,000 results
May 2011 6,200,000 results
Nov 2012 23,900,000 results

What does “Stability” mean to you?

What is ‘Core Stability’?

“Stability means absolutely no movement. Core stability assumes both the lumbar spine and pelvis remain immobile.”

www.pilates-pn.com
What is ‘Core Stability’?

“Core Stabilisation is your body’s ability to dynamically control and support your spine via deep and specific muscles. Your spine is an inherently unstable area. Your lower back has five vertebrae that sit on top of a triangular bone called the sacrum, which wedges itself into the pelvis. The vertebrae allow twisting, bending and arching. Unfortunately, without constant muscular support or your core stabilisers, your spine would fall in a heap on the ground.”

www.physioworks.com.au

Is the spine inherently unstable?

If you say this to patients… what does this mean to them?

Requirements for ‘Stability’

Panjabi 1992
What is “Buckling”? 

Is “Buckling” Bad?
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Buckling & the Euler Model of Static Stability

Requirements for ‘Stability’

How is Stability Achieved? Different Opinions from the Research? What is Stability?

Euler Model - Static
Stiffness = Stability

Strength
Endurance
Co-contraction of multiple muscle groups → Bracing
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Does ↑ Stiffness = Better Function?

How is Stability Achieved?
Different Opinions from the Research?
What is Stability?
Euler Model - Static
Stiffness = Stability
- Strength
- Endurance
- Co-contraction of multiple muscle groups → Bracing

Control Model –
Static & Dynamic
- Coordination
- Timing
- Right place, right time, right effort, right specificity

‘Stability’
Spine stability: the six blind men and the elephant

‘Stability is a term that appears to change depending upon the context, and as such, appears to have unstable definitions. The ambiguity of this term in spinal biomechanics should not be surprising, given that even in more established disciplines in engineering, there is no absolute definition of stability.’

(Reeves, Natendo, Cholewicki 2007)
Low back pain has been partially attributed to clinical spinal instability. However, clinical spinal instability is a complex pathology with no generally accepted definition. Although many definitions of spinal instability include mathematical parameters, we make no attempt at this time to correlate definitions of clinical spinal instability with the Euler stability presented here.

Crisco, Panjabi, Yamamoto, Oxland 1992

RIGIDITY STRATEGY
STIFFENING

Costs of Compression
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Requires a finely-tuned motor control system with accurate feedforward and feedback mechanisms.
Stability - A Better Definition

Stability of a dynamic system - ability to maintain the desired trajectory despite kinetic, kinematic or control disturbances

Hodges & Cholewicki 2007

"Desired Trajectory" defined by task goals, and encompasses "static" tasks

Which Muscles are Important for Stability?

Multiple Muscles – All are Important

Who is ‘More’ Stable? Is this a good question to ask?

Which strategy is more Robust?

Reeves, Narendra, Cholewicki 2007
You are either stable or not.... Stability of the spine and pelvis is necessary for optimal total body function.... But Stability does not guarantee optimal function & performance....

**Optimal Strategies for Function & Performance**

*Provide spinal & pelvic stability*  
AND  
*Desired output for the task*  
Performance, agility, flow, ‘beautiful movement’

**Many Considerations for Optimal Strategies during Functional Tasks**

What are the loading requirements?  
What are the mobility requirements?  
How predictable is the situation?  
What is the threat value?  
What is the context?  
Is there accurate proprioceptive information?
Optimal Function Requires Multiple Strategies → Choice is Specific to the Individual & Ability of the CNS to Match Strategy to the Demands of the Task

A Healthy System has Choice

Optimal Strategies for Posture & Movement
Support & Reflect Function of Multiple Systems in the Whole Person – Musculoskeletal, Neurological, Vascular, Respiratory, Emotional … and Desired output for the Task = "Beautiful movement"

Problem Comes when Non-Optimal Strategy Choices are Made = Loss of Options
Research shows motor control changes are variable across patients with low back pain, neck pain, ACL deficiency…
Common link – strategy is non-optimal for the task:
• Unable to adapt muscle timing and activity to variable load demands
• Less efficient function
• Movement strategies continue to stress structures that perpetuate pain
• Some argue that these changes are adaptive / protective
Non-optimal Strategies lead to Failed Load Transfer
Compromise mobility or segmental stability and can lead to structural damage

Non-optimal Strategies affect multiple systems
Prevent rib cage expansion and compromise respiration

Non-optimal Strategies affect multiple systems
Create excessive intra-abdominal pressure, excessive fascial load & ultimately facilitate prolapse or herniation
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Non-Optimal Strategies
Create excessive stiffening of the system and compromise ability to adapt to challenges to postural equilibrium

Equilibrium
SensoriMotor

"I don't have any major pain, I just keep falling off my bike"

Non-Optimal Strategies
Affect performance & outcomes

Neither of these patients will have full recovery with a typical 'core stability' program – think about where the driver is

Find the Driver by screening tasks that are related to the Meaningful Task
Where do “Core Stability” Exercises fit in?

What are “Core Stability” Exercises? Should we keep using this term?

Need to consider the complex connections between all muscles and the nervous system for trunk control.

Dysfunction in any of the trunk muscles can be caused by a driver anywhere in the body – foot, pelvis, thoracic ring, neck…

Impairments in the trunk muscles are individual and need to be assessed in order to prescribe appropriate exercises.

What About Training Transversus Abdominis and Deep Multifidus?

Depends on where the underlying driver is – foot, knee, hip, pelvis, lumbar spine, thorax, shoulder … etc.

Depends on what the underlying impairment is – Right TrA, overactive external obliques, imbalance between trunk extensors and flexors… etc.

Just because TrA is not functional doesn’t mean that “transversus exercises” will make it functional.

From the science

Research shows motor control changes are variable across patients with low back pain.

*Compromised* activity – often in the deep muscles (but not always present, other muscles may also be compromised):

- reduced activity (TrA, deep neck flexors)
- delayed activity (TrA, dMF, Glute max, dNF, others…)
- less tonic activity (TrA in gait, neck extensors decreased endurance)
- cortical re-organization (TrA)
- Reduced spinal excitability
- Atrophy & fatty infiltration (multifidus)  

Multiple authors; summary from Hodges 2011.
Augmented activity - often in the superficial muscles, but can also be in deep muscles
• Individual strategy
• Task-specific
• Variability in which muscles are involved

Common link – strategy is non-optimal for the task

Key message – Changes in deep and superficial systems are individual → need to assess the individual patient
Train Muscles Related to the Primary Driver Based on the Meaningful Task
Think specificity to sport when designing training

Goal – To use clinical reasoning (including clinical expertise combined with knowledge of the relevant science) to build prescriptive multimodal treatment plans that facilitate optimal strategies during multiple tasks and loading situations – optimal strategies create stability AND facilitate performance

More than Stability…
The Integrated Systems Model (ISM) – Facilitating Change to Create Optimal Strategies for Function & Performance = Beautiful Movement
A Good Dr. Google Quote

Remember, the ultimate goal of core stabilization is to train “movements” and “positions” rather than muscles. Exercises are most effective when they mirror the demands of the athlete’s sport. When the system works efficiently, the result is appropriate distribution of forces, optimal control and efficiency of movements, adequate absorption of ground reaction forces, and absence of excessive compression, translation or shearing forces on the joints of the kinetic chain.

By: Dr. Ian MacIntyre B.Sc., CSCS, DC, FCCSS(C), D.Ac, ART
Sports Specialist Chiropractor, Acupuncture

Treatment Principles

Specific Muscle Recruitment, Support, & Integrated Movement Training
- Deep muscle recruitment
- Coordinated deep muscle training – “the chord”
- Coordinated deep and superficial muscle training – “the symphony” - in specific movements that rewire the neural network
- Taping/ Com-Pressor SI belt
- Train new postural alignment
- Integrated functional and sport specific patterning – find the “way in” with verbal and tactile cues – to create a new strategy for the task

Changing Strategies for Function & Performance

- Finding “the way in” to re-wire the neural networks – using principles of neuroplasticity & treating the primary driver
- Focused attention is essential
  → it’s all about awareness
- The Primary Driver is your “key” to unlock change in strategies

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Driving Long Lasting Brain Change

Key Factors Required for Facilitating Neuroplastic Change

- Focused Attention – seems critical
- Training tasks that have MEANING
- Massed practice – high quality
- Sensory input – normalize
- Positive feedback
- Importance of Specificity principle
- Prescribe visualization of meaningful task with optimal strategy and without pain

Teach a New Strategy for Function & Performance

“Neurons that fire together wire together”

Use neuroplasticity to create new neural networks – make new, or; wake up, brain maps

Neuroplasticity Resources for Musculoskeletal Therapists

Dodge N – The Brain that Changes Itself
Siegel D – Mindsight and The Mindful Therapist

They showed that skilled training induced an anterior and medial shift in motor cortical representation of the trained muscle, TrA, in patients with recurrent LBP, towards that reported in pain-free individuals

Boutheau et al 2010 The role of motor learning and neuroplasticity in designing rehabilitation approaches for musculoskeletal pain disorders

Training a New Strategy – ISM
RACM – Release, Align, Connect, Move

Task Specific Exercises:
Should include
a) Release training
b) Align & Connect training – specific to primary driver requiring control/ postural alignment
c) Movement training – specific pattern related to meaningful task & demands
d) Tissue specific targeted exercises
Doidge (2007) notes the importance that well known neuroscientist V. S. Ramachandran places on individual patient cases. Ramachandran believes that individual cases have everything to contribute to science and quotes him as saying:

“Imagine I were to present a pig to a skeptical scientist, insisting it could speak English, then waved my hand, and the pig spoke English. Would it really make sense for the skeptic to argue, ‘But that is just one pig, Ramachandran. Show me another, and I might believe you!’”