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A Comprehensive Review of Current Physical Therapy Treatment for the Lumbar Spine

Ellie Pong, DPT, MOTR/L

Learner Outcomes

As a result of this course, participants will be able to:

1) ...discuss difficulties in selecting effective physical therapy treatments for patients with low back pain; define the terms “clinical prediction rules” and discuss their uses and pitfalls.

2) ...identify conclusions of recent systematic reviews of conservative treatments for patients with low back pain, as presented in this course, while participating in reflection and critical thinking question and answer opportunities throughout the course, in order to recognize limitations in the evidence.

3) ...discuss current knowledge in conservative treatments for patients with low back pain, state the potentials and limitations of these treatments, and confidently incorporate selected treatments for this pathology in their clinical practice.
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Introduction

- A popular opinion among many healthcare practitioners and payers is that the majority of patients with low back pain will eventually get better no matter what you do.
- Evidence supports that pain and disability from a first episode of acute low back pain does resolve by itself in the short term (Hides, Jull & Richardson, 2001).
Introduction

- This follows what we usually see in practice. Unless first-episode acute back pain was caused by a significant injury such as sports, or on-the-job, the patient often does not see the physician.

- Some of these patients may see the primary care physician to receive palliative medications. They do not return to the physician unless the pain persists.

Introduction

- Those who return to the physician may be referred to physical therapy for palliative care; however, more often the injury is then thought to be severe enough to warrant films and referral to a specialist.
Introduction

• What the proponents of the “back pain is self-limiting no matter what you do” belief fail to consider is that the course of low back pain is that of recurrence rather than our usual definition of acute or chronic. Injure, heal, then reinjure...the cycle repeats with acute and chronic phases repeating, often becoming progressively severe with time.

Introduction

• Although we will explore palliative treatments in this course, most of the treatment and evidence presented will be appropriate to patients with chronic phases of recurrent low back pain, or continuous chronic low back pain.
Clinical Prediction Rules

• When we treat patients with peripheral pathologies, such as rotator cuff tears, distal radius fractures, and sprain of the anterior talofibular ligament, we often treat in a tissue-specific fashion. This is not true 100% of the time; however, it is often.

Clinical Prediction Rules

• When we treat people with low back pain, both conservatively and post-operatively, often the pathologies involve many tissues. For example, I have anterolisthesis Grade II at L5 on S1, a herniated disc at L3/4, and hypermobility of the right sacroiliac joint.
Clinical Prediction Rules

• Furthermore, what is visible on the MRI is not necessarily what is causing the patient’s pain and dysfunction.

Clinical Prediction Rules

• Suppose that I am your patient, with my back pain due to multiple tissue-specific pathologies.
  – Can you then select a treatment that is proposed to be helpful for patients with herniated discs?
  – Or should you choose those helpful for patients with anterolisthesis?
  – If I perform an extension-based exercise program for the herniated disc, I will increase the pain from the anterolisthesis.
  – Can you really choose treatments based only on the tissue involved?
• With many patients, we are often not told what the specific pathology is.
Clinical Prediction Rules

• More recent studies of best treatment practice for patients with low back pain have attempted to define a set of rules or standards that will suggest, based on evidence, that patients whose signs and symptoms match these rules will benefit from a specific treatment.
• These are called “Clinical Prediction Rules” (CPR).

Clinical Prediction Rules

• These CPRs are not infallible and are not meant to be used as a cookbook. In fact, studies often conflict in support of specific rules.
• Throughout this course, I will present CPRs specific to treatments, as I am able to find them, to further guide our treatment choices.
Layout of Conservative Treatments

- Exercises
  - Stretching/flexibility
  - Stabilization
    - Motor retraining
  - Strengthening
- Manual therapies
  - Bones and joints
  - Soft tissues
- Modalities
- Alternative and experimental

Exercises

- Currently, exercises are not recommended for patients with *acute* low back pain, with a few exceptions.
  - Hides and associates (2001) tested long term (up to 3 years) effects of basic (multifidus work on stable surfaces) stabilization exercises in patients with first-time acute low back pain, finding that specific exercises may be more effective in reducing recurrences of low back pain than medical management alone.
  - Note the emphasis on “specific” exercises. The immediate goal is to avoid increasing pain or injury.
Exercises

• Another exception:
  – Jang and associates (2015) tested basic t’ai chi exercises versus a stretching program in their abilities to enable posture maintenance with lesser force, improve balance ability, and decrease low back pain, in young women with acute low back pain.

  Results were positive for both, but greater for the t’ai chi group.

Exercises

• A systematic review and meta-analysis of randomized controlled trials was recently published, exploring exercise interventions for the treatment of chronic low back pain compared to modalities, massage, manual therapy, and wait (no physical therapy treatment) (Searle, Spink, Ho & Chuter, 2015).

• Their results suggested that strength/resistance and coordination/stabilization exercise programs have superior results in decreasing pain over other interventions in the treatment of chronic low back pain (Searle, Spink, Ho & Chuter, 2015).
Exercises: Stretching/Flexibility and Mobility Exercises

• Clinical Prediction Rules for Stretching/Flexibility exercise treatment in patients with low back pain.
  – After lengthy searching, I was unable to locate established CPR for the specific intervention of stretching/flexibility exercises in patients with low back pain, even consulting Glynn and Weisbach’s (2011) reference manual *Clinical Prediction Rules, A Physical Therapy Reference Manual*.  
  – At this time, published CPRs for treatment of low back pain appear to be limited to manual therapy/manipulation and to stabilization exercises.

Exercises: Stretching/Flexibility and Mobility Exercises

• Additionally, it is difficult to find the effectiveness of stretching as an isolated intervention.
  – Stretching is normally part of a larger treatment program.
  – Favorably reported in the literature for effective LBP when combined with strengthening.
  – Most evidence for mobility exercises focuses on the repeated movements and stretches advocated by McKenzie, or on the self-mobilization techniques of Mulligan (Kennedy & Levesque, 2015).
Exercises: Stretching/Flexibility and Mobility Exercises

• As far back as the 1980s, the literature has suggested that lumbar and hip muscle tightness are present in patients with LBP (Kennedy & Levesque, 2015).
• We, as a profession, have been dilatory in providing evidence to support this suggestion. Indeed, Borman and peers demonstrated that success in hamstring lengthening made no change in lumbar mobility or curvature.
• Currently, many therapists include hamstring, hip flexor, and tensor fasciae latae stretches in exercise programs for low back pain, and this may be by rote or cookbook, rather than thoughtful application.

Exercises: Stretching/ Flexibility and Mobility Exercises

• So let us talk about this.
  – Does stretching really add length, additional sarcomeres, to the hamstrings? And is this accomplished with 30 second stretches?
  – If this is the case, then why are serial casting, dynamic splinting, and z-plasty surgery employed to lengthen muscles?
• I will share my opinion, based only on my knowledge of this subject.
  – No, I do not believe that 30 second stretches (or what I have seen more often, 10 second stretches performed reluctantly and with incorrect form in the clinic and possibly or possibly not performed at home) add measurable actual length to the muscle.
Exercises: Stretching/Flexibility and Mobility Exercises

- So what is it we are seeing when the patient is able to touch fingertips to the floor after a week of stretching?
  - I believe that the difference is the ability to access the full length or greater length of the muscle than before the stretching began. This is a functional, rather than a structural, change.
  - Our stretches performed for 2 minutes and less do seem to allow relaxation of the muscle.
  - If the muscle is relaxed, more of its true length may be utilized.
  - Perhaps this is a reason why increases in hamstring muscle “length” have not shown a cause and effect with changes in lumbar mobility or curvature.
Exercises: Stretching/Flexibility and Mobility Exercises

• Does this mean that we should omit stretching from treatment for low back pain?
  – Is a relaxed muscle likely to pull less on a painful joint/muscle/other tissue?
  – Are the stretches we choose to use causing increased pain or injury to the patient?
  – Are we using them to add time to our charges for treatment, as “fillers?”

• Until high quality studies are performed in this area, it is too early to say that stretches are not helpful in a treatment program for low back pain.

Exercises: Stretching/Flexibility and Mobility Exercises

• Which stretching exercises are recommended?
  – Very few specific stretches have been supported in the literature.

  • Therapist assisted hamstring stretching (Kennedy & Levesque, 2015)
  • Jackknife hamstring stretch (Sairyo et al., 2013)
  • Lunge and propped prone hip extension to stretch hip flexors (Kennedy & Levesque, 2015)

• At times a list of ideas is helpful (following).
Exercises: Stretching/Flexibility and Mobility Exercises

- *Note: these recommendations also contain mobility exercises included in protocols by McKenzie.* (Kennedy & Levesque, 2015)

<table>
<thead>
<tr>
<th>TO FACILITATE LUMBAR EXTENSION</th>
<th></th>
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<tbody>
<tr>
<td>Prone press-up</td>
<td></td>
</tr>
<tr>
<td>Prone unilateral leg lift</td>
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<tr>
<td>Supine anterior pelvic tilt</td>
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<tr>
<td>Quadruped extension</td>
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<tr>
<td>Standing back arch</td>
<td></td>
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<tr>
<td>Forward lean at wall</td>
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<tr>
<td>Self-mobilization</td>
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- Progressions – elbows, full press up on hands, symmetrical, unilateral/ diagonal

Exercises: Stretching/Flexibility and Mobility Exercises

(Kennedy & Levesque, 2015)

<table>
<thead>
<tr>
<th>TO FACILITATE LUMBAR FLEXION</th>
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<tbody>
<tr>
<td>Supine knee to chest</td>
<td></td>
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<tr>
<td>Pelvic tilt</td>
<td></td>
</tr>
<tr>
<td>Forward curl</td>
<td></td>
</tr>
<tr>
<td>Jackknife</td>
<td></td>
</tr>
<tr>
<td>Quadruped</td>
<td></td>
</tr>
<tr>
<td>Flexion over end of bed</td>
<td></td>
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<tr>
<td>Self-mobilization</td>
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- Double, single
- Supine to full curl up; standing
- Sitting, with therapy ball; standing
- Flexion “angry cat”; quadruped with sit-back in “child’s pose”
- Utilize contract-relax
- Use of hand or strap to localize
### Exercises: Stretching/Flexibility and Mobility Exercises

(Kennedy & Levesque, 2015)

<table>
<thead>
<tr>
<th>TO FACILITATE LUMBAR SIDE-FLEXION</th>
</tr>
</thead>
</table>
| Standing lateral glide 
automobilization / stretch         |
| Side-lean into wall               |
| Side-flexion in child’s pose      |
| Pole side-flexion                 |
| Lateral pelvic tilt/ hip hike-drop
in supine and standing             |
| Side-lying                        |
| Legs drop over the edge of the bed|
| Over a roll/bolster               |
| With arms overhead                |

### Exercises: Stretching/Flexibility and Mobility Exercises

(Kennedy & Levesque, 2015)

<table>
<thead>
<tr>
<th>TO FACILITATE LUMBAR ROTATION</th>
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<tbody>
<tr>
<td>Quadruped</td>
</tr>
<tr>
<td>Thread the needle</td>
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<tr>
<td>Pole rotation</td>
</tr>
<tr>
<td>Spinal twist</td>
</tr>
<tr>
<td>Supine</td>
</tr>
<tr>
<td>Side-lying</td>
</tr>
<tr>
<td>Rotation with chair/wall assist</td>
</tr>
<tr>
<td>Diagonal rotation in standing</td>
</tr>
<tr>
<td>Into flexion (towards floor)</td>
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<tr>
<td>Into extension (overhead)</td>
</tr>
</tbody>
</table>
Exercises: Stretching/Flexibility and Mobility Exercises

• Jackknife Stretch (Sairyo, et al., 2013)
  – In the starting posture, the patient squats while holding his/her ankle joints with the hands.
  – The patient then gradually extends the knee joints while maintaining contact of chest and thighs.
  – Maximum extension is reached when the quadriceps femoris are at maximal contraction.
  – The maximum extension position is held for 5 seconds.
Exercises: Stretching/Flexibility and Mobility Exercises

• A new direction in stretching: surface electromyographic biofeedback assisted stretching (SEMGAS) for the treatment of chronic low back pain
  — Was explored in a case series by Moore, Mannion, and Moran (2015).
    • Their conclusion: SEMGAS used alone, with a limited dose, can be effective at improving impaired flexion relaxation (FR) in some individuals with chronic LBP

Exercises: Stretching/Flexibility and Mobility Exercises

• What is flexion relaxation?
  — “Flexion Relaxation (FR) is a muscle activation pattern where lumbar paraspinal muscle activity decreases near maximal voluntary flexion (MVF).”
  — “FR is commonly attributed to the change in spinal load bearing structures from the muscles, which contract eccentrically to control the flexion movement, to the passive structures including spinal ligaments, discs and fascia”
  — “As the posterior passive ligaments become increasingly tensioned during flexion, stretch receptors located in those posterior elements produce a reflex, which acts to inhibit the paraspinal muscles”

(Moore, Mannion & Moran, 2015, p. 9)
Exercises: Stretching/Flexibility and Mobility Exercises

• What is flexion relaxation, cont.
  – “Individuals with chronic low back pain (LBP) commonly display abnormal FR, maintaining substantial muscle activity at MVF.”
  – “Absent FR can reportedly identify 86-89% of chronic LBP patients from asymptomatic individuals”
  – “While a reduced FR response appears to present as a positive adaptive response to acute injury, acting as a biological splint, aberrant muscle patterns and persistent activation may also partly contribute to the chronicity of chronic LBP”
  (Moore, Mannion & Moran, 2015, p. 9)

Exercises: Stretching/Flexibility and Mobility Exercises

• Surface electromyographic biofeedback assisted stretching...what did they do?
  – “With electrodes placed and real-time visual feedback displayed on a monitor, participants were directed to ‘slowly flex their neck and bend forward with their knees slightly bent, as if to touch their toes’. When they felt a gentle stretch in their low back, they were to stop the bending movement and concentrate on relaxing the muscles in their back” (Moore, Mannion & Moran, 2015, p. 10).
Exercises: Stretching/Flexibility and Mobility Exercises

– The stretch performed 3 times with 30 second holds. Date was recorded in real time. The researcher’s verbal cues to the patient included instructions to relax during the stretch (Moore, Mannion & Moran, 2015).

Exercises: Stretching/Flexibility and Mobility Exercises

• Mobility Exercises by McKenzie
  – I have included selected McKenzie mobility exercises in the previous tables.
  – It is beyond the scope of this course to instruct the complete program of diagnosis and treatment techniques created by Robin McKenzie (1931-2013) in the 1950’s.
  – A practitioner who desires to become truly proficient in McKenzie techniques is advised to go to the source, the McKenzie Institute, where six complex courses are offered. http://mckenzieinstituteusa.org/courses.cfm
Exercises: Stretching/Flexibility and Mobility Exercises

• Mobility Exercises by McKenzie
  – Currently, a randomized placebo-controlled trial is underway, comparing the McKenzie mobility exercise method to sham ultrasound and sham shortwave, with patient responses followed for up to 12 months.

  This study will hopefully provide additional evidence to guide us in selection of exercise treatments for patients with low back pain (Garcia et al., 2015).

Exercises: Stabilization

• Clinical Prediction Rules to identify patients with chronic low back pain who are likely to demonstrate at least short term benefits from spinal stabilization exercises were developed by Hicks and associates in 2005, and further tested in 2014 (Rabin, Shashua, Pizen, Dickstein, & Dar, 2014).

  • Although current studies have not yet validated these CPRs, they are worthy of discussion here.
Exercises: Stabilization

• CPRs developed by Hicks and associates:
  (1) age less than 40 years
  (2) average straight leg raise (SLR) of 91° or greater
  (3) the presence of aberrant lumbar movement
  (4) a positive prone instability test

  “When at least 3 of the 4 variables were present, the positive likelihood ratio for achieving a successful outcome was 4.0, increasing the probability of success from 33% to 67%” (Rabin et al., 2014, p. 7).

Exercises: Stabilization

2. Average straight leg raise (SLR) of 91° or greater.

(quotations)

The Straight Leg Raise Test takes place with the in supine position, upon a horizontal examination table.

The examiner lifts the patient's leg while keeping the knee in extension; the patient’s knee is stabilized with examiner’s cranial hand while lifting the patient's leg (from the heel) with his caudal hand.

The hip flexion maneuver ends either when the patient notes the beginning of typical pain or when hip flexion of 90° is reached (Capra et al., 2011, p.233).
Exercises: Stabilization

Average straight leg raise (SLR) of 91° or greater.

An angular goniometer is applied at the level of the greater trochanter to measure the value of hip flexion in positive findings.

The basic SLR test is not performed in association with cervical flexion, dorsiflexion of the ankle, or internal hip rotation.

The test is interpreted as positive if the pain is reproduced in the sciatic nerve distribution distal to the knee (Capra et al., 2011, p.233).
Exercises: Stabilization

3. The presence of aberrant lumbar movement

(quotations)

In a standing position, the subject was asked to flex the trunk forward as far as possible while the examiner observed in an effort to identify any of the following abnormalities:

1. Painful arc in flexion: symptoms felt during the movement at a particular point in the motion (or through a particular portion of the range) that are not present before or after this point.

2. Painful arc on return: symptoms occur only during return from the flexed to the erect position (Hicks, Fritz, Delitto & Mishock, 2003, p.1863).

Exercises: Stabilization

The presence of aberrant lumbar movement, cont.

3. Gower sign (“thigh climbing”): pushing on the thighs or another surface with the hands for assistance during return from the flexed to the erect position.

4. Instability catch: any sudden acceleration or deceleration of trunk movement or movement occurring outside the primary plane of motion (eg, lateral bending or rotation during trunk flexion).

5. Reversal of lumbopelvic rhythm: on attempting to return from the flexed position, the patient bends the knees and shifts the pelvis anteriorly before returning to the erect position (Hicks, Fritz, Delitto & Mishock, 2003, p.1863).
Exercises: Stabilization

4. A positive prone instability test

First, we must explain the technique for Passive Intervertebral Motion Testing, as this is utilized to perform the Prone Instability Test.

(Quotation)

- With the subject in the prone position, segmental mobility testing is performed by placing the hypothenar eminence of the testing hand over the spinous process of the segment to be tested.
- With the elbow and wrist of the testing hand extended, the examiner applies a gentle, but firm, anteriorly directed pressure on the spinous process.
- Two judgments are made at each spinal level: segmental mobility and pain provocation (see article for additional details) (Hicks, Fritz, Delitto & Mishock, 2003, p.1863).
Exercises: Stabilization

4. **A positive prone instability test**

(quotation)

- The subject is prone with the torso on the examining table and legs over the edge with the feet resting on the floor.
- While the subject rests in this position, the examiner performs passive intervertebral motion testing as previously described.
- The patient is asked to report any provocation of pain.

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Exercises: Stabilization

**A positive prone instability test, cont.**

(quotatation)

- The subject then lifts the legs off the floor (handholding to the table may be used to maintain position), and the passive intervertebral motion testing is reapplied to any segments that were identified as painful.
- A positive test occurs when pain is provoked during the first part of the test but disappears when the test is repeated with the legs off the floor (Hicks et al., 2003, p. 1683).
Exercises: Stabilization

A positive prone instability test, cont.

Exercises: Stabilization

Now then...does this mean that if your patient is 50 years of age, you should not utilize stabilization exercises as a treatment?

REMEMBER that clinical prediction rules are, like most rules, created based on needs of many rather than needs of individuals. Let us not forget that we are treating patients, not spines, and each patient is a person, an individual, not a pathology.
Exercises: Stabilization

With that said, think about the job of the muscular stabilizers of the spine, and realize that in the case of an anterolisthesis or global lumbar instability, the muscles must do their jobs more efficiently than they were designed to do. They are working overtime to compensate for the structural defect.

Is there an age group that might have difficulty developing muscles to that degree? Why?

What can you do about this? A good compensatory adjunct to treatment with stabilization exercises will be discussed later in Alternative Treatments.

Exercises: Stabilization

- The systematic review by Searle and associates (2015) found that stabilization exercise programs featured focused on strengthening muscles believed to be essential for core stability:
  - lumbar multifidus
  - transversus abdominus

- Additional studies added two additional muscle groups (Kennedy & Levesque, 2015):
  - pelvic floor
  - diaphragm
Exercises: Stabilization

• Layers of the lumbar multifidus, from left: deep fascicles; intermediate fascicles, superficial fascicles.

Exercises: Stabilization

• Multifidus...the filet mignon.
Exercises: Stabilization

- Transversus abdominis =

Exercises: Stabilization

- Pelvic floor muscles:
  - Puborectalis
  - Pubococcygeus
  - Iliococcygeus
  - Coccygeus
  - Piriformis
  - Obturator internus
Exercises: Stabilization

“There is evidence that these muscles contribute to lumbo-pelvic stability and segmental stiffness and assist with support of the spine when stability is challenged. ⁶⁵ People with chronic low back pain have demonstrated delayed or decreased activation of these muscles ⁶⁶, ⁶⁷ and a loss of the normal tonic activation of tranversus abdominus during gait and extremity movement ⁶⁸” (Searle et al., 2015, p. 1163).

Exercises: Stabilization

• So...in which exercises can we have some level of confidence that they are helpful in the problem of chronic low back pain? Is there an order that is most helpful?
• Costa and associates (2009) described a stabilization and motor control program consisting of two stages.
Exercises: Stabilization

• “Stage 1: Train coordinated activity of the trunk muscles, including independent activation of the deeper muscles (including transversus abdominis and multifidus) and reduce overactivity of specific superficial muscles in an individualized manner” (Costa et al., 2009, p. 1277).

Exercises: Stabilization

• “Stage 2: Implement precision of the desired coordination and train these skills in static tasks and incorporate them into dynamic tasks and functional positions” (Costa et al., 2009, p. 1277).
Exercises: Stabilization

- Based on programs described by Costa and others, Kennedy and Levesque (2015) recommended the following basic stabilization exercises for the transversus abdominis muscle:
  - Abdominal draw-in maneuver (ADIM)
  - ADIM with lower limb challenges
  - Abdominal curl-up (with progressions)

Exercises: Stabilization

- Abdominal draw-in maneuver (ADIM), using pressure cuff to self-monitor.
Exercises: Stabilization

– ADIM with lower limb challenges

Kennedy and Levesque (2015) also recommended the following basic stabilization exercises to activate the multifidus muscles:

– Bridge exercises in supine
– Quadruped activation
– Side plank/horizontal side support activation
– Front plank/prone bridge activation
Exercises: Stabilization

– Bridge exercises in supine

Exercises: Stabilization

– Quadruped activation
Exercises: Stabilization

– Side plank/horizontal side support activation

Exercises: Stabilization

– Front plank/prone bridge activation
Exercises: Stabilization

- How do we progress from static surface stabilization exercises?
- Chung, Lee, and Yoon (2013) showed that stabilization exercises performed by patients with chronic low back pain, using the small plyoball, can increase the cross sectional area of the multifidus segments, provide pain relief, and facilitate recovery from functional disorders.
- Specifically, the increases in the cross sectional area of the multifidi were significant at the L4 and L5 segments.

Exercises: Stabilization

- 1) “In a supine position, the subject placed a ball below the neck, bent the knees, and crossed and bent 90° the arms so that the crossed arms came to the eye level. While breathing out, the subject slowly raised each lower limb in turn. The subject performed the motion of bending the hip joint and the knee joint 90° five times, for 10 seconds each time” (Chung et al., 2013, p. 535).
Exercises: Stabilization

• #1

Exercises: Stabilization

• 2) “In a supine position, the subject placed a ball below the pelvis, bent the knees, and crossed and bent 90° the arms so that the crossed arms came to the eye level. The subject performed the motion of pressing the ball below the pelvis slowly with the pelvis five times, for 10 seconds each time” (Chung et al., 2013, p. 535).
Exercises: Stabilization

• #2

Exercises: Stabilization

• 3) “In a crawling position, the subject placed a ball below one knee and kept the toes away from contact with the floor. The subject balanced first to stabilize the posture and slowly raised the other lower limb. This exercise was performed in turn for the two lower limbs 10 times, for 10 seconds each time” (Chung et al., 2013, p. 535).
Exercises: Stabilization

• #3

Exercises: Stabilization

• 4) “After assuming a prone position, the subject placed a ball in front of the pelvis and raised both lower limbs. As if kicking, the subjects repeatedly raised and lowered the two lower limbs alternately. The subject performed this exercise 10 times, for five sets, taking a rest of at least 15 seconds between each set” (Chung et al., 2013, p. 535).
Exercises: Stabilization

• Kennedy and Levesque (2015) summarized the work of Czaprowski, Imai, and others in identifying more specifically which muscles are activated with stabilization exercises on the Swiss ball (plyoball) and stabilized half-ball, or BOSU®.
  – Prone bridge on Swiss ball
  – Side-bridge on Swiss ball or BOSU®
  – Supine bridge on Swiss ball or BOSU®
Exercises: Stabilization

• Prone bridge on Swiss ball
  – Highest rectus abdominis and external oblique muscle
    (global muscles, versus local stabilizers)
• Side-bridge on Swiss ball or BOSU®
  – Significant increase in activity of transversus abdominis and external oblique muscles
• Supine bridge on Swiss ball or BOSU®
  – Trunk muscle activity in this exercise is not changed from stable surface to unstable surface
  (Kennedy & Levesque, 2015)

Exercises: Stabilization

• What can we do with this information to guide our treatments?
  – For someone who is less able to participate in difficult or active exercises, such as the elderly or those whose pain significantly limits participation, the choice of a low-load, low muscle activity exercise, such as the supine bridge on stable or unstable surfaces is a good place to start.
  – Use the side-bridge exercise with unstable surface to generate the greatest abdominal activity in patients who can tolerate and benefit from more aggressive exercises.
Exercises: Motor Control and Retraining

• Certain exercise disciplines are difficult to classify according to stretching versus stabilization versus strengthening. They may contain all elements.
  – These are extremely functional, as the body in real tasks must meet concurrent challenges in flexibility, balance, stability, strength, and endurance.

Exercises: Motor Control and Retraining

• Three major disciplines:
  – Yoga
  – Pilates
  – T’ai Chi

• Currently, Pilates appears to lead the way in randomized controlled trials for treatment of patients with low back pain
Exercises: Motor Control and Retraining

- To date, Pilates has not shown significant differences versus general exercises or standard physical therapy in the treatment of chronic low back pain (Posadzki, Lizis & Hagner-Derengowska, 2011).

- Yet, as part of our reason for meeting today is to discuss actual treatments, I will list a physical therapy-modified and tested Pilates program for patients with chronic low back pain (Mostagi et al., 2015).

Exercises: Motor Control and Retraining

- An Eight Week Program (Mostagi et al., 2015)

- WEEK 1:
  - Presentation of the method and apparatus of Pilates.
  - Basic principles: concentration, control, centering, flow, precision and breathing.
  - Fundamental movements: breathing, pelvic bowl, knee sway, spinal bridge, twist, flight and cat (10 reps)
Exercises: Motor Control and Retraining

• An Eight Week Program (Mostagi et al., 2015)

• WEEK 2:
  – Fundamental movements: breathing, pelvic bowl, knee sway, spinal bridge, twist, flight and cat (10 reps)
  – Spine stretch (10 reps)
  – Saw (10 reps)
  – Hundred/dynamic with Swiss ball (10 reps)

Exercises: Motor Control and Retraining

• An Eight Week Program (Mostagi et al., 2015)

• WEEK 3:
  – Breathing (10 reps)
  – Pelvic bowl (10 reps)
  – Spine stretch (10 reps)
  – Saw (10 reps)
  – Hundred/dynamic with Swiss ball (10 reps)
  – Spinal bridge with flex ring (10 reps)
  – Rolling back (Cadillac/10 reps)
Exercises: Motor Control and Retraining

- An Eight Week Program (Mostagi et al., 2015)
- WEEK 4:
  - Breathing (10 reps)
  - Pelvic bowl (10 reps)
  - Spine stretch (10 reps)
  - Saw (10 reps)
  - Hundred/dynamic with Swiss ball (10 reps)
  - Spinal bridge with flex ring (10 reps)
  - Rolling back (Cadillac/10 reps)
  - Side arm sit (chair/10 reps)
  - Hamstring (chair/10 reps)

Exercises: Motor Control and Retraining

- An Eight Week Program (Mostagi et al., 2015)
- WEEK 5-6:
  - Breathing (10 reps)
  - Pelvic bowl (10 reps)
  - Spine stretch (10 reps)
  - Saw (10 reps)
  - Leg series (reformer/8 reps)
  - Hundred (reformer/8 reps)
  - Front split (reformer/8 reps)
  - Rolling back (Cadillac/8 reps)
  - Teaser (Cadillac/8 reps)
  - Bridge (Cadillac/8 reps)
  - Side arm sit (chair/8 reps)
  - Swan front (chair/8 reps)
  - Hamstring (chair/8 reps)
### Exercises: Motor Control and Retraining

- **An Eight Week Program**
  (Mostagi et al., 2015)
- **WEEK 7-8:**
  - Breathing (10 reps)
  - Pelvic bowl (10 reps)
    - Spine stretch (10 reps)
    - Saw (10 reps)
    - Swimming (10 reps)
    - Leg series (reformer/10 reps)
    - Hundred (reformer/10 reps)
  - Front split (reformer/10 reps)
  - Pulling straps (reformer/10 reps)
  - Mermaid (reformer/10 reps)
  - Rolling back (Cadillac/10 reps)
  - Teaser (Cadillac/10 reps)
  - Bridge (Cadillac/10 reps)
  - Swan front (chair/10 reps)
  - Hamstring (chair/10 reps)

### Exercises: Higher Level Strengthening

- Depending upon your clinical venue, you may not encounter many patients who can tolerate high level strengthening. Alternately, you may work exclusively with athletes and other patient populations whose lives have high physical requirements.
  - Exercises for these patients will vary considerably with specific physical demand.
  - Exercising at the higher level assumes that the patient has progressed excellently in strengthening the core stabilizers.
  - Now is the time to re-train the superficial muscle groups while continuing to engage the deep stabilizers.
Exercises: Higher Level Strengthening

- Although the choices for exercise tools used in higher level strengthening are myriad, remember that transfer of training can be questionable.
- Exercises need to be as specific and functional to that patient’s performance needs as possible.
- Consider as well, the magnitude of loading on the spine in regard to the tissue tolerance at any stage of healing.
  - “In quadruped position, a single leg lift creates around 2000 Newtons (N) of compression, an opposite arm and leg lift creates 3000 N, while a prone simultaneous bilateral arm and leg lift imposes over 4000 N of compressive force on the spine” (Kennedy & Levesque, 2015, p. 270).

Manual Therapy: Soft Tissues

- Massage...
  - I personally could force myself to endure a massage every day. They reduce my pain without medication. On two occasions, however, I have received massages that caused increased back pain for days. In those situations, the therapist did not understand the pathology of my lumbar spine, even when I discussed it.
- Any soft tissue technique must be considered carefully along with the suspected pathology, and even more important, feedback from the patient during the treatment.
- Remember...primum non nocere!
Manual Therapy: Soft Tissues

- Swedish massage
- Deep tissue massage
- Trigger point therapy
- Shiatsu massage
- Cross-friction
- Reflexology
- Relaxation massage
  - Effleurage
  - Petrissage
  - Kneading
  - Percussion
  - More...

Manual Therapy: Soft Tissues

  - Massage produced beneficial results for mechanical LBP when compared to acupuncture self-care/education, relaxation therapies, conventional physiotherapy, and placebo controls.
  - Massage therapy is an evidence-based addition to therapeutic exercise and education when treating patients with sub-acute and chronic LBP, providing immediate and short term post treatment decreases in pain and disability.
Manual Therapy: Soft Tissues

- Interestingly, Quinn’s 2008 randomized controlled trial of reflexology for low back pain was rated as one of only four high-quality studies included in Brosseau’s 2012 review.
- Reflexology may be considered to be a form of complementary and alternative medicine; however, it was included in Brosseau’s review along with Swedish massage, connective tissue release, myofascial trigger point techniques, and cross-friction massage.
  - Remember, Quinn’s study did not attempt to validate the theory of reflexology; it simply assessed patient response.

Manual Therapy: Soft Tissues

- Let us take a quick look then, at reflexology for low back pain in Quinn’s study. This is a specialized area of knowledge, thus I will not attempt to teach technique / treatment.
  - “Participants in the treatment group received precision reflexology involving a sequence of pressure massage which allowed stimulation of the numerous specific reflex points on the feet associated with organs throughout the body.
  - This method was based on that developed by Eunice Ingham\textsuperscript{20,21}; and is supported by the International Institute of Reflexology.
  - The reflexology treatment included the key points of the feet that are representative of the vertebrae of the spine and the surrounding musculature; these points are located along in inner edge of the two feet...” (Quinn, Hughes & Baxter, 2008, p. 4)
Manual Therapy: Soft Tissues

Reflex points for:
- Lower back
- Sacroiliac joint
- Pelvis
- Sciatic nerve

Manual Therapy: Soft Tissues

- Reflexology
Manual Therapy: Bones and Joints

• Clinical prediction rules for spinal manual therapy are probably the best-represented area of physical therapy in the literature today. There is disagreement among the studies, however.
  – Flynn et al., 2002, developed five clinical prediction rules for classifying which patients with low back pain will benefit from spinal manipulative therapy.

Manual Therapy: Bones and Joints

• **Flynn’s CPRs** (Flynn et al., 2002):
  – Duration of symptoms <16 days
  – Fear-Avoidance Beliefs Questionnaire (FABQ) work subscale score <19
  – at least one hip with > 35° of internal rotation range of motion
  – hypomobility in the lumbar spine
  – no symptoms distal to the knee.

• The presence of four of five variables in the prediction rule increased the likelihood of success with manipulation from 45% to 95%.
Manual Therapy: Bones and Joints

• *Flynn’s CPRs cont.*

"...the therapist performed a manipulation technique with the patient supine. The therapist stood opposite the side to be manipulated. The patient was passively side-bent away from the therapist. The therapist passively rotated the patient and then delivered a quick posterior and inferior thrust through the anterior superior iliac spine..." (Flynn et al., 2002, p. 2836).
Manual Therapy: Bones and Joints

• *Flynn’s CPRs cont.*
• Physical examination included:
  – “Range of motion and status change in symptoms with single lumbar movements were recorded. Supine straight-leg raise and prone hip rotation range of motion were measured. Posteroanterior spring testing was performed for pain provocation and mobility at each lumbar level. Mobility was judged as normal, hypomobile, or hypermobile. Numerous special tests proposed to be diagnostic of SI dysfunction were performed…” (Flynn et al., 2002, p. 2836).

Manual Therapy: Bones and Joints

• *Flynn’s CPRs cont.*
• Considerations…my experience.
  – Given the physical examination that Flynn performed, would I have been a candidate to benefit from this treatment? Remember…anterolisthesis grade 2, L5 on S1; hypermobile right sacroiliac joint; L3/4 disc pathology.
  – It seems that the tests would have ruled me out…if they had been performed.
  – But remember, the CPR does not specify mobility of the sacroiliac joints.
Manual Therapy: Bones and Joints

• *Flynn’s CPRs cont.*
• Considerations...my experience.
  – At the time I was evaluated for these CPRs, I met 4 out of 5...which should have been a 95% success rate.
  – This is where cookbooks must go out of the window and critical thinking, logic, and clinical experience must intervene.
  – I did not benefit from the global sacroiliac manipulation, and went home with first-time radicular symptoms in the right leg.

Manual Therapy: Bones and Joints

• Specific techniques
  – It is definitely not in the scope of this course to instruct anyone in the safe techniques of spinal mobilization and manipulation.
  – We will list techniques approved by Maitland and Hartman (Puenteedura, 2015) as beneficial when used specifically and proficiently to treat patients with chronic low back pain.
Manual Therapy: Bones and Joints

• Specific techniques
  – Central posterior-to-anterior mobilization
  – Unilateral posterior-to-anterior mobilization
  – Lumbar rotation mobilization: Grades I-IV
  – Lumbopelvic regional manipulation
  – Lumbar rotation in neutral or extension manipulation
  – Lumbar rotation in flexion manipulation

Modalities: Superficial Heat and Ice

• “The U.S. Agency for Healthcare Research and Quality guidelines found no evidence of benefit from the application of ice or heat for acute low back pain, however, recommended self-application of heat or cold for patients to provide temporary relief of symptoms” (French, Cameron, Walker, Reggars & Esterman, 2006, p.998).
• My question is, if there is NO BENEFIT from the application of ice or heat...then why is self-application recommended? Either it is useful or it is not, no matter who applies it.
  – Do you think that a financial aspect has driven the above statement by the U.S. Agency for Healthcare Research and Quality?
Modalities: Superficial Heat and Ice

- Superficial heat methods deliver heat by conduction or convection, elevating the tissue temperature, and achieving the greatest effect at 0.5 cm or less from the skin's surface (French, Cameron, Walker, Reggars & Esterman, 2006).

  - Superficial heat sources:
    - hot water bottles
    - heated stones
    - soft heated packs filled with grain
    - Poultices
    - hot towels
    - hot baths
    - Saunas
    - Steam
    - heat wraps
    - heat pads
    - electric heat pads
    - infra-red heat lamps

Modalities: Superficial Heat and Ice

- Cold therapy is used to reduce inflammation, pain, and edema, and is used both acutely for vasoconstriction and analgesia, and in the chronic stage for analgesia. (French, Cameron, Walker, Reggars & Esterman, 2006).

  Superficial cold sources:
  - cryotherapy
  - ice
  - cold towels
  - cold gel packs
  - ice packs
  - ice massage
Modalities: Superficial Heat and Ice

- **The basics:**
  - Therapists have utilized superficial heat and cold modalities for a very long time, without supportive evidence other than observation.
  - Dehghan and Farabod (2014) have attempted to provide evidence for use of the most basic of these modalities, a hot water bottle and an ice pack, on patients with acute low back pain.

Modalities: Superficial Heat and Ice

- *Dehghan and Farabod (2014) cont.*
  - Participants received either naproxen with hot water bottle, naproxen with ice pack, or naproxen alone.
    - The hot water bottles and ice pack treatments were applied to the low back twice a day for 20 minutes each session, for one week.
  - Results indicated that both heat and ice (plus naproxen) provided greater pain reduction by the fourth visit than naproxen alone, with application of heat resulting in the greatest benefit.
Modalities: Superficial Heat and Ice

• **What is new?**

• Petrofsky and associates (2014) tested the home use of commercial heat wraps in patients with acute low back pain, with the intention of reducing pain to increase compliance with the home exercise program.
  – ThermaCare heat wraps were self-applied and worn by the patient at home for 6 hours in between therapy clinic sessions.
    • Question – what physiological effects might be caused by 6 hours of continuous superficial heat?
    • Are any precautions in order here?

Modalities: Superficial Heat and Ice

• **Petrofsky (2014) commercial heat wraps cont.**
Modalities: Superficial Heat and Ice

*Petrofsky and associates (2014) cont.*

• Conclusions of the study:
  – “Use of sustained low-level heat wraps (ThermaCare) for 6 hours on days when therapy is not being accomplished for low back pain is associated with improved home exercise compliance, reduced pain and improved recovery in strength after 2 weeks of therapy. This was also evidenced in improved scores in standard clinical measures of back pain, the Roland-Morris and Oswestry questionnaires” (Petrofsky, Laymon, Alshammari, Khowailed & Lee, 2014, p. 433).

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Modalities: Superficial Heat and Ice

• *How can we use this information clinically?*
  – When we read a study such as Petrofsky (2014) presented, the first inclination is to tell our patients with low back pain to purchase this heat wrap and use it at home before performing their home exercises.
  – *Is this a good idea?*
  – *Is there a reason why patients with hot packs in the clinic are provided with a call bell and monitored throughout the treatment?*
Modalities: Superficial Heat and Ice

• *Let us look at the product label* (Pfizer.com, 2016, para. 2):
  
  — THIS PRODUCT CAN CAUSE BURNS.
  
  — 55 OR OLDER: YOUR RISK OF BURNING INCREASES AS YOU AGE
  
  — WEAR THERMACARE OVER A LAYER OF CLOTHING,
    NOT DIRECTLY AGAINST YOUR SKIN
  
  — DO NOT WEAR WHILE SLEEPING
  
  — CHECK SKIN FREQUENTLY DURING USE
  
  — IF YOU FIND IRRITATION OR A BURN, REMOVE
    PRODUCT IMMEDIATELY

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Modalities: Superficial Heat and Ice

• *Let us look at the product label, cont* (Pfizer.com, 2016, para. 3-5):

  — Do not use
    • if heat cell contents leak and/or wrap is damaged or torn
    • for more than 8 hours in a 24-hour period
    • with pain rubs, medicated lotions, creams or ointments
    • on unhealthy, damaged or broken skin
    • on areas of bruising or swelling that have occurred within 48 hours
    • on areas of the body where you can’t feel heat
    • with other forms of heat
    • on people unable to remove the product, including children, infants, and some elderly
    • on people unable to follow all use instructions
  
  — Ask a doctor before use if you have
    • DIABETES
    • poor circulation or heart disease
    • rheumatoid arthritis
    • or are pregnant
  
  — When using this product
    • check skin frequently for signs of burns or blisters - if found, stop use
    • if product feels too hot - stop use or wear over clothing
    • do not place extra pressure over the product such as leaning against hard surfaces, or wearing under tight clothing, a tight waistband or belt
    • to avoid increased risk of burns, remove product before undergoing any MRI (magnetic resonance imaging) procedures
Modalities: Superficial Heat and Ice

- We are not responsible for injury to a patient from this product when self-applied at home.
  - Are we?
  - Did we direct the patient to use this product?
  - Did our education and licensure as physical or occupational therapists qualify us to make this instruction for home care to the patient?
  - Again, is there a reason why patients receiving hot and cold modalities in the clinic are supervised?

Modalities: Superficial Heat and Ice

- Lewis and associates (2012) also tested use of a heat wrap on patients with low back pain, applied 2 hours prior to a testing session in the clinic.
  - It was hypothesized that the heat wraps would engender decreased muscle activity, which would be accompanied by increased stature recovery.
  - Muscle activity was measured by EMG throughout the study.
Modalities: Superficial Heat and Ice

• *Lewis and associates (2012) heat wrap cont.*
  – “The wrap appeared to have a positive short-term effect on disability, self-efficacy, catastrophizing, and pain-related anxiety. Changes in both stature recovery and muscle activity were found to be related to changes in a number of the psychological factors, confirming the link between the biomechanical and psychological outcome measures” (Lewis, Holmes, Woby, Hindle & Fowler, 2012, p. 372).

Modalities: Superficial Heat and Ice

• **What is new in cryotherapy?**
• **Whole Body Cryotherapy (WBC)**
  – This consists of single or repeated exposure(s) to extremely cold dry air (below -100°C or even -250°C) in a specialized chamber or cabin for two to four minutes per exposure.
    • Used to reduce muscle soreness after exercise
    • Used to reduce pain in rheumatic disorders and low back pain
Modalities: Superficial Heat and Ice

• Costello et al., 2015, conducted a Cochrane review of WBC, concluding:
  – There is insufficient evidence that WBC reduces post-exercise muscle soreness or improves subjective recovery.
  – Also expressed concern with the lack of evidence of potential adverse effects.

• On October 20, 2015, 24-year-old Chelsea Ake-Salvacion, was found deceased in a WBC chamber at a Las Vegas spa (Ho & Ritter, 2015).
  – The spa was not licensed by the city, county or state to perform cosmetic or other procedures, including WBC, which is reportedly currently unregulated.

• Yet use of WBC continues, as do studies on its benefits with diverse patient populations.

• For example, Giemza and Ostrowska (2015) reported that WBC was beneficial for chronic low back pain in elderly males.
  – This was a low quality evidence study.
  – Results were incorrectly generalized to entire population of patients with low back pain.

• WBC is now offered in some physical therapy clinics. (example: http://evophysicaltherapy.com/portfolio-view/whole-body-cryotherapy-wbc/)
Modalities: Electric Stimulation

• Transcutaneous electrical nerve stimulation (TENS)
  – Is there a therapist who has not used this modality?
  – Have any of you moved away from its use?
  – Do you think that some of your patients believe that the TENS treatment is producing a healing effect?
  – What exactly do you feel its purpose is in treatment of patients with low back pain?

Modalities: Electric Stimulation

• TENS cont.
• Khadilkar and associates (2013) conducted a Cochrane systematic review of studies that compared TENS versus placebo for chronic low-back pain.
  – Conclusion: The evidence from a small number of low-quality placebo-controlled trials was insufficient to support the use of TENS in the routine treatment of chronic LBP.
Modalities: Electric Stimulation

- *TENS cont.*
  - Does this mean that we should not continue to use TENS for these patients?
  - If you are using TENS to provide your patient with temporary analgesia against low back pain, your purpose may be to improve treatment tolerance, in cases of chronic pain. In cases of acute low back pain, your purpose may be simply palliative, which may assist with patient compliance.

Modalities: Electric Stimulation

- **Interferential Current (IFC)**
  - Similar to other electric modalities, no clinical prediction rules or definitive evidence of efficacy of IFC has been published to date.
    - Outcome measures are mostly subjective pain and disability scales.
  - Lara-Palomo and associates (2013) conducted a randomized controlled trial to determine short-term effects of interferential current electromassage in adults with chronic non-specific low back pain.
Modalities: Electric Stimulation

• *IFC cont*
• Lara-Palomo’s RTC...how did they use the IFC?
  – “The interferential current (Endomed 682 V, Enraf NONIUS Ibérica, Spain) was administered by bipolar application with a carrier frequency of 4000 Hz at constant voltage and amplitude modulation of 80 Hz.
  – The electro-massage was performed using two rubber electrodes (8 × 12 cm) to which sponges were fitted.
  – The sponges were dampened with water and then moved over the lumbar and dorsal–lumbar region for 30 minutes at stimulation intensity of 30–50 mA, which was always below the pain threshold of the patient.
  – Treatment comprised 20 sessions (twice a week)” (Lara-Palomo et al., 2013, p. 441).

Modalities: Electric Stimulation

• **H-WAVE**
• Blum and associates (2008) conducted a meta-analysis to determine if the H-Wave device is an effective and safe non-pharmacological analgesic for chronic pain.
  – “The findings indicate a moderate to strong effect of the H-Wave device in providing pain relief, reducing the requirement for pain medication and increasing functionality” (Blum et al., 2008, p. 644).
Modalities: Electric Stimulation

• *H-WAVE cont.*

• Two main ways to utilize H-Wave
  – Fast pulse with tolerable intensity
  – Low pulse with muscle twitch intensity

• Many theories exist on what physiological changes are accomplished; however, evidence is limited.

• My personal use of this device as a clinician has been that many patients prefer it and report superior analgesia, some with carryover, versus the TENS application.

Modalities: Electric Stimulation

• *H-WAVE cont.*

• Electrode placement for a patient with low back pain and radicular pain into left sciatic nerve
  – Fast pulse with tolerable intensity (green) over PSIS bilaterally
  – Gentle low pulse with muscle twitch intensity (blue) over piriformis and biceps femoris
  – Stronger pulse with muscle twitch intensity (red) over bilateral area of quadratus lumborum
Modalities: Electric Stimulation

• A brief word regarding use of functional electric stimulation (FES) / neuromuscular electric stimulation (NMES) in treatment of patients with low back pain.
  – Possible uses could be to enhance specific muscle strengthening *while* exercising
  – Challenges include contracting the correct muscles, as the transversus abdominis and multifidi will be overlain by global movers rectus abdominis and erector spinae, among others.

Modalities: Electric Stimulation

• (FES) / (NMES) in treatment of patients with low back pain.
  – You may see supporting evidence and specific technique guidance in the future.
  – Hicks and associates (Jan., 2016) published a randomized preliminary trial of trunk muscle training augmented with neuromuscular electrical stimulation in elderly adults with chronic low back pain.
    • Treatment was well tolerated and appeared to produce functional improvement
    • Larger trials are warranted
Modalities:
Lumbar Mechanical Traction

“The use of mechanical traction in the management of patients with acute or chronic low back pain (LBP) has generally not been endorsed by evidence-based practice guidelines.1–4 This lack of support is based on the results of randomized clinical trials that have examined heterogeneous samples of patients with LBP and failed to find any benefit for traction when compared with sham, placebo, or other treatments5–9” (Fritz et al., 2007, p. E793).

Modalities:
Lumbar Mechanical Traction

• Does anyone still use lumbar mechanical traction?
• According to a random sampling of 4,000 Orthopaedic Section members of the American Physical Therapy Association (Masdon & Hollman, 2015):
  – 76.6% of respondents stated that they use lumbar mechanical traction
  – 58.4% of the respondents used traction for patients with signs of nerve root compression
  – Delivery modes included manual methods (68.3%) and mechanical tables (44.9%)
  – Most often used as part of a comprehensive treatment plan
Modalities: Lumbar Mechanical Traction

• **Is this treatment doing what we think it is?**
• Santos and Ribiero (2011) assessed the height of patients before and after mechanical lumbar traction.
  – Healthy patients received 15 minutes of continuous traction (intensities were 10% and 50% of body weight), in two sessions one week apart.
  – Patient height was measured before and immediately after the traction and every five minutes for 30 minutes after traction treatment.

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Modalities: Lumbar Mechanical Traction

• **Santos and Ribiero (2011) cont.**
  – Both traction intensities produced a significant increase in stature; traction with 50% of body weight produced a greater increase than traction with 10% body weight (0.567 ± 0.049 vs. 0.298 ± 0.041 cm, p>0.001).
  – Height increase was maintained 10 mins after treatment with 50% of body weight used; it was maintained 5 mins after treatment when 10% of body weight was used.
• **What do you think of these results versus the effects you hope to achieve?**
Modalities:
Lumbar Mechanical Traction

- Kai, Pua and Lim (2009) developed a clinical prediction rule for classifying patients with low back pain who demonstrate short-term improvement with mechanical lumbar traction.
  - The CPR has not been validated.
- When all four factors are present, the probability of response rate with mechanical lumbar traction increased from 19.4 to 69.2%.

Modalities:
Lumbar Mechanical Traction

- Four variables:
  - non-involvement of manual work (demographic)
  - low level fear-avoidance beliefs (fear-avoidance beliefs questionnaire (FABQ) )
  - no neurological deficit (conducted on reflex and manual muscle testing (MMT) )
  - age above 30 years
Modalities:
Lumbar Mechanical Traction

- Kai, Pua and Lim (2009) CPR, cont.
- Exact treatment (quotation): (Cai, Pua & Lim, 2009, pp. 555-556)
  - A total of three lumbar traction sessions were given within 9 days using motorized mechanical lumbar traction (Triton DTS Traction System, The Chattanooga Group) in Fowler’s position (The patient is in supine with hip and knee 90 flexion).
  - The patient’s leg is supported by a stool with adjustable height) for patients were not flexion sensitive. Patients who were flexion sensitive were given traction in the supine position.
  - Traction force was determined by 30–40% of subject’s body weight.

Modalities:
Lumbar Mechanical Traction

- Kai, Pua and Lim (2009) CPR, cont.
- Exact treatment (quotation): (Cai, Pua & Lim, 2009, pp. 555-556)
  - Treatment duration is 15 min with 30 s on and 10 s off intermittent approach. For those subjects who could not tolerate the regime above, the traction force was reduced according to his/her tolerance.
Modalities:
Lumbar Mechanical Traction

  - Triton DTS Traction System, The Chattanooga Group

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Modalities:
Lumbar Mechanical Traction

- Earlier, in 2007, Fritz and associates attempted to identify a subgroup of patients with low back pain who would benefit from mechanical lumbar traction.
  - Found superior short-term results when traction was included in an evidence-based intervention for patients with low back and leg pain, with no differences present after 6 weeks of treatment.
  - A subgroup of two baseline variables were identified as having better outcomes from receiving traction; peripheralization with extension movements and a positive crossed straight leg raise test.
Modalities: Lumbar Mechanical Traction

• *Fritz 2007* Crossed Straight Leg Raise Test

As the examiner lifts the ipsilateral leg, radicular pain will be felt in the contralateral leg.

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Modalities: Lumbar Mechanical Traction

• *Fritz and associates (2007) cont.*

  – Mechanical traction: an adjustable table allowing for modifications of a subject’s position in flexion/extension, rotation or side-bending (3-dimensional ActiveTrac table, The Saunders Group, Inc.).

  – Traction was performed in prone.

  – The table was adjusted as needed to maximize centralization of the subject’s symptoms before beginning traction.

  – Static traction was applied for a maximum of 12 minutes (10 minutes at the desired intensity with 1-minute ramp up and ramp down time).

  – Intensity of the traction force was 40% to 60% of the subject’s body weight, adjusted based on the subject’s tolerance and symptom response.
Modalities:
Lumbar Mechanical Traction

  – After 3 minutes of traction, if the table was initially positioned in flexion or side bending/rotation, the table was repositioned as tolerated, with the goal of achieving a neutral or extended spinal position.
  – After completing the traction subjects remained in prone lying for at least 2 minutes, and then performed a set of active extension exercises (prone-press-ups) before resuming a weight-bearing position.
  – Subjects in the TRACT group could receive a maximum of 12 sessions during the 6-week treatment period (4 sessions per week for weeks 1–2, 1 session per week for weeks 3–6 during which only the EOTA intervention was received).

Modalities:
Lumbar Mechanical Traction

- The recent Cochrane database review exploring traction as a treatment for low back pain with or without sciatica was updated by Wegner and associates in 2013.
  – “These findings indicate that traction, either alone or in combination with other treatments, has little or no impact on pain intensity, functional status, global improvement and return to work among people with LBP” (Wegner et al., 2013, para. 11).
  – “To date, the use of traction as treatment for non-specific LBP cannot be motivated by the best available evidence. These conclusions are applicable to both manual and mechanical traction” (Wegner et al., 2013, para. 12).
Modalities: Ultrasound

• Recent (2013) study concludes that both phonophoresis (with capsaicin) and continuous ultrasound are beneficial to patients with chronic low back pain; however, there was no difference in outcome measures between the two types of ultrasound (Durmas et al, 2013).
  — Outcome measures assessed pain, disability, trunk muscle strength, walking performance, spinal mobility, QOL, and depression

Modalities: Ultrasound

• Phonophoresis therapy
  — Ultrasound device (Enraf–Nonius Sonopuls 434) was used. Initially, Gluco Gel containing capsaicin (10 % capsicum oleoresin in 0.22 % solution) was applied circularly with a thickness of 2–3 mm. Then, ultrasound with a 5-cm diameter applicator was applied over the paravertebral low back region with 1 MHz frequency and 1.5 Wt/cm² power. The treatment duration was 10 min [7] (Durmas et al, 2013, p. 1738).
Modalities: Ultrasound

• Ultrasound therapy
  – The patients also received continuous US using Enraf–Nonius Sonopuls 434 that operated at 1 MHz frequency and 1.5 W/cm² intensity and a transducer head with an area of 5 cm, an ERA of 4 cm, and a BNR of 1:5. Slow circular movements were applied by the transducer head over the paravertebral low back region. The treatment duration was 10 min [7] (Durmas et al, 2013, p. 1738).

Modalities: Ultrasound

• Considerations (Birmingham, 2006)
  – The area to be treated with therapeutic ultrasound/phonophoresis should be no larger than two to three times the size of the sound head.
  – A 5 cm² sound head was used.
  – Treatment area was the “paravertebral low back region” (Durmas et al, 2013, p. 1738).
  – Treatment area should have been no larger than 10 to 15 cm² (4-6”²). As the treatment time was 10 mins, it can be thought that each side received 5 minutes.
Modalities: Ultrasound

• Considerations
  – Are thermal US and phonophoresis valid? In this case, were tissues deeper than 2cm heated with the thermal US and did the capsaicin penetrate the skin and flesh greater than 2cm using the phonophoresis? In other words, does US do what we think it does, mechanically?
  – If we assume “yes” to the above question, then in reality, what was being tested for low back pain in this study was the effectiveness of heat (greater than 2cm depth) versus capsaicin to decrease pain or produce tissue changes that would allow significant differences in the outcome measures.

Modalities: Ultrasound

• Applications
  – When considering the use of non-thermal, thermal, or medicated ultrasound as treatment for low back pain, look at the uses of the end product: possible tissue healing versus deep heat versus effects of the specific medication chosen.
  – Acute: non-thermal, possibly NSAIDs or lidocaine to increase treatment tolerance or comfort
  – Chronic: thermal, possibly corticosteroid to resolve overlying inflammation, or lidocaine/capsaicin to increase treatment tolerance or comfort
Modalities: Ultrasound

• Applications (Birmingham, 2006)
  – Keep the treatment within the mechanical limitations of the ultrasound machine
    • Size of sound head versus size of treatment area
    • Considerations of varying absorption, reflection, and refraction per each type of tissue encountered in the treatment area
    • Depth of treatment area
    • Correct parameters in frequency MHz, intensity in w/cm², and pulse duration in %.

Modalities: Ultrasound

• Applications
  – Consider the specific goal:
    • What is the state of tissue in chronic versus acute conditions? When is heat appropriate? When is inflammation present?
    • Deep heat – chronic vs acute
    • Possible tissue healing effects – chronic vs acute
    • Specific choice of medication – corticosteroid vs NSAID vs temporary local anesthetic vs analgesic or counter-irritant
Modalities: Ultrasound

- Recommended reading for therapeutic ultrasound parameters and technique:

Belts, Corsets, Straps, and Gizmos

- **Lumbar belts** were the focus of assessment in the 1990s. I remember around this time seeing many workers in the home improvement stores walking around with these belts dangling, open, from various parts of their anatomy.
  - “The rationale for the use of these belts is based on the theory that they increase intra-abdominal pressure. Raised intra-abdominal pressure is believed to reduce compression forces on the spinal column and to assist the back extensor muscles in producing extension torque. The assistance of the belt is believed to protect the spine from injury” (Sullivan & Mayhew, 1995, p. 131).
Belts, Corsets, Straps, and Gizmos

• Lumbar belts cont.
• Although we still see these belts in the drugstores and other durable medical equipment sales, it appears that studies on the product ended in the 1990’s with the following judgment:
  – “The use of a lumbar belt does not enhance isometric lumbar muscle strength or dynamic lifting capacity” (Reyna et al., 1995, p. 68).

Belts, Corsets, Straps, and Gizmos

• Elastic lumbar corsets
• I was surprised to find studies on these items. I have been using this type of device for years, with excellent results. Without the evidence, let’s first talk about what the thing is trying to do:
  – The elastic support is tall, and covers from the pubis to just above the waist; short versions are not as helpful, although they are easier to wear.
Belts, Corsets, Straps, and Gizmos

• *Elastic lumbar corsets cont.*
• Consider a person who has an unstable spine
  – From spondylolisthesis
  – From global wearing and insufficiency of the lumbar facet joints
  – From global, advanced degenerative disc disease and collapse

Belts, Corsets, Straps, and Gizmos

• *Elastic lumbar corsets cont.*
• The spinal stabilizers must function beyond their normal capacity to stabilize the spine dynamically.
  – Is this patient usually young with excellent ability to build muscle?
  – Is it reasonable, then, to expect a middle-aged sedentary endomorph or a frail elderly male or female to build these muscles not only to full capacity, but beyond?
Belts, Corsets, Straps, and Gizmos

• Elastic lumbar corsets cont.
• There is no reason NOT to treat this patient with spinal stabilization exercises; however, recognize the need of this person for pain relief and increased function...now.
  – The patient may experience considerable pain relief and increased function by INTERMITTENT wearing of the correctly donned and fitted elastic lumbar corset.
    • Wear it for challenge activities – long term standing, bending, downhill walking, shopping, lifting

Belts, Corsets, Straps, and Gizmos

• Sacroiliac (SI) straps
• These might more properly be called belts; however, when you consider an abdominal corset and a lumbar belt, these are more like a large strap in height. In the literature they are mostly referred to as belts.
  – Yes, I have worn one, and wondered why some of my pain was instantly relieved and some was not. When I viewed the anterolisthesis (undiagnosed) of L5 on S1 on plain films for the first time, things became clear to me. The sacroiliac strap was alleviating the pain from my injured right sacroiliac joint; however, it was unable to provide support beyond that.
    • After trials of different belts/straps, I found one that helped most, which featured a front closure with the addition of two elastic fasteners pulled forward from the back for separate tension adjustment.
Belts, Corsets, Straps, and Gizmos

• Sacroiliac straps cont.
• So what dynamic effects do these provide beyond a firm hug around the pelvis?
• Jung and associates (2013) performed a pilot study to assess the effect of the pelvic compression belt (PCB) on hip extensor activation patterns of patients with SI joint pain during one-leg standing.

Belts, Corsets, Straps, and Gizmos

• Sacroiliac straps cont., Jung’s pilot study
  (Jung, Jeon, Oh & Kwon, 2013)
• EMG data was collected from the glute max and biceps femoris on the supporting leg during one-leg standing, assessed with and without use of the belt.
• In the patients with SI joint pain, the EMG amplitude of the biceps femoris was significantly decreased when wearing the pelvic compression belt.
• Additionally, premotor reaction time (RT) of the glute max of these patients was significantly decreased; the RT of the biceps femoris was increased.
• The authors concluded that this data supports the use of the PCB to favorably alter the activation patterns of the hip extensors among patients with SI joint pain.
Belts, Corsets, Straps, and Gizmos

• *Sacroiliac straps cont., Jung’s pilot study*
  (Jung, Jeon, Oh & Kwon, 2013)

  - SI belt used in Jung’s study: The pelvic compression belt. (A) Main body belt and two short elastic bands of the pelvic compression belt, and (B) The body belt was positioned just below the anterior superior iliac spine to compress the right anterior pelvis and the left posterior pelvis.

Belts, Corsets, Straps, and Gizmos

• *Sacroiliac straps cont.*

• More recently, Hammer and associates (2015) assessed pelvic belt effects on health outcomes and functional parameters of patients with sacroiliac joint pain

• Their findings:
  - “Pelvic belts improve health-related quality of life and are potentially attributed to decreased SIJ-related pain. Belt effects include decreased rectus femoris activity in patients and improved postural steadiness during locomotion. Pelvic belts may therefore be considered as a cost-effective and low-risk treatment of SIJ pain” (Hammer et al., 2015, p. 1).
Belts, Corsets, Straps, and Gizmos

• **Inversion tables**
• There is much I *cannot* say about inversion tables utilized for low back pain relief, primarily because I was unable to find specific discussion in the scholarly literature.
  - An enormous number and variety of inversion tables are advertised.
  - When following up on their research claims, I found that they merely generalized studies performed on mechanical traction to traction provided by body weight against gravity in these devices.
    • This generalization should not be made, as the inversion table provides little control or alteration of force.
  - Many physicians have written informal articles cautioning patients with hypertension, problems with eye or ear pressure, or those using blood thinners, against sustained inversion in these tables; however, these are not published in the scholarly literature.

Alternative or Experimental

• **Dry Needling – what is it?**
  - “Dry needling is a skilled intervention that uses a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points, muscular, and connective tissues for the management of neuromusculoskeletal pain and movement impairments. Dry needling (DN) is a technique used to treat dysfunctions in skeletal muscle, fascia, and connective tissue, and, diminish persistent peripheral nociceptive input, and reduce or restore impairments of body structure and function leading to improved activity and participation” *(American Physical Therapy Association, 2013, p. 2).*
Alternative or Experimental

• *Dry Needling for low back pain...*
  • Koppenhaver and associates (2015) conducted a study to identify possible associations between demographic, patient history, and physical examination variables and short-term improvement in self-reported disability following dry needling therapy performed on patients with low back pain (LBP).
    – Similar to attempting to identify clinical prediction rules

Alternative or Experimental

• *Dry Needling for low back pain...*
  • Koppenhaver’s treatment plan consisted of dry needling to the lumbar multifidus muscles bilaterally, administered during a single treatment session.
    – Two predictors of improved disability with dry needling were identified:
      • pain with the multifidus lift test
      • no aggravation with standing
Alternative or Experimental

• *Dry Needling for low back pain*...
• multifidus lift test
  – “The multifidus lift test (MLT) was used to assess lumbar multifidus muscle function at the L3, L4, and L5 levels by having prone participants lift their abduced arm off the table while the examiner palpated for activity in the contralateral lumbar multifidus muscles” (Koppenhaver et al., 2015, p. 606).

Please note that the patient actively lifts the ipsilateral arm to activate the contralateral multifidus, which is palpated by the examiner.
Alternative or Experimental

- *Dry needling cont.*

- “The participant was prone, with spinal processes for L1 through L5 marked with a skin pen for consistency. One needle on each side of spinal levels L3, L4, and L5 was inserted into the lumbar multifidus muscle to the depth of the vertebral lamina” (Koppenhaver et al., 2015, p. 606).

Alternative or Experimental

- *Dry needling cont.*

- (Koppenhaver et al., 2015, p. 606).
Alternative or Experimental

• Dry needling for LBP

Alternative or Experimental

• Dry Needling
  – Furlan and associates (2011) performed a Cochrane systematic review of acupuncture and dry needling for low back pain.
    • Lacking other details, we are informed that dry-needling appears to be a useful adjunct to other therapies for chronic low-back pain.
    • This is a review first performed in 1976 and updated at least four times since then; with the last update, no changes were made between 2005 and 2011.
**Alternative or Experimental**

- **Low Level Laser Therapy (LLLT)**
  - Also called “cold laser,” this modality is not new. It was introduced in 1968, but attempts to prove the efficacy of treatment have risen in the past 15 years.
  - Huang and associates (2015) conducted the most recent systematic review for use of LLLT in treating patients with chronic low back pain.
    - Results indicated that while LLLT is effective to reduce pain, there is insufficient support for its ability to increase function.

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**Alternative or Experimental**

- **LLLT cont.**
  - How does it work? Theoretical mechanisms (Huang et al., 2015):
    - increased endogenous opioid neurotransmitter production
    - raised threshold to thermal pain and enhanced local blood circulation
    - increased oxygen consumption by accelerating the redox reaction rate of the electron respiratory chain of mitochondria
    - increased adenosine triphosphate (ATP) production at the cellular level
    - Increased production of anti-inflammatory cytokines
Alternative or Experimental

• *LLLT cont.*

Huang (2015) also detailed the variables that affect the clinical therapeutic effects of laser therapy

– Wavelength determines the ability of a laser to penetrate tissue.
  • A range of 700–1000 nm is most often used to treat deep tissues because of superior penetration
  • Recommended LLLT wavelengths per World Association of Laser Therapy (WALT) guidelines are 780–860 nm and 904 nm, depending upon the condition being treated

– Energy density
  • Reportedly, better therapeutic effects of LLLT are obtained with higher energy density

– Number of treatment sessions and their duration
  • More is better
Alternative or Experimental

• Telehealth/telemedicine/telerehabilitation
  – Thus far, research efforts in the literature appear to be focused on global pain management rather than management of low back pain by physical therapists.
  – Telehealth for very specific conditions and treatment opens up an array of potential problems, such as continuity of care, insufficient means of regulating quality of care, and lack of follow-up care.

A randomized trial by Iles and associates (2011) was the only study I found investigating specifically the use of tele-services to provide physical therapy treatment to patients with NON-chronic low back pain.
  – This tele-service was conducted over the telephone in a series of coaching calls that augmented the in-clinic therapy treatment.
  – After 12 weeks, the group that received tele-coaching in addition to in-clinic treatment produced improvements in activity and recovery expectations.
Summary

• When reviewing the scholarly literature for current physical therapy treatments for low back pain, it was fairly depressing at times to see the poor quality studies, the noise and unwarranted generalizations as well as cause and effect, and even more, a dearth of literature on so many treatment choices that need validation. If I treated patients with only those few treatments supported in the literature, I would have very few tools in the toolbox.

Summary

• Evidence based medicine is the purposeful and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating our own individual clinical expertise with the best available external clinical evidence from systematic research. By individual clinical expertise, I mean the proficiency and judgment that individual clinicians have acquired through clinical experience and clinical practice. This is a two part harmony, and each cannot exist without the other while still providing best care.
Learner Outcomes

As a result of this course, participants will be able to:

1) ...discuss difficulties in selecting effective physical therapy treatments for patients with low back pain; define the terms “clinical prediction rules” and discuss their uses and pitfalls.

2) ...identify conclusions of recent systematic reviews of conservative treatments for patients with low back pain, as presented in this course, while participating in reflection and critical thinking question and answer opportunities throughout the course, in order to recognize limitations in the evidence.

3) ...discuss current knowledge in conservative treatments for patients with low back pain, state the potentials and limitations of these treatments, and confidently incorporate selected treatments for this pathology in their clinical practice.

References


References


References


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Questions and Answers:

**Point of Contact:**
Please feel free to email me with any additional questions or discussion of this course. Thank you for your time and attention!
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