Therapeutic Exercise and Manual Therapy: Analysis of the Independent and Synergistic Effects

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Outline

• Theoretical basis for combining exercise and manual therapy
• Evidence for MPT and therapeutic exercise
  – Independent and synergistic effects
• Selected musculoskeletal applications

Theoretical Basis for Manual Therapy

Responses to a disorder or condition and the associated clinical outcomes are not limited to local or adjacent regions of the body but can involve a neuromuscular response that can be more widespread.

Narrative Review

A regional interdependence model of musculoskeletal dysfunction: research, mechanisms, and clinical implications

Derrick G. Suekino, Joshua A. Cleveland, Robert S. Wainner

Spinal Manipulative Therapy Has an Immediate Effect on Thermal Pain Sensitivity in People With Low Back Pain: A Randomized Controlled Trial

Joel E. Balowsky, Mark D. Bishop, Michael E. Robinson, Giorgio Zeppetella Jr., Steven Z. George

36 Subjects with LBP
• Outcomes:
  – Drug Reaction Scale
  – Anadanide (AEA)
    • Mimics effects of THC
  – 2-arachidonoylglyc
    • Activates cannabinoid receptor
  – Olelethanolamide
    • Binds to receptors that regulate satiety

Results - DRS

• Manual therapy group:
  – More likely to report feeling-
    • Stoned, good, high and hungry

• Placebo group:
  – More likely to report feeling-
    • relaxed and rested

The Original Treatment-Based Classification System
Theoretical Basis for Therapeutic Exercise

Prevention of Impairments

Restoration of Function

• Specific Adaptation to Imposed Demand (S.A.I.D. Principle)
  – To the extent we have goals, the imposed demands must be specific.
  • Exercise v. therapeutic exercise
  • Working out v. training

Consider the well-documented effects of immobilization and zero gravity

• Motor Learning
  – Effective motor programs are adaptable to changing circumstances.
  – Because of skilled feedback, PT [v. generic Rx to “stay active”) is best chance for creating an optimal motor program.
Theoretical Basis for Manual Therapy + Therapeutic Exercise

MT
• Immediate analgesic effect
• Positive alteration in N-M tone

Ex
• Better quality of movement
• Greater volume of activity

Mind
• Less kinesiophobia
• Better habits regarding physical activity

Evidence by Region:

LBP

Do we know what causes most LBP?

• We can only diagnose definite pathology in about 15% of patients with LBP.
• There is very little relationship between physical pathology & associated pain and disability.
• We regard back pain as an injury, but most episodes occur spontaneously with normal everyday activities.
• High-tech imaging tells us very little about simple backache.
The Medical Model of Disease
(Waddell, Spine 1987, Engel, Science 1977)

- The biomedical model has transformed from a model into cultural dogma.
- All disease must be explained in terms of derangement of underlying physical mechanisms.
- Not all conditions appear to fit, this is particularly true for LBP and also true for much of musculoskeletal medicine.

Is There An Alternative Model?

Culture
Social interactions
Sick role (participation restrictions)

ICF (WHO 2000)

Illness behavior
beliefs, coping strategies
emotions, distress (activity
restrictions)

Impairments
of Body
Structure & function
(Tissue damage?)

Low Back Pain Classifications

Manipulation
- No symptoms below the knee
- Recent symptoms
- Hypomobility
- Low Fear-Avoidance
- More hip IR

Specific Exercise
- Centralization phenomenon during movement examination
- Postural preference

Stabilization
- Prone instability test
- Aberrant motions
- Hypermobility
- Younger age
- Greater SLR ROM

Traction
- Neurological signs
- Leg symptoms
- No Centralization during movement testing

Manipulation and exercise
Activities to Promote Centralization
Stabilization exercises
Mechanical auto-traction
Low Back Pain

**Strong Evidence For:**

**Manual Therapy**
- Thrust Manipulation
  - Acute LBP and related buttock and thigh pain w/mobility deficits
- Thrust Manipulation and non-thrust mobilization
  - Spine/hip mobility deficits
  - Reduce pain and disability
  - Sub-acute and CLBP
  - Back related LE pain

**Therapeutic Exercise**
- Acute
  - Centralization and directional preference exercise
- Sub-acute and Chronic
  - Centralization and directional preference exercise
  - Trunk coordination
  - Strengthening
  - Endurance activities


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**Low Back Pain**

**Pain v. Disability**

**Patient w/CLBP**
- Manual Therapy, primarily MET
- Sham Manual Therapy
  - Position for MET
- Specific Exercise
  - tailored to treat their musculoskeletal dysfunctions
- Non-specific Exercise
  - general stretching and aerobic conditioning

- The results suggest that pain reduction associated with CLBP does not necessarily lead to a change in function. These findings suggest that the factors that influence pain and disability among persons with CLBP may be different...psychosocial factors may need to be addressed
  - Geisser, Clin J Pain, 2005

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**Low Back Pain**

**Liccioardone, Ann Fam Med, 2013**

- Osteopathic Manual Treatment (thrust, soft-tissue, muscle energy) v. Ultrasound v. Sham Ultrasound
- Pain reduction with OMT was statistically significant and clinically relevant. The OMT patients also reported less frequent concurrent use of prescription drugs.

- No change in back-specific functioning, general health, or work disability.

- The OMT regimen associated with high levels of treatment adherence and satisfaction with back care.
Low Back Pain

MT + Ex v. Sham + Ex

Balthazard, BMC Musculoskeletal Disorders, 2012

• Sham = detuned ultrasound
• **MT + active exercise reduced pain and disability**
• Abdominal muscle endurance decreased more in the MT group v. Sham group
  – Unexplained effect

Manual Therapy and Exercise

Therapy in Patients w/CLBP

Aure, Spine, 2003

• Both groups improved, but the manual therapy approach resulted in significantly greater improvements than exercise therapy on spinal range of motion, pain, **function**, general health, and sick leave.
  – Effects recorded up to 12 months.
• Buyer Beware: The manual therapy group did perform exercise
  – The patients also performed a subset of five general exercises for the spine, abdomen, and lower limbs, and six specific and localized exercises for spinal segments and the pelvic girdle in each treatment session “in order to normalize function.”

Stabilizing training compared with manual treatment in sub-acute and CLBP

Rasmussen-Barr, Man Ther, 2003

**Short term**

• No clear differences between the groups in the accessed outcome measures.
  – Pain
  – Health
  – Functional Disability

**Long-term**

• Stabilizing training more effective and reduced need for recurrent treatment periods.
Effect of Graded Exercise
Rasmussen-Barr, Spine, 2009

• A graded exercise intervention emphasizing stabilizing exercises seems to improve perceived disability and health parameters in short and long terms in patients with recurrent LBP.

• No such improvement was seen in the longer terms for perceived pain.

• The exercises, by being individually graded, might change self-efficacy beliefs and thus improve perceived disability.

• The exercise intervention seems to reduce the need for recurrent treatment in long-term.

MT + Ex + MD Consult v.
MD Consult Alone for CLBP
Niemisto, Spine, 2003

Short, specific manipulative-treatment program with stabilizing exercises and physician’s clinical examination, information, encouragement, and simple advice was more effective than physician consultation alone in reducing self-assessments of pain and disability for patients with chronic low back pain in a 1-year follow-up.

Meta-analysis of Exercise Strategies for CLBP
Hayden, Ann Intern Med 2005

• Best programs:
  – Individually designed
  – Supervised
  – High-dose v. low-dose
  – Multi-modal
Comparison of general exercise, motor control exercise and SMT manipulative therapy for CLBP

Ferreira, Pain, 2007

- Motor control exercise and spinal manipulative therapy produce slightly better short-term function and perceptions of effect than general exercise, but not better medium or long-term effects

- Caveat:
  - Rx not controlled after 8W
  - General exercise group might have received effective co-interventions at that time

Low Back Pain

Exercise and Prevention

  - Level 1 Evidence

- Exercise prevented self-reported BPs in seven of eight trials
- Exercise significantly reduced work absence in three trials
- Not effective:
  - stress management, shoe inserts, back supports, ergonomic/ back education, & reduced lifting programs

Low Back Pain

Bigos, 2009, cont.

- Exercise Programs
  - Trunk strength, endurance, flexibility, stabilization, directional preference
  - 5/7 successful programs involved 45–60 min of supervised exercise, twice a week for 3–12 months,
Low Back Pain

Exercise and Prevention

• Moderate quality evidence that post-treatment exercise programmes can prevent recurrences of back pain but conflicting evidence was found for treatment exercise
  – Cochrane Review, 2010

• Rationale: Post-treatment exercise is about habits. Exercise as a treatment might or might not help in short time, but won’t necessarily change habits and therefore future episodes.

Evidence by Region:

Neck Pain

MT and EX for Neck Pain: Systematic Review

Miller, Manual Therapy, 2010

• MT alone provides short-term pain relief.
• Exercise appears to improve pain and function over the long-term
• Combo therapy associated with
  – better short-term pain reduction than exercise alone
  – Better long-term outcomes in comparison to manual therapy alone.
Manipulation/Mobilization Systematic Review (Gross, Cochrane Collaboration, 2010)

- 27 Trials, 1522 participants
- Cx manip/mob produced similar changes. Either may provide immediate- or short-term change; no long term data are available.
- Thoracic manipulation may improve pain and function.
- Optimal techniques and dose are unresolved.

Which are the best exercises for neck pain? Kay, Cochrane, 2007

- Moderate and low GRADE evidence suggests
  - specific neck stretching and strengthening exercises for chronic neck pain, improved function and satisfaction post-treatment to long term.
  - cranio-cervical endurance and low-load endurance exercises for subacute/chronic cervicogenic headache from post-treatment to long term.
  - no benefit for some upper extremity stretching and strengthening exercises or a general exercise program.

Preventing Recurrence

“Rehabilitation of the neuromuscular and sensorimotor systems to a ‘normative’ status positively impacts on recurrence rate” Gwen Jull, 2013
Effectiveness of Manual Physical Therapy and Exercise for Mechanical Neck Disorders
A Randomized Clinical Trial

Subjects referred by physician, PT, or self
Screened for inclusion criteria
Blinded baseline outcomes
Baseline Examination by treating therapist
Randomly Assigned
Manual Physical Therapy And Exercise (MTE)
\( n = 47 \)
Minimal Intervention (MI)
\( n = 47 \)
Six clinic visits (biw x 3 weeks)
Blinded outcome assessments
(3-week, 6-week, 1-year)

Results
Neck Disability Index scores

<table>
<thead>
<tr>
<th>Score</th>
<th>MTE Group</th>
<th>MI Group</th>
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<tbody>
<tr>
<td>Initial</td>
<td>15.63</td>
<td>16.94</td>
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<tr>
<td>3 wk</td>
<td>10.34</td>
<td>10.96</td>
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<tr>
<td>6 wk</td>
<td>6.34</td>
<td>6.91</td>
</tr>
<tr>
<td>1 yr</td>
<td>5.85</td>
<td>5.32</td>
</tr>
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2x4 ANCOVA: \( p < 0.010 \)
Post-hocs: \( p < 0.001 \)
(3, 6 and 22 week follow-ups)
Results

Cervical/Shoulder VAS scores

Results

Treatment Success Rates

Results

Follow-up Healthcare Sought (1-yr)

Intention to Treat Analysis
Chi-square test; p=0.112

- 47 patients
  - 23 received manip
  - 24 nonthrust mob only

Results

Does C-manipulation add benefit to supervised, high-dose exercise for chronic neck pain?

Evans, Spine, 2012

- N = 279, randomized to:
  - high-dose supervised exercise (with or without spinal manipulation)
  - low-dose, home exercise and advice

- Outcome measures
  - Pain, disability, health status, global perceived effect, medication use, and satisfaction @ 4, 12, 26, 52 weeks.

- High-dose supervised exercise resulted in greater short-term pain reduction, global perceived effect, and satisfaction than low-dose home exercise for people with non-specific, chronic neck pain.

- 41% of HEP group had meaningful reduction in pain at short and long term

- Cost implications
Effectiveness of manual physical therapy in the treatment of cervical radiculopathy: a systematic review

R Boyles, P Toy, J Mellon Jr, M Hayes, B Hammer

"...general consensus exists within the literature that using manual therapy techniques in conjunction with therapeutic exercise is effective in regard to increasing function, as well as AROM, while decreasing levels of pain and disability."

• High quality RCTs featuring control groups are necessary to establish clear and effective protocols in the treatment of CR.

Thoracic Spine Thrust Manipulation Versus Cervical Spine Thrust Manipulation in Patients With Acute Neck Pain: A Randomized Clinical Trial

Study Objective
Disability

![Disability Graph]

Follow-up | Thoracic Group | Cervical Group
--- | --- | ---
Treatment 2 | 0/10 | 13/14
1-week | 2/10 | 14/14
4-weeks | 2/10 | 14/14
6-months | 2/10 | 14/14

Number of patients who reported GROC of at least +5 from baseline
CPR for Cervical Manip
Puentedura et al JOSPT July 2012

> 3 factors present:
- Symptoms < 38 days
- Positive expectation that manipulation will help
- > 10° Difference rotation
- Pain with spring (PA) testing middle cervical spine

Pre-test Probability of Success: 39%
Post-test Probability of Success: 90%

Addition of Thoracic Manipulation
Improved Upon Cervical Mobilization and Exercise

Evidence by Region:

The Shoulder

Thoracic spine motion and shoulder function

• Hypomobility in the cervicothoracic (CT) increases risk of shoulder pain  
• Thoracic posture effects shoulder function  
  – Bullock 2005, Lewis 2005
• Significant movement in the thoracic spine with arm elevation  
  – Crosbie et al 2008
• Increased thoracic kyphosis may influence shoulder function by abducting the scapula on the thoracic wall  
  – Bowling et al, 1986

Thoracic spine motion and shoulder function

• Reduced thoracic mobility may directly contribute to a lack of full range of arm elevation  
  – Bowling et al, 1986; Chapman, 1986; Crawford, 1993; Stewart, 1995
• Painful shoulder elevation may be caused by restricted cervicothoracic spine motion  
• Treating the CT spine may enhance outcomes in subgroups of patients with shoulder pain  
Effectiveness of Manual Therapy on Painful Shoulder Conditions: A Systematic Review

GH joint only across all painful shoulder conditions

- 7 articles fitting criteria
- 5 studies demonstrated benefits utilizing manual therapy for mobility, and 4 demonstrated trend towards decreasing pain values.
- Manual therapy appears to increase either active or passive mobility of the shoulder.
- A trend was found favoring manual therapy for decreasing pain, but the effect on function and quality of life remains inconclusive.

Comparison of Supervised Exercise With and Without Manual Physical Therapy for Patients With Shoulder Impingement Syndrome

- Subjects (N=52)
- Treatment conditions:
  - Group 1: Manual therapy (upper quarter) and exercise
  - Group 2: Exercise alone; stretches and strengthening
- 3-week intervention - bw for 6 Rcs
- Results:
  - Function: significantly more improvement in MT group (35% vs 17%)
  - Pain: significantly less pain in MT group (70% vs 35%)
  - Strength: significant increase for MT group (16%)
- Conclusion: MT and exercise is superior to exercise alone for improving strength, function, and pain in patients with impingement syndrome

Positive Effects of Targeting the Thoracic Spine for Shoulder Pain

The Short Term Effects of Thoracic Spine Thrust Manipulation on Patients with Shoulder Impingement Syndrome Manual Therapy

Boyles & Ritsland et al, 2008, Manual Therapy

The Immediate Effects of Thoracic Spine Manipulation on Patients with Primary Complaints of Shoulder Pain.

Strunce & Boyles et al, 2010, JMMT
Identifying Prognostic Factors for Successful Short-Term Outcomes in Individuals with Shoulder Pain Receiving Cervicothoracic Manipulation

Paul Miniken, Josh Cleland, Kristin Carpenter, Mel Bieniek, Mike Keirns, Julie Whitman
Physical Therapy January 2010

The Rule

3 or more present:
- Painfree shoulder flexion < 127°
- Shoulder IR < 53°
- Negative Neer test
- Not taking medications
- Symptoms < 90 days

61% 89%

Pre-test Probability of Dramatic Success with Manipulation

Post-test Probability of Dramatic Success with Manipulation

+LR = 5.3

In the works.....

Manual physical therapy versus subacromial corticosteroid injection for the treatment of shoulder impingement syndrome: a randomized clinical trial.
Rhon, Boyles & Cleland
Currently in Review
In the works......

Validation of a Clinical Prediction Rule to Identify Patients with Shoulder Pain Likely to Benefit from Cervicothoracic Manipulation: A Randomized Clinical Trial

Mintken, Cleland, Boyles, Carpenter, Michener, Burns, Strunze, & McDevitt

In data collection phase

The Effect of Therapeutic Exercise and Mobilization on Patients With Shoulder Dysfunction:

• Brudvig, JOSPT, 2011
• SR w/Meta-analysis
• Included all RCTs for shoulder dysfunction resulting in pain, restriction of ROM and/or limitation in function
• Inconclusive that combined therapy is superior to therapeutic exercise alone
• Cannot rule out that one treatment is more beneficial than the other.

Chronic RTC DZ
Bennell, BMJ, 2010

Conclusion: manual therapy and home exercise did not confer additional immediate benefits for pain and function compared with a realistic placebo treatment that controlled for therapists’ contact in middle aged to older adults with chronic rotator cuff disease. However, greater improvements were apparent at follow-up, particularly in shoulder function and strength, suggesting that benefits with active treatment take longer to manifest.
### Comprehensive Impairment-Based Ex and MT Intervention for Patients w/Subacromial Imp.

**Syndrome: A Case Series**  
*Tate, JOSPT, 2010*

- N=10 w/10 visits in 6-8 W.
- 3-phase progressive strengthening, manual stretching, thrust and non-thrust manipulation to the shoulder/spine, patient education, activity modification, QD HEP of stretching/strengthening.
- Outcomes at 2/4/6/12W

- **Success**
  - 50% improved DASH
  - “Moderately better” on the GROC
  - At 6W
    - 6/10 successful
  - At 12W
    - 8/10 successful

### Shoulder Impingement

*Krommer, J Rehabil Med, 2013*

- MT + EX v. EX only
- All treatments individualized
- Both groups had 10 treatments over 5 weeks w/HEP for 7 more weeks.
- Primary outcome measures at 5 and 12 W: Shoulder Pain and Disability Index, and Patient’s Global Impression of Change.

- **Both groups showed significant improvements**
- **No difference between groups** for the primary and secondary outcomes
- Only the results for mean pain differed at 5 weeks in favor of the intervention group.

### Frozen Shoulder

*Mobilization Techniques in Subjects With Frozen Shoulder Syndrome: Randomized Multiple-Treatment Trial*  
*Jing-lan Yang, Chein-wei Chang, Shiu-yee Chen, Shwu-Fen Wang, Jiu-jenq Lin*  
*Physical Therapy, 87 (10), 2007*

- Effectiveness of the end-range mobilization and scapular mobilization approaching a subgroup of subjects with frozen shoulder syndrome: A randomized control trial  
*Jing-lan Yanga, Mei-Hwa Jana, Chein-wei Changb, Jiu-jenq Linb*  
*Manual Therapy, 2011*
Evidence Status
- Roubal, 1996, Case Series (n=8)
- Placzek, 1998, Case Series (n=31)
- Placzek, 2004, Guidelines & Case Report (n=1)
- Boyles, 2005, Case Series (n=4)
- Roubal, 2006, Case Report (n=1)
- Hando, 2012, Case Series (abstract, n=15)
- Rendeiro, 2012, Prospective cohort (n=9 with tManip)

Total: 69 subjects

Conclusions
- Translational manipulation is effective and safe
- Potentially less risk of harm to GH structures compared to long-lever manipulation
- Need more comparisons to other management approaches
Clinical Practice Guidelines: Adhesive Capsulitis

MAY 2013 | VOLUME 43 | NUMBER 5 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

INTERVENTION – JOINT MOBILIZATION: Clinicians may utilize joint mobilization procedures primarily directed to the glenohumeral joint to reduce pain and increase motion and function in patients with adhesive capsulitis. (Recommendation based on weak evidence.)

INTERVENTION – TRANSLATIONAL MANIPULATION: Clinicians may utilize translational manipulation under anesthesia directed to the glenohumeral joint in patients with adhesive capsulitis who are not responding to conservative interventions. (Recommendation based on weak evidence.)

Clinical Practice Guidelines: Adhesive Capsulitis, cont.

MAY 2013 | VOLUME 43 | NUMBER 5 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY

INTERVENTION – STRETCHING EXERCISES: Clinicians should instruct patients with adhesive capsulitis in stretching exercises. The intensity of the exercises should be determined by the patient’s tissue irritability level. (Recommendation based on moderate evidence.)

Evidence by Region:

Hip and Knee OA
Recommendations for OA of the Hip or Knee:
Am. College of Rheumatology
Hochberg, Arthritis Care & Research, 2012

**Strong Support**
- Participate in aerobic and/or resistance land-based exercise
- Participate in aquatic exercise
- Lose weight (for persons who are overweight)

**Conditional Rec.**
- Receive manual therapy in combination with supervised exercise

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**EB recommendations for the role of exercise in the management of osteoarthritis of the hip or knee—the MOVE consensus—Rheumatology, 2005**

- Multidisciplinary guidelines
- Established 10 ‘propositions’ with ‘strength of evidence grades (1A through 4)
  - 1A – Meta-analysis of RCT; 1B – ≥ 1 RCT
  - 2A - ≥ 1 controlled trial without randomization
  - 2B – at least one quasi-experimental study
  - 3 – descriptive studies
  - 4 – expert reports / opinions

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**MOVE Consensus**

1. Both strengthening & aerobic exercise can reduce pain and improve function and health status in individuals with knee and hip OA (1B knee; 4 hip)

2. Few contraindications to prescription of strengthening or aerobic exercise in individuals with hip/knee OA (4 both)

3. Prescription of both general (aerobic fitness training) and local strengthening exercises is an essential aspect of management of hip or knee OA (4 both)

4. Exercise therapy for OA of hip or knee should be individualized & patient-centered taking into account age, co-morbidity, and overall mobility (4 both)
MOVE Consensus

5. To be effective, exercise programs should include **advice and education** to promote a positive lifestyle change with an increase in physical activity (1B advice/education; 4 that these are required for ex program to be effective)

6. Group ex and home ex are equally effective and **patient preference** should be considered (1A to support group and home, but no head to head comparison has been made)

7. **Adherence** is the principal predictor of long-term outcome from exercise in pts with hip or knee OA (1B as a predictor, 4 as principal predictor)

MOVE Consensus

8. Strategies to improve and maintain **adherence** should be adopted (long-term monitoring/review and inclusion of spouse/family in ex) (1B from gen ex literature, 4 for specific hip/knee evidence)

9. The effectiveness of exercise is **independent** of the presence or severity of **radiographic** findings (4)

10. Improvements in muscle **strength and proprioception** gained from exercise programs may **reduce the progression** of knee and hip OA (4)

**Keep Moving...it is not rocket science!**

Comparison of Manual Therapy and Exercise Therapy in Osteoarthritis of the Hip: A Randomized Clinical Trial

- **Subjects:** 109 patients with hip OA
- **Treatment conditions**
  - Group 1: Manual therapy for hip joint
    - Distraction mobilizations/manipulations and hip stretching
  - Group 2: Exercise therapy
    - 5-week intervention – biw for 9 Rx sessions
- **Outcomes:** 5-, 17-, 29-wk follow-ups
  - Primary: Patient perceived improvement
  - Secondary: Harris Hip Score, timed walk test, VAS pain for main complaint, ROM

*(Hoekstra et al, Arthritis Rheum, 2004)*
Comparison of Manual Therapy and Exercise Therapy in Osteoarthritis of the Hip, cont.

- Manual physical therapy
  - Session started with stretching of shortened muscles
  - Traction of the hip joint, followed by traction manipulation in each limited position
  - All manipulations repeated during each session until optimal results
- Exercise therapy
  - Program adjusted to individual symptoms and designed to improve muscle function, length, joint mobility, pain relief, and walking ability
  - Home exercise program
  
(Hoeksma et al, Arthritis Rheum, 2004)

Comparison of Manual Therapy and Exercise Therapy in Osteoarthritis of the Hip: A Randomized Clinical Trial

- Perceived recovery: significantly more improvement in MT group (81% vs 50%)
- Significant benefits in MT group for function, pain, and ROM

![Graphs: Harris Hip Score (function) and Flexion-Extension ROM](Hoeksma et al, Arthritis Rheum, 2004)


- Subjects: 7 patients with hip OA (per ACR)
- Treatments:
  - Manual Therapy (thrust and nonthrust): Caudal, caudal/medial, lateral, and PA glides
  - Exercise: abductor and ER strengthening, stretches, ex bike

![Images of physical therapy](MacDonald et al, JOSPT, 2006)

• Results:
  – # treatment sessions: median = 5 (range, 4-12)
  – Hip ROM: median increase of 82° (range, 70-86°)
  – Harris Hip Score: median increase of 25 pts (range, 15-38 pts)
  – NPRS: average decrease of 5 pts (range, 2-7 pts)

• Conclusion: Supports combined use of MT and exercise for patients with hip OA

(MacDonald et al, JOSPT, 2006)

Short- and long-term clinical outcomes following a standardized protocol of orthopedic manual PT and exercise in individuals with hip OA: a case series

Hando, Man Manip Ther, 2012

• Methods: Fifteen consecutive subjects (9 males, 6 females; mean age: 52 ± 7.5 years) with unilateral hip OA received an identical protocol of manual therapy and therapeutic exercise interventions. Subjects attended 10 treatment sessions over an 8-week period for manual therapy interventions and performed the therapeutic exercise as a home program.

• Results:
  – Clinically meaningful short and long term improvements in outcomes following a standardized protocol of manual therapy and therapeutic exercise interventions.

• 24 studies
• Analyzed effect on arthritis self-efficacy
• Results:
  – Small-mod effect size observed for both
  – Adding exercise to self-management education programs did not add value
• Implication
  – Social cognitive theory concepts should be included in exercise interventions
  – i.e., set goals, develop individualized action plans, identify rewards, self-monitor progress, and use social supports

High v. Low Intensity Resistance Training for Patients With Knee OA Jan, PTJ, 2008

• Both high- and low-resistance strength training significantly improved clinical effects in this study. The effects of high-resistance strength training appear to be larger than those of low-resistance strength training for people with mild to moderate knee OA, although the differences between the HR and LR groups were not statistically significant

Manual therapy, exercise therapy, or both, in addition to usual care, for hip/knee OA

“As both manual therapy and exercise therapy appear effective, in addition to usual care alone, depending on the outcome of interest, the choice of therapy should be determined by patient characteristics and patient choice.”

Abbott, Osteoarthritis and Cartilage, 2013
Effectiveness of Manual Physical Therapy and Exercise on Osteoarthritis of the Knee: A Randomized, Controlled Trial

Deyle et al, Ann Inter Med, 2000

- Subjects: 83 patients with knee OA
- Treatment conditions
  - Group 1: Manual therapy and Exercise (impairment-based for LS, hip, knee, and ankle joints)
  - Group 2: Subtherapeutic US
  - 4-week intervention – biw for 8 Rx sessions
- Outcomes (initial, 4-wk, 8-wk, 1-yr)
  - 6-minute walk distance
  - WOMAC score

Effectiveness of Manual Physical Therapy and Exercise on Osteoarthritis of the Knee, cont.

Deyle et al, Ann Inter Med, 2000

- Significant improvement in MTE group for WOMAC scores, walk test, and surgery rates

Effectiveness of Manual Physical Therapy and Exercise on Osteoarthritis of the Knee, cont.

Deyle et al, Ann Inter Med, 2000

<table>
<thead>
<tr>
<th>1-year results</th>
<th>MTE Group (n=42)</th>
<th>Placebo Group (n=41)</th>
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<tr>
<td>Surgery Rates</td>
<td>2 (5%)</td>
<td>8 (20%)</td>
</tr>
<tr>
<td>Steroid injections</td>
<td>2 (5%)</td>
<td>6 (15%)</td>
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</tbody>
</table>

Conclusion: Manual physical therapy and exercise results in functional improvements and may delay surgery for patients with knee OA
Home Based Exercise Program for Knee Pain & Knee OA: Randomized Controlled Trial
Thomas et al, BMJ, 2002

• 786 patients into 4 groups
  – Exercise therapy
  – Monthly phone contact
  – Exercise therapy + phone contact
  – No intervention
• WOMAC at 2 years
• Highly significant reduction in knee pain for pooled exercise groups
• Conclusion: A simple home based exercise program can significantly reduce knee pain

Physical Therapy Treatment Effectiveness for Osteoarthritis of the Knee: A Randomized Comparison of Supervised Clinical Exercise and MT Versus a HEP
Deyle et al, Phys Ther, 2005

• Subjects: 134 patients with knee OA
• Treatment conditions
  – Group 1: Manual therapy, supervised exercise, and HEP (impairment-based for LS, hip, knee, and ankle joints)
  – Group 2: Home exercise program
  – 4-week intervention – biw for 8 Rx sessions
• Results: (initial, 4-wk, 8-wk, 1-yr)
  – Significant improvement in WOMAC scores
    • 52% MTE group; 26% HEP group
  – Similar improvements in 6-minute walk distance (~10%)
Clinical Hip Tests And A Functional Squat Test In Patients With Knee Osteoarthritis: Reliability, Prevalence Of Positive Test Findings, And Short-term Response To Hip Mobilization

Cliborne AV et al, JOSPT, 2004

• Purpose:
  – Examine short-term effects of hip mobilizations
  – Identify prevalence of painful hip symptoms

• Methods:
  – 22 pts with knee OA; 17 asymptomatic pts
  – Hip tests: Functional Squat, FABER, Hip Flexion, Hip Scour
  – Hip mobilizations: Caudal glide, AP glide, PA glide, PA in FABER position

• Outcomes:
  – Pre- and post-mobilization measurements
    • % of knee OA patients with positive hip tests
    • NPRS for each hip test
    • ROM for each hip test (except hip scour)

Hip flexion
Hip scour
FABER
Functional squat

Mobilization Procedures

Anterior-Posterior
Caudal Glide

Cliborne AV et al, JOSPT, 2004
**Mobilization Procedures**

Posterior-Anterior in Flexion/Abduction/External Rotation

Cliborne AV et al, *JOSPT*, 2004

**Results**

Significant decrease ($p<0.05$) in prevalence of positive test results (except Hip Flexion) post-treatment

Cliborne AV et al, *JOSPT*, 2004

- Significant improvement in Pain and ROM following treatment
- Change score: NPRS = 3.9pts; ROM = 13 degrees
**Conclusion**

- Hip assessment may be beneficial in the examination of patients with knee OA
- Impairments improved, positive test findings were reduced after a single treatment session
- Further work needed to determine the effect of hip mobilization on function and disability

Cliborne AV et al, *JOSPT*, 2004

**Development of a Clinical Prediction Rule to Identify Patients with Knee Osteoarthritis who Respond Favorably to Short-Term Hip Mobilizations**


**Inclusion Criteria**


Knee pain & 3 of the following:
- Age 50-80 years old
- Palpable bony enlargement
- Morning stiffness < 30 minutes
- Knee crepitus
- Bony tenderness to palpation
- No palpable warmth of the synovium
Clinical Prediction Rule

<table>
<thead>
<tr>
<th>Item</th>
<th>Sn</th>
<th>Sp</th>
<th>LR+</th>
<th>LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip/Groin Pain or Paresthesia</td>
<td>.20</td>
<td>.98</td>
<td>8.1</td>
<td>.82</td>
</tr>
<tr>
<td>Anterior Thigh Pain</td>
<td>.27</td>
<td>.95</td>
<td>5.1</td>
<td>.77</td>
</tr>
<tr>
<td>Pain with Hip Distraction</td>
<td>.13</td>
<td>.98</td>
<td>5.2</td>
<td>.89</td>
</tr>
<tr>
<td>Knee Flexion PROM &lt; 122°</td>
<td>.32</td>
<td>.95</td>
<td>6.0</td>
<td>.72</td>
</tr>
<tr>
<td>Hip IR PROM &lt; 17°</td>
<td>.32</td>
<td>.95</td>
<td>6.0</td>
<td>.72</td>
</tr>
</tbody>
</table>

Results

- 41 of 60 (68%) subjects responded successfully
- Single best item: pain or paresthesia in hip/groin (+LR=8.1)
- Combination of any 2 CPR items; +LR=12.9

![Mean GRCS Scores between subjects classified as a success and nonsuccess](chart.png)
Evidence by Region:

**Ankle Sprain**

**Ankle Stability and Movement Coordination Impairments:**

**Ankle Ligament Sprains**

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Ortho Section of the APTA

**Manual Therapy**

**Acute Phase**

Moderate evidence for lymphatic drainage, active and passive soft tissue and joint mobilization, and anterior-to-posterior talar mobilization procedures, within pain-free movement.

**Therapeutic Exercise**

- Strong evidence for early weight-bearing w/external support prn, progressing as tolerated.
  - Strong evidence for general therapeutic exercise program.

**Therapeutic Exercise**

• Weak evidence for single-limb balance activities using unstable surfaces.
  • Weak evidence for balance and sport-related activity training to reduce the risk of re-injury in athletes.

**Sub-Acute Phase**

- Strong evidence for graded joint mobs, manipulations, and WB/NWB mobilization with movement, to improve DF proprioception, and weight-bearing tolerance.
Subjects: 41 patients with acute inversion sprains (<72 hrs)

Treatment conditions:
- Group 1: RICE (RG)
- Group 2: RICE and AP mobilization (MG)
- Six treatments over two weeks

Outcome measures
- Dorsiflexion ROM
- Stride speed
- Step length
- Single support time

Results:
- D/C by 4th treatment: 13/19 in MG; 3/19 in RG (p<.01)
- Dorsiflexion: significant gains over RICE alone (p<.01)
- Stride speed: Greater increases in MG group after 1st and 3rd sessions (p<.05)
- Step length: Greater increase in MG after 2nd session (p<.05)
- Single limb support time: no difference

Conclusion:
- Addition of a talocrural mobilization to the RICE protocol in the management of ankle inversion injuries necessitated fewer treatments to achieve pain-free dorsiflexion and to improve stride speed more than RICE alone.
The Initial Effects of a Mobilization with Movement Technique on Dorsiflexion and Pain in Subacute Ankle Sprains  
Collins et al, Man Ther, 2004

• Subjects: 14 pts w/ subacute Grade II ankle sprains
  – Repeated measures design
• Treatment conditions
  – Mobilization With Movement (MWM)
  – Placebo – firm elbow contact
  – Control – no manual contact
• Results
  – Significant increase in DF ROM post-MWM
  – No differences in pressure or thermal pain threshold
• Conclusion: MWM technique results in increased DF ROM post treatment

Initial Changes in Posterior Talar Glide and Dorsiflexion of the Ankle After Mobilization With Movement in Individuals With Recurrent Ankle Sprain  
Vicenzino et al, JOSPT, 2006

• N= 16, chronic lateral ankle sprain.
• Within subjects design.
• 3 conditions:
  – WB MWM
  – NWB MWM
  – Control
• Outcomes: WB DF ROM, Posterior talar glide ROM.

Results
• WB and NWB MWM techniques significantly improved posterior talar glide by 55% and 50% of the pre-application deficit between affected and unaffected sides, respectively, (P.001).
• WB and NWB MWM treatment techniques improved WB DF by 26% (P.017), compared to 9% for the control condition.  
Vicenzino et al, JOSPT, 2006
**Efficacy of Mobilization with Movement for Patients with Limited Dorsiflexion after Ankle Sprain: A Crossover Trial**

Reid et al, *Physio Canada*, 2007

- N = 23, ankle sprains within last 2 years, limited DF.
- Randomized cross over design.
- Sham vs. WB MWM
- Outcome: WB DF ROM
- Change in DF following
  - MWM: .63 cm
  - Sham: .18 cm

**The Use of Manipulation in a Patient with an Ankle Sprain Injury not Responding to Conventional Management: A Case Report**

Whitman et al, *Man Ther*, 2005

- Subject: 27yo volleyball player s/p inversion ankle sprain; chronic symptoms x 3 weeks
- Treatment interventions:
  - Manual therapy: proximal tib-fib manipulation, ankle distraction manipulation, TCJ AP glide, TCJ/STJ lateral glide, and ankle eversion mobilizations
- Results (4-day and 6-wk follow-up)
  - NPRS decreased from 7/10 to 1/10 to 0/10
  - PSFS increased from 5.5 to 10
  - Function: Crutches to 2 mile runs within 4 days
- Conclusion: Assess joint function and consider MT techniques early for patients s/p ankle sprains

**Treatment of Cuboid Syndrome Secondary to Lateral Ankle Sprains: A Case Series**

Jennings & Davies, *JOSPT*, 2005

- Subjects: 7 (5 male) w/ similar injuries of plantar flexion/inversion ankle sprains
  - Symptom duration (range, 1 day to 8 weeks)
- Treatment: 1-2 cuboid manipulations
- Results: All back to competitive activity after 1-2 visits.
Predicting Short-Term Response to Thrust and Non-thrust Manipulation and Exercise in Patients Post Inversion Ankle Sprain

Whitman et al, *JOSPT*, 2009

- **N = 85**
- Prospective Cohort design
- Standardized examination
- Standardized Intervention up to 2 visits.
- Success = at least +5 on GROC.
- Inclusion criteria:
  - GD I-II inversion ankle sprains, ages 16-60, at least 3/10 on NPRS.
- Exclusion criteria:
  - GD III sprain, +OAR, Red Flags, prior ankle/foot surgery, fractures.
- Days post injury
  - Mean: 22
  - Median: 11
- 13 subjects with symptoms > 90 days
  - 10 in success group
  - 3 in non-success group

Manual Therapy Intervention Thrust Procedures

Whitman et al, *JOSPT*, 2009

Superior tib-fib P/A thrust

Talocrural distraction thrust

Max of 2 attempts based on presence of audible pop.
Manual Therapy Intervention
Non-Thrust Procedures

Whitman et al, JOSPT, 2009

Exercise Intervention

Whitman et al, JOSPT, 2009

- Achilles WB and NWB stretch 3 x 30 sec. each 2 x/day.
- Ankle ‘Alphabet’ 2x/day.
- Self mobilization TC & ST 3 x 30 reps.

Outcomes

- 75% met criteria for success within the first 2 visits.
- 4 predictor variables:
  - Symptoms worse when standing
  - Symptoms worse in the evening
  - Navicular drop > 5 mm
  - Distal tibiofibular joint hypomobility.
- + LR for success with 3 of 4 variables = 5.90. 95% CI (1.08, 41.60)

Whitman et al, JOSPT, 2009
Interventions Considerations
with Selected Manual and Exercise Interventions

How will you decide if pain is ok?

TherEx is Prescribed and Progressed

• Which exercises are the best medicine
• What is the therapeutic dose?

• How can we convince patients to consider exercise as medicine?
• How might we facilitate attention to dosing?
**TherEx Considerations**

*Are the muscles...*

**...too loud?**
- Rx
  - Inhibition
  - Lengthening

**...too quiet?**
- Rx
  - Activation
  - Strength/Endurance
  - Integration

“When we try to pick out anything by itself, we find it hitched to everything else in the universe.”

---

John Muir

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**Progress Exercise Based on the Physical Requirement**

- Factors of Progression
  - Excursion
  - Speed
  - Load
  - Volume
  - Complexity

Which is more relevant for your gardener, golfer, soldier...?
Sources of Motivation

- Rewards / Punishment
- Shame / Guilt
- Values
- Self Identity

External  Internal

Managing Expectations

- Valid pain treatment can lose its clinical efficacy if patients do not expect pain relief.
- Consider previous experiences with ineffective treatments
  – Goffaux, Pain, 2007

Med Options

- Manage Thoughts and Emotions
- Take Control of Diet and Lifestyle Choices
- Understand the Effect of Life Events
- Optimize Activity and Function
Goals are not enough
Get patient buy in for specific tasks, not just agreement on goals.

Sense of Coherence

**Def:** A global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that one’s internal and external environments are predictable and that there is a high probability that things will work out as well as can reasonably be expected  
— Antonovsky 1979

**Components of SoC**

- **Comprehensibility**
  - understanding the nature of the problem
- **Manageability**
  - aka, agency
    - “You can do it!”
- **Meaningfulness**
  - Connect the dots from actions to goals

**Physical therapists need to “search for words with clear, precise meaning and with connotations that do not evoke dread in the patient.”**

**Phrases that scare**
- Bone on Bone
- To a 29 y/o “you have the spine of an 80 y/o”
- You don’t have a curve in your lower back
- Your SI is out of place
- This bone in your neck is rotated
- This rib is out

**Phrases that heal**
- The good news is...
- Normal age related changes...
- We see this a lot...
Bottom Line

Move It & Move On

Educate and Assuage Fear!

Fire It & Fire On

Selected Manual and Exercise Interventions for Low Back Pain

Low Back Pain
Manual Therapy Interventions
Low Back Pain
Manual Therapy Interventions

Kisner and Colby, Therapeutic Exercise, 6th Ed., F.A. Davis
Neck Pain
Ther Ex Interventions

Shoulder
Manual Therapy Interventions

Shoulder
Manual Therapy Interventions
Shoulder
Ther Ex Interventions

Phase 1
Tate, JOSPT, 2010
Knee OA
Ther Ex Interventions

Ankle Sprain
Manual Therapy Interventions
Ankle Sprain

Manual Therapy Interventions

- Successful programs involve
  - SLS on stable and unstable surfaces
  - General strengthening
  - Performance of functional activities such as hopping and figure of 8 running
  - Frequency/duration of these programs has been
    - 1–5 times per week for 4–8 weeks

Ankle Sprain

Ther Ex Interventions

Integrate the kinetic chain
Ankle Sprain
Ther Ex Interventions

Integrate the kinetic chain

Ankle Sprain
Ther Ex Interventions

Integrate the kinetic chain

Ankle Sprain
Ther Ex Interventions

Return to Sport Activities
Summary

• Substantial theoretical and empirical evidence that manual therapy and therapeutic exercise have synergistic effects

• Biopsychosocial model and the evidence suggest that approaches to manual therapy and exercise can be varied

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