Advanced Rehab for clinical practice: Lower Extremity

Jeffrey Sergent DC

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2004 Michigan State University- Environmental Science

2008 - National University of Health Science

Post graduate training

300 plus hours Diplomat, Rehab American chiropractic Council

McKenzie Mechanical Diagnosis and therapy, A-C

Dynamic Neuromuscular Stabilization, DNS, Clinical A-C, Certified Exercise Trainer

Functional Movement Systems I and II

Movnat certified trainer

Selective Functional Movement Assessment
Weekend outline

Day 1
Why exercise is important?
Anatomy LE
Functional Tests and tests
Exercise Correction

Day 2
Questions from day 1
Anatomy UE
Functional test
Exercise correction
Bring it all together

Goals of Therapeutic exercise

Function!!

We need our patients to do things of life! Bending (hinging), squatting, reaching,

Prevent injury (Take away the hammer)

Reduce pain

Build strength
Concepts of the weekend

Proximal stability leads to distal mobility

If patient comes in with hip, knee or ankle focus on the developing breathing and support then go down the chain

Push the patient to the most challenging exercise they can do well

Rehab is practice so every day can be a little different, focus on better not perfect

Add progressions as you see fit

Sagittal plane → Transverse plane

Test and retest

Clinical Audit process before visit, during treatment and before next visit

Exercise can become the test

GOAL: INTENT: FUNCTION

Spinal manipualtion and exercise
Lancet study

• MSK disorders are number 2 leading cause of disability worldwide
• Guidelines recommend self-management, physical and psychological therapies, and some forms of complementary medicine, and place less emphasis on pharmacological and surgical treatments; routine use of imaging and investigations is not recommended

Lancet Report

• The evidence:
  • Little prevention evidence exist
  • Exercise and education best evidence
  • Ergonomic alone – ineffective
  • “Non-evidence-based practice is apparent across all income settings; common problems are presentations to emergency departments and liberal use of imaging, opioids, spinal injections, and surgery “
Exercise Therapy
Spinal Manipulation
Behavioral Therapy

Lancet

• Overall:
• Spend more = worse outcomes
• Patient Centered Care for best outcomes
Physical activity guidelines for Americans

**Guide lines for kids**
- 3-5 year: Active throughout the day
- 6-17: 60 minutes or more per day
- Moderate to vigorous

**Adults**
- 150-300 minutes per week moderate intensity
- Or
- 75-150 vigorous or equivalent combination of moderate and vigorous
- AND
- 2 or more strength days per week
- Older adults need to focus on balance as week

**Exercise progression**

Local stability; motor control 0-3 weeks, neuromuscular junction

Global stability; strength, endurance and proprioception (train in vacum)

0-12 weeks for physiological change

Dynamic stability; Functional task and specific training. Being able to adapt to environment and train outside of specific tasks
Selling exercise!

Compliance is an important part of our exercise program.

Exercise is the one prescription that can help with a list of diseases.

Being stronger and better condition just makes us better for the future us.

So how do we get people to exercise more?

Think for them what they could be in 10 years, 20 years...

Fitness and exercise are the best thing for them.

Selling - A.I.D.A.

ATTENTION: In our case pain gets the patients attention.

INTEREST: What is causing it and what can they do for it? Perform exam that shows what is going on with explanation.

DECISION: Do exercise to make them feel better and what can they do from making this happen again. Using a clinical audit process to show change.

ACTION: Patient understands what is going on and what they can do to make it better.
Definitions

Isotonic movements:

Isotonic: equal + tone, throughout the movement. Contraction is equal throughout movement but joint angle changes. Example: squat, pushup, bicep curl

   Can be either: Concentric : contraction with shortening

   Eccentric, aka negatives: Contraction while elongating

Isometric: Equal tone with no change in joint angle. Static position.

Isotonic and isometric
Planes of Movement

**Sagittal**: divides the body left and right. Forward and backward movements

**Frontal**: divides body front and back

Move side to side

**Transverse**: divide body upper and lower

Involve twisting

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Ipsilateral and Contralateral movement

**Ipsilateral**: joints on the same side.

Examples: rolling, swing

**Contralateral**: Opposite joints at same

Examples: walking, crawling
Ipsilateral movement

Ipsilateral Global Pattern

Stepping forward - top limbs
Support - bottom limbs

direction of muscle pull  moving segments  fixed segments

Ipsilateral movement

Support
Stepping forward limbs

Support
Contralateral movement

Closed Chain and Open chain

**Closed Kinetic chain exercises**: Distal segment fixed: arm or leg stay fixed to the ground

Example: push up, squat,

Switches the traditional actions of muscle: insertion static and origin moves toward

**Open Kinetic chain exercise**: distal segment mobile: arm or leg are free to move

Bench press, hamstring curl

Traditional actions of muscles: origin static and insertion moves toward
Core?!

Hollow: draw belly button toward the spine; Paul Hodges

Brace: Eccentrically contract abdomen, prepare for a punch. Stuart McGill

IAP: Intra abdominal pressure, Pavel Kolar

Overall, Proximal stability leads to Distal mobility
Core Cylinder

Breathing

Think cylindrical
Karel Lewit

If breathing is not normalised – no other movement pattern can be” Karel Lewit, MD

Cylinder

Inferior draw
Parachute effect
Recent research on core and lower extremity

ACL Injury Mechanisms and the Kinetic Chain Linkage: The Effect of Proximal Joint Stiffness on Distal Knee Control during Bilateral Landings

Jordan Cannon † MSc, Edward DJ Cambridge BKin, PhD(c), and Stuart M McGill PhD

Muscle stiffness and its contribution to joint rotational stiffness, is a function of neural drive in response to proprioceptive feedback and the instantaneous task demand constraints. In the absence of sufficient stiffness joint integrity is compromised, whereby instability and aberrant joint micromovements can occur and/or structures may be unable to resist perturbations and excessive motion.

Anatomy overview

Psoas
Glutes
Calf m group
Hamstring
IT band
Psoas

O: Transverse process of T12 -L4 and IVD
I: less trochanter of the femur

Glute group

O: Gluteal surface of ilium, lumbar fascia, sacrum, sacrotuberous ligament
I:Gluteal tuberosity of the femur and iliotibial tract
IT band

TFL anterior structure

Glute Max posterior structure

Hamstring Group

O: Ischial tuberosity

I: tibia, fibula

Hamstring Muscles

- Biceps Femoris
- Semitendinosus
- Semimembranosus
Calf muscle group

O: superior to articular surfaces of lateral condyle of femur and medial condyle of femur

I: teno calcaneus (achilles tendon) into mid-posterior calcaneus

Global thinking

Image 1: Immobile t-spine = Weak Link
Injury vs dysfunction

Mechanical stress leads to injury

Bending a pencil, cracks in the middle

Lower extremity complaints

Runners knee
Knee OA
Hip FAI
Psoas Tendinopathy
Shin splints
Plantar fasciitis
Lower extremity Rehab

Where to start?
Abs control the pelvis
Pelvis houses the hip
Hip controls the knee
Knee directs ankle
Or is it reverse?

Functional exams

Functional exams

Give us a clue how the complex system is working by isolating out one thing at a time.

Example: looking at a squat that has multiple joints and motor control issues, looking at ankle dorsiflexion helps delineate out one potential dysfunction

Getting our eyes better and watching more movement makes us more effective
**LE functional exams**

1) Single leg glute bridge - motor control
2) Internal rotation - Range of motion
3) Adductor plank test - Endurance
4) Ankle Dorsiflexion - Range of motion
5) Single leg stance - Proprioception
6) Plank test - endurance
7) Horizontal bridge - Endurance

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**Single leg bridge**

This helps look at single leg movements and the motor control of the pelvis core and glue

Walking, running, stairs, squats, hinging, lunge, transitional movements
Single leg glute bridge test

Exercises for single leg bridge test

**Anti rotation exercises**- bird dogs, glute bridge with rotation, gray bridge, chops and lifts

**Core Motor control**- pelvic tilts, breathing, rolls

**Glute mm.**- clam shells, lateral band walks, glute bridge with rotation, side bridge, Bulgarian split squat, squats, Single leg RDL, Hip airplanes

**Hip extension**: Psoas stretch in half kneeling
Internal rotation of the hip

Evaluate: internal rotation

Prone internal rotation test

Relative internal rotation of the hip is important in tasks of running, walking, golfing, throwing. **IT IS IMPORTANT**

Patient lying prone with inclinometer measure mid shin and rotate the foot out.

**Pass is Greater than 35 degrees**

Internal rotation rehab

**Lower ab exercises**- Diaphragmatic breathing, triple flexion, uprighting plank, bear stance

**Tissue dysfunction** - Foam roller internal rotation and external rotators

**Glute stabilization** - Glute Medius mm. - clam shells, lateral band walks, glute bridge with rotation, side bridge, bulgarian squats
Adductor Plank test

Evaluating: strength and endurance of adductor

Leg is placed on box and held

Can place knee on table top at first

30 Seconds is Normal

Goal is 30 sec bilaterally

Adductor plank test - rehab

Position: Side lying position with leg supported

Raise for 3 seconds concentric movement

Lower for 3 seconds

Watch for side flexion of the torso

Start with 1 rep of 3 sets progress

Goal is 3 sets of 15 reps
**Dorsiflexion test**

Evaluates for proper dorsiflexion
Needed for squats, running,

Position: patient in half kneeling, rod/wall is placed one fist away from foot, knee protrudes over 2nd and 3rd digits
Pass: able to reach rod or wall,
Can use Inclinometer, normal is 48 degrees

**Dorsiflexion rehab**

Foam roller to calf
Tri planar stretch
Single leg RDL
Ankle Dorsiflexion test

P: able to reach dowel
F: unable to reach dowel or wall

Single leg stance
Evaluate for proprioception
Position: patient stands on one leg
Other leg at 90 degrees
Single leg normals

<table>
<thead>
<tr>
<th>AGE (Years)</th>
<th>EYES OPEN (Seconds)</th>
<th>EYES CLOSED (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-59</td>
<td>29.30</td>
<td>21-28.8 (25 Sec. Ave.)</td>
</tr>
<tr>
<td>60-69</td>
<td>22.5 Ave.</td>
<td>10</td>
</tr>
<tr>
<td>70-79</td>
<td>14.2</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Calculation method: Pt Result / norm from Table x 100 = \( \text{6h} \)

**Example:** 45yo Pt result (eyes closed)) = 6 sec.; \( \frac{6}{25} \times 100 = 24\% \) (transfer to Form: Exercise Screen Results pg 19)


Single leg correction

Bird dogs

Half kneeling- static, lifts, chops

By the wall
**Plank test**

Position: patient in plank position on elbows and holds

Evaluate for abdominal muscle endurance; been associated with neck, hip, knee, back pain

Normal data varies (goals for patients)

120 sec is about average through data

60 sec for non athlete

90 for moderate

120 for athlete

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**Train endurance**

8 sec holds, no need to really train over 20 sec planks.

Think about overall time rather than one endurance.

Test for re evaluation.

Reverse pyramid: 8 reps x 8 sec, then 7 reps at 8 sec, then 6 reps, then 5 reps, then 4 reps...
Horizontal plank

Lateral or frontal abdominal endurance

Patient in side lying plank: elbow under shoulder, top foot in front of other

Hold

Males: 95 sec

Female: 75 sec

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### Normative Data: The Horizontal Side Bridge

<table>
<thead>
<tr>
<th>Task</th>
<th>Men</th>
<th></th>
<th></th>
<th>Women</th>
<th></th>
<th></th>
<th>All</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Ratio</td>
<td>Mean</td>
<td>SD</td>
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<td>Mean</td>
<td>SD</td>
<td>Ratio</td>
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<tr>
<td>Extensor</td>
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<td>51</td>
<td>1.0</td>
<td>189</td>
<td>60</td>
<td>1.0</td>
<td>177</td>
<td>60</td>
<td>1.0</td>
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<td>Flexor</td>
<td>144</td>
<td>76</td>
<td>0.99</td>
<td>149</td>
<td>99</td>
<td>0.79</td>
<td>147</td>
<td>90</td>
<td>0.86</td>
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<tr>
<td>Side Bridge, Rt</td>
<td>94</td>
<td>34</td>
<td>0.64</td>
<td>72</td>
<td>31</td>
<td>0.38</td>
<td>81</td>
<td>34</td>
<td>0.47</td>
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<tr>
<td>Side Bridge, Lf</td>
<td>97</td>
<td>35</td>
<td>0.66</td>
<td>77</td>
<td>35</td>
<td>0.40</td>
<td>85</td>
<td>36</td>
<td>0.5</td>
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</tbody>
</table>

**Average:**

- Men: 146 sec = 95
- Women: 189 sec = 75

Calculation method: Pt Result / norm from Table x 100 = ______ %

**Example:** Male Pt result = 43 seconds; 43/95 x 100 = **45%** (transfer to Form: Exercise Screen Results pg 19)

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Horizontal plank

Same 8-15 sec holds building over time

Reverse pyramid

**Progressions/regression:**

Start at side position

Knees for support

Add in rotations

<table>
<thead>
<tr>
<th>Test</th>
<th>Motor control</th>
<th>Range of motion</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glute bridge SL</td>
<td>Core</td>
<td>Hip extension</td>
<td>Glute</td>
</tr>
<tr>
<td>Hip IR</td>
<td>Core</td>
<td>Hip internal rotation</td>
<td></td>
</tr>
<tr>
<td>Adductor</td>
<td>core</td>
<td>adductor</td>
<td>Adductor</td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td>core</td>
<td>gastroc / soleus</td>
<td>Foot</td>
</tr>
<tr>
<td>Single leg</td>
<td>core</td>
<td></td>
<td>Foot</td>
</tr>
<tr>
<td>Plank</td>
<td>Core</td>
<td>Thoracic spine</td>
<td>Core sagittal plane</td>
</tr>
<tr>
<td>Horizontal plank</td>
<td>core</td>
<td></td>
<td>Frontal plane</td>
</tr>
</tbody>
</table>
Better movement
“Take away the hammer” training

Squats - transitional
To and from the ground
Hip hinge

Sit to stand
Place at edge of seat
Eyes on corner of a wall
Rise from seat with spine straight
Movement through hip
To and from the floor

Get ups or down

1. Standing to lunge
2. Lunge to tall kneeling
3. Tall kneeling to quadruped
4. Quadruped to side or prone

Pick up off ground

Dowel to develop hip hinge

Weight to instill movement


10. ACL Injury Mechanisms and the Kinetic Chain Linkage: The Effect of Proximal Joint Stiffness on Distal Knee Control during Bilateral Landings

Jordan Cannon *1 MSc, Edward DJ Cambridge BKin, PhD(c), and Stuart M McGill PhD