Spinal Manipulative Therapy: Integration in Sports Medicine

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Houston, Texas
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WHAT DID THE DOCTOR SAY?

HE SAID I NEED TO GET MORE EXERCISE

SO, WHAT ARE YOU GOING TO DO?

GET A SECOND OPINION

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PARKER
• At the end of this course, providers will...
  
  – Understand the current best evidence for use of manipulation
  
  – Understand the potential physiologic mechanisms for effectiveness
  
  – Dialogue on integration in sports medicine
QUICK OVERVIEW OF WHAT WE KNOW?

Leveraging LBP as an example
LBP statistics

• 2\textsuperscript{nd} most common reason to visit MD’s office

• 60-90\% general population will have LBP at some point

• Estimated 40-60\% of those will have chronic episodes

• Billions of dollars spent on medical expenditures and lost labor costs
Causes of LBP

- Spinal Infection .01%
- Cauda Equina .04%
- Cancer .7%
- Compression Fracture 4%
- Ankylosing Spondylitis .3-5%
- Spinal Stenosis 3%
- Symptomatic Herniated 4%
- Non-specific LBP >85%

Most LBP warrants conservative management

Chou R et al. Diagnosis & Treatment of LBP. Ann Intern Med. 2007; 147:479-491
Expenditures and Health Status Among Adults With Back and Neck Problems

Figure 1. Estimated Annual Per Capita Age- and Sex-Adjusted Health Expenditures Among US Adults With and Without Spine Problems, MEPS 1997-2005

Expenditures and Health Status Among Adults With Back and Neck Problems

• Proportion of those with self-reported limitations in physical functioning increased from 20.7% to 24.7%

• Total estimated expenditures on spine problems increased 65% (inflation-adjusted) from 1997 to 2005
  — Outpaced overall health care expenditures

• Self-report measures for mental health, physical functioning, work or school limitations, and social functioning all worsened from 1997-2005


Figure 2. Change in total national expenditures for spine problems for 4 major service categories relative to 1997 (MEPS, 1997–2006) (age, sex, and inflation adjusted).
Anatomical Gray Hair

Find your age on the Age in Years line then look up the chance of a findings being present before your symptoms begin.
"I'll want to run a few tests on you, just to cover my ass."
Overall, expenditures on the management of LBP continue to increase while patient outcomes continue to deteriorate.

SO, HAVE YOU SEEN THIS IN THE ATHLETIC POPULATION?

BOTTOM-LINE
Problems & Barriers

• Practice Variation

• Over-utilization & under-utilization of services

• Research protocol design flaws
  – Lack of sub-grouping LBP into homogenous groups
  – Lack of clear definition of “manual therapy” and “manipulation”
Including over-utilization and under-utilization of services &/or procedures

PRACTICE VARIATION
Increases in Lumbosacral Injections in the Medicare Population

1994 to 2001

Figure 1. Lumbosacral injection rates by year: age- and sex-adjusted per 100,000.
Physical Therapy for Acute Low Back Pain
Associations With Subsequent Healthcare Costs

• Only 28% of patients were provided with guideline adherent care

Similar to other healthcare providers, it appears that physical therapy care for patients with LBP is characterized by widespread and unwarranted variations in practice.

• Guideline adherent care also reduced subsequent health care utilization in the 1-yr following treatment

  • Reduced utilization of meds, diagnostic imaging, and steroid injections
Physical Therapy for Acute Low Back Pain
Associations With Subsequent Healthcare Costs

<table>
<thead>
<tr>
<th></th>
<th>Adherent (n = 132)</th>
<th>Nonadherent (n = 339)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. physical therapy visits</td>
<td>4.6 (2.0)*†</td>
<td>5.9 (2.2)*†</td>
</tr>
<tr>
<td>Duration of physical therapy care (d)</td>
<td>25.4 (16.2)*† median = 19</td>
<td>29.7 (20.6)*† median = 22</td>
</tr>
<tr>
<td>Physical therapy charges</td>
<td>$562 (269)*†</td>
<td>$729 (345)*†</td>
</tr>
<tr>
<td>Percent change in Oswestry</td>
<td>53.7% (33.1)*†</td>
<td>37.5% (33.3)*†</td>
</tr>
<tr>
<td>Percent change in pain rating</td>
<td>49.1% (45.9)*†</td>
<td>39.2% (46.8)*†</td>
</tr>
<tr>
<td>Successful outcome of physical therapy (n %)</td>
<td>59.1%†</td>
<td>37.8%†</td>
</tr>
</tbody>
</table>

Guideline adherent care

- Less visits, shorter duration & decreased costs
- Greater improvement in Oswestry, Pain, and “Successful Outcome”

Fritz et al. Spine 2008;33:1800–1805
What is it, where does it fit in the health care delivery, and what can I expect from the utilization of manipulation.

MANIPULATION
Practice Variation for SMT

Assessment of diclofenac or spinal manipulative therapy, or both, in addition to recommended first-line treatment for acute low back pain: a randomised controlled trial

Mark J Hancock, Chris G Maher, Jane Latimer, Andrew J McLachlan, Chris W Cooper, Richard O Day, Megan F Spindler, James H McAuley

- “Most participants had several low-velocity mobilisation techniques (232/239, 97%) with a small proportion also having high-velocity thrust techniques (12/239, 5%).”

SMT, when left to expert opinion, is clearly under-utilized. In fact, this study does not even attempt to answer its aim by not prescribing the utilization of high-velocity thrust joint manipulation.
What is Manipulation?

- Lumbar Manipulation
  - [http://youtu.be/Z2V3ceTWT5Q](http://youtu.be/Z2V3ceTWT5Q)

- Sidelying SI Manipulation
  - [http://youtu.be/ON3r7wFTeAk](http://youtu.be/ON3r7wFTeAk)

- Thoracic Manipulation
Examples of problematic trials

• “Manipulation” and “manual therapy” mean different things in different studies

• Poorly-defined manipulation protocols left to discretion of the clinicians do not produce large clinical improvements

• Using manipulation for heterogeneous groups of patients with LBP will result in moderate improvements that may not be superior to other treatments
WHO BENEFITS FROM SMT?
# Evaluation of a Treatment-Based Classification Algorithm for Low Back Pain

## Table 1.
Individual Subgroup Criteria Used to Classify Patients Into Treatment Subgroups

<table>
<thead>
<tr>
<th>Treatment Subgroup</th>
<th>Individual Subgroup Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulation(^{12})</td>
<td>Duration of symptoms &lt;16 days&lt;br&gt;At least one hip with less than 35° of medial (internal) rotation&lt;br&gt;Lumbar hypomobility&lt;br&gt;No symptoms distal to the knee&lt;br&gt;Fear-Avoidance Beliefs Questionnaire work subscale score &lt;19</td>
</tr>
<tr>
<td>(must meet 4 or more criteria)</td>
<td></td>
</tr>
<tr>
<td>Stabilization(^{14})</td>
<td>Age &lt;40 y&lt;br&gt;Average straight leg raise &gt;91°&lt;br&gt;Aberrant movement present&lt;br&gt;Positive prone instability test</td>
</tr>
<tr>
<td>(must meet 3 or more criteria)</td>
<td></td>
</tr>
<tr>
<td>Specific exercise(^{10,35})</td>
<td>Demonstrated centralization or a directional preference (an improvement in pain intensity) during repeated movement testing in any one position (standing, sitting, or lying)</td>
</tr>
<tr>
<td>Traction(^{13})</td>
<td>Signs and symptoms of nerve root compression (positive straight leg raise or reflex, sensory, or muscle strength deficit)&lt;br&gt;and&lt;br&gt;Pain or numbness extending distal to the buttock in the previous 24 hours&lt;br&gt;and&lt;br&gt;Peripheralization of pain with extension or positive crossed straight leg raise</td>
</tr>
<tr>
<td>(must meet all criteria)</td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Updated Classification Criteria</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Manipulation</td>
<td>• No symptoms distal to the knee</td>
</tr>
<tr>
<td></td>
<td>• Recent onset of symptoms (&lt;16 d)</td>
</tr>
<tr>
<td></td>
<td>• Low FABQW score (&lt;19)</td>
</tr>
<tr>
<td></td>
<td>• Hypomobility of the lumbar spine</td>
</tr>
<tr>
<td></td>
<td>• Hip internal rotation ROM (&gt;35° for at least 1 hip)</td>
</tr>
<tr>
<td>Stabilization</td>
<td>• Younger age (&lt;40 y)</td>
</tr>
<tr>
<td></td>
<td>• Greater general flexibility (postpartum, average SLR ROM &gt;91°)</td>
</tr>
<tr>
<td></td>
<td>• “Instability catch” or aberrant movements during lumbar flexion/extension ROM</td>
</tr>
<tr>
<td></td>
<td>• Positive findings for the prone instability test</td>
</tr>
<tr>
<td></td>
<td>• For patients who are postpartum:</td>
</tr>
<tr>
<td></td>
<td>• Positive posterior pelvic pain provocation (P4), and ASLR and modified Trendelenburg tests</td>
</tr>
<tr>
<td></td>
<td>• Pain provocation with palpation of the long dorsal sacroiliac ligament or pubic symphysis</td>
</tr>
</tbody>
</table>
Evaluation of a Treatment-Based Classification Algorithm for Low Back Pain

Does the patient have symptoms distal to the buttock and signs of nerve root compression?

NO

Does the patient:
1. Centralize with 2 or more movements in the same direction (i.e., flexion or extension)? OR
2. Centralize with movement in one direction and peripheralize with an opposite movement?

Yes

Does the patient:
1. Peripheralize with extension movement? OR
2. Have a positive crossed SLR test?

Specific Exercise Classification

Traction Classification

Does the patient:
1. Centralize with 2 or more movements in the same direction (i.e., flexion or extension)? OR
2. Centralize with movement in one direction and peripheralize with an opposite movement?

Specific Exercise Classification

Does the patient:
1. Have duration of symptoms of <16 days? AND
2. No symptoms distal to knee?

Manipulation Classification

Stabilization Classification

Does the patient have 3 or more:

Which subgroup does the patient fit best?

Manipulation

Factors favoring
- Hypomobility with spring testing
- Low FABQ scores (FABQ-W <19)
- Hip medial (internal) rotation ROM >35°

Factors against
- Symptoms below the knee
- Increasing episode frequency
- Peripheralization with motion testing
- No pain with spring testing

Stabilization

Factors favoring
- Hypermobility with spring testing
- Discrepancy in SLR ROM (>10°)

Factors against
- Low FABQ scores (FABQ-PA <9)
- Centralization with motion testing
- Peripheralization in direction opposite to centralization

Specific Exercise

Factors favoring
- Directional preference for extension or flexion
- Status quo with all movements

Factors against
- Low back pain only (no distal symptoms)
- No sign of nerve root compression

Traction

Factors favoring
- Peripheralization of symptoms, with no ability to centralize with movement

Factors against
- Low back pain only (no distal symptoms)

Figure.
Comprehensive algorithm. SLR = straight leg raise, ROM = range of motion, FABQ-W = Fear-Avoidance Beliefs Questionnaire work subscale, FABQ-PA = Fear-Avoidance Beliefs Questionnaire physical activity subscale.
Identifying Subgroups of Patients With Acute/Subacute “Nonspecific” Low Back Pain

Results of a Randomized Clinical Trial

• Patient Profile
  – 123 pts, age 37 +/-10.7 yrs, 45% female
  – LBP of 90 days duration or less

• Procedures
  – Subgrouped based on classification system
  – Randomized to receive manip, stabilization, or specific exercise
  – 4-week treatment period

• Outcomes
  – Disability measured with Oswestry Questionnaire
  – 4 wks and 1 yr follow-up

Identifying Subgroups of Patients With Acute/Subacute “Nonspecific” Low Back Pain

Results of a Randomized Clinical Trial

- Pts receiving **matched** treatments experienced great short- and long-term reductions than those receiving unmatched treatments

- Outcomes can be improved when **subgrouping** is used to guide-treatment decision-making.

Table 1. Five Criteria in the Spinal Manipulation Clinical Prediction Rule*

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Definition of Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of current episode of low back pain</td>
<td>&lt;16 d</td>
</tr>
<tr>
<td>Extent of distal symptoms</td>
<td>Not having symptoms distal to the knee</td>
</tr>
<tr>
<td>FABQ work subscale score</td>
<td>&lt;19 points</td>
</tr>
<tr>
<td>Segmental mobility testing</td>
<td>≥1 hypomobile segment in the lumbar spine</td>
</tr>
<tr>
<td>Hip internal rotation range of motion</td>
<td>≥1 hip with &gt;35 degrees of internal rotation range of motion</td>
</tr>
</tbody>
</table>

* See Appendix 1 and Appendix 3 video, available at www.annals.org, for details (17). FABQ = Fear-Avoidance Beliefs Questionnaire.
66% decrease in disability rates in week 1
The Use of a Lumbar Spine Manipulation Technique by Physical Therapists in Patients Who Satisfy a Clinical Prediction Rule: A Case Series

**TABLE 1.** The 5 criteria in the clinical prediction rule developed by Flynn et al.$^8$

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition of Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom location</td>
<td>No symptoms distal to knee</td>
</tr>
<tr>
<td>Duration of current episode</td>
<td>Less than 16 d</td>
</tr>
<tr>
<td>FABQ work subscale</td>
<td>Less than 19</td>
</tr>
<tr>
<td>Segmental mobility testing in a postero-anterior direction</td>
<td>At least 1 hypomobile segment in the lumbar spine</td>
</tr>
<tr>
<td>Hip internal rotation range of motion</td>
<td>At least 1 hip with greater than 35° of internal rotation</td>
</tr>
</tbody>
</table>

Abbreviation: FABQ, Fear-Avoidance Beliefs Questionnaire.

Joshua A. Ciepland, DPT, PhD, OCS$^1$
Julie M. Fritz, PT, PhD, ATC$^2$
Julie M. Whitman, PT, DSc, OCS, FAAOMPT$^3$
John D. Childs, PT, PhD, MBA, OCS, FAAOMPT$^4$
Jessica A. Palmer, MPT$^5$
92% of patients positive on the rule has successful outcome
Pragmatic application of a clinical prediction rule in primary care to identify patients with low back pain with a good prognosis following a brief spinal manipulation intervention

Julie M Fritz*1,2, John D Childs3 and Timothy W Flynn4

<table>
<thead>
<tr>
<th>ORIGINAL CRITERIA – (at least 4 out of 5 must be present)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterion</strong></td>
</tr>
<tr>
<td>1. Duration of current episode of low back pain</td>
</tr>
<tr>
<td>2. Extent of distal symptoms</td>
</tr>
<tr>
<td>3. Fear-Avoidance Beliefs Questionnaire Work subscale score</td>
</tr>
<tr>
<td>4. Segmental mobility testing</td>
</tr>
<tr>
<td>5. Hip internal rotation range of motion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRAGMATIC CRITERIA – (both criteria must be present)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterion</strong></td>
</tr>
<tr>
<td>1. Duration of current episode of low back pain</td>
</tr>
<tr>
<td>2. Extent of distal symptoms</td>
</tr>
</tbody>
</table>
Comparison of the Effectiveness of Three Manual Physical Therapy Techniques in a Subgroup of Patients With Low Back Pain Who Satisfy a Clinical Prediction Rule

A Randomized Clinical Trial

- 112 patients enrolled
- Age: 40.3 (11.5)
- Gender: 52% female
- Duration: 45 days
- Pain: 5.2 (1.2)
- ODQ: 35.5 (7.7)
- FABQ-PA: 12.9 (4.7)
- FABQ-W: 12.2 (7.7)
- 17 PT’s
- Experience: 9.1 (5.9)
Comparison of the Effectiveness of Three Manual Physical Therapy Techniques in a Subgroup of Patients With Low Back Pain Who Satisfy a Clinical Prediction Rule

A Randomized Clinical Trial

Treatments 1 & 2

Figure 1. Supine thrust manipulation technique used in this study.

Thrust Manipulation

Figure 2. Side-lying thrust manipulation technique used in this study.

Mobilization

Figure 3. Non-thrust manipulation technique used in this study.
Comparison of the Effectiveness of Three Manual Physical Therapy Techniques in a Subgroup of Patients With Low Back Pain Who Satisfy a Clinical Prediction Rule

A Randomized Clinical Trial

Treatments 3-5
Pain score changes

- Supine Thrust Manipulation
- Side-Lying Thrust Manipulation
- Non-Thrust Manipulation

Numeric Pain Rating

Baseline | 1-Week | 4-Weeks | 6-Months
Thrust manipulation seems to have positive effect over & above that of mobilization.
• WHERE IS THE LITERATURE ON ATHLETES?
How Spinal Manipulative Therapy Works: Why Ask Why?

Regional interdependence, neurophysiologic components, patient expectation, and placebo effects...

POTENTIAL MECHANISMS FOR EFFECTIVENESS
Clinical studies suggest that successful outcome is not linked to specific spinal manipulative therapy techniques or joint cavitation.

Rather, the recent clinical literature emphasizes the importance of identifying characteristics of individuals likely to respond favorably to spinal manipulative therapy.

How can we explain why such patterns of signs and symptoms predict successful outcomes? What is the biologic plausibility/underlying mechanism(s)?
Regional Interdependence

- the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient’s primary complaint

- focuses primarily on impairments present in proximal or distal segments and is distinct from the phenomenon of referred pain
Evidence of RI

• Increased quad activation in healthy individuals following lumbopelvic manipulation

• Decreased quad inhibition after SI manip in PFPS

• Improved multifidi activation after lumbopelvic manip

• Deficits in neuromuscular control of trunk predict knee injury risk
Increasing Complexity

Figure 2 The allostatic process is responsible for the regulation and integration of biopsychosocial, neurophysiological, somatovisceral, and musculoskeletal responses.
Mechanical stimulus
Peripheral mechanisms
Spinal mechanisms
Supra-spinal mechanisms
Non-specific mechanisms: Placebo, patient expectation, etc

NEUROPHYSIOLOGY
Mechanical Stimulus

- Transient changes in motion, but no lasting structural changes

- Force application is variable between clinicians & localization questionable

- Choice of technique insignificant, but neurophysiologic response likely force and velocity dependent

- Sign & symptom changes occur locally and at sites distant from application

Spinal Mechanisms


Non Specific Responses
- Placebo/Expectation
- Psychological measures
  - Fear
  - Catastrophizing
  - Kinesiophobia

Endocrine Response
- B-endorphins
- Opioid response

(Amanzio et al., 2001)
(Benedetti et al., 2006)
(Zubieta et al., 2005)

Pain-Related Brain Circuitry
- ACC
- Amygdala
- PAG
- RVN

Pain Modulatory Circuitry

Autonomic Response
- Skin temperature
- Skin conduction
- Cortisol levels
- Heart rate

(Lanotte et al., 2005)
(Pollo et al., 2003)
(Johansen et al., 2003)

(Price et al., 2007)
(Kong et al., 2006)
(Bingel et al., 2006)

Imaging

Rating

Mechanical Stimulus

Peripheral Nervous System

Spinal Cord

Decrease Spasm
Increase range of motion

Inflammatory mediators

Neuromuscular Responses
- Motor Neuron Pool
- Afferent Discharge
- Muscle activity

(Hypoalgesia)

(Imaging)

(Price et al., 2002)
(Matre et al., 2006)

(Price et al., 1999)
(Benedetti et al., 2003)
(Vase et al., 2002)

(Goebel et al., 2002)

(Pain)

(Goffaux et al., 2007)
PLACEBO & PATIENT EXPECTATION
Non-Specific Responses

J.E. Bialosky et al. / Manual Therapy 14 (2009) 531-538

Non Specific Responses
- Placebo/Expectation
- Psychological measures
  - Fear
  - Catastrophizing
  - Kinesiophobia

Endocrine Response
- B-endorphins
- Opioid response

Neuromuscular Responses
- Motor Neuron Pool
- Afferent Discharge
- Muscle activity

Hypoalgesia

Inflammatory mediators

Decrease Spasm
Increase range of motion

Mechanical Stimulus
Tissue

Pain-Related Brain Circuitry
ACC
Amygdala
PAG
RVN

Pain Modulatory Circuitry

Autonomic Response
- Skin temperature
- Skin conduction
- Cortisol levels
- Heart rate

Imaging

Spinal Cord

(Matte et al., 2006)

Peripheral Nervous System

Increase range of motion

Inflammatory mediators

(Goebel et al., 2002)
Placebo & Patient Expectation

- The magnitude of the placebo effect can be explicitly altered by changing patient expectation to enhance the treatment effect.

- The treatment effect of spinal manipulative therapy can be enhanced by informing patients that spinal manipulative therapy has been shown to have a powerful pain-relieving effect.

The influence of expectation on spinal manipulation induced hypoalgesia: An experimental study in normal subjects
Joel E Bialosky*1, Mark D Bishop1, Michael E Robinson2, Josh A Barabas1 and Steven Z George*1
The influence of expectation on spinal manipulation induced hypoalgesia: An experimental study in normal subjects
Joel E Bialosky*1, Mark D Bishop1, Michael E Robinson2, Josh A Barabas1 and Steven Z George*1

Published: 11 February 2008


Figure 2
Change in Pain Perception in the Low Back and Lower Extremity by Expectation Instructional Set.
Useful Podcasts

- Adherence to Clinical Practice Guidelines: Do Patients Benefit
  - http://ptjournal.apta.org/content/suppl/2010/07/22/90.8.1111.DC2/ptj_201008_discussion_guidelines.mp3

- Developing and Using Clinical Prediction Rules
  - http://ptjournal.apta.org/content/suppl/2009/06/25/89.7.698.DC1/ptj_200907_debate_1.mp3
  - http://ptjournal.apta.org/content/suppl/2009/06/25/89.7.698.DC1/ptj_200907_debate_2.mp3

- Classification and Manipulation for LBP: Should they be linked?
  - http://ptjournal.apta.org/content/suppl/2008/01/10/88.1.DC1/debate_lbp.mp3

- Tim Flynn, PT, PhD: Stop The Maddness
  - http://www.viddler.com/explore/Evidenceinmotio/videos/7/
Before I conclude.

QUESTIONS?
FINAL THOUGHTS
Risk of not providing manipulation

- NNT = 9.9
  - The NNT with spinal manipulation to prevent 1 additional patient from experiencing a worsening in disability at the one-week follow-up was 9.9 and this persisted for 4 weeks

- NO one who was **positive** on CPR and received manipulation experienced a worsening in disability...
  - *Subsequently the bigger risk occurred by NOT manipulating*
The acute and sub-acute groups are likely those that would benefit from manipulation.

Figure 1. Likelihood of subsequent surgery, spinal injection, or frequent office visit in each PT group. Patients receiving PT in the acute and subacute phase had significantly decreased likelihoods of undergoing subsequent lumbar surgery or spinal injection, as well as decreased use of frequent physician office visits.
Move It and Move On

Timothy W. Flynn, PT, PhD, OCS, FAAOMPT
US Army-Baylor University Graduate Program in Physical Therapy
Guest Editorial

- Pain, biomechanical, neurophysiologic, placebo effects that might accelerate return to play
THANK YOU

Brian.Duncan@memorialhermann.org