ChiroCredit.com Presents
Manipulation 106

Current Research and Cost Effectiveness

By: Dean Smith, DC, PhD

Educational Objectives

- describe spinal manipulation use by time, place, and person, identify predictors of the use of spinal manipulation
- review cost-effectiveness of SMT compared to other treatment options for people with spinal pain of any duration
- describe the current literature on patient-centered outcomes following a specific type of commonly used SM, high-velocity low-amplitude (HVLA), in patients with LBP

Educational Objectives

- review the putative mechanical features of the subluxation and three theories that form the foundation for much of chiropractic practice
Scope of Paper

- Chiropractic and osteopathic medicine are the two most common professions associated with manipulation
- Objectives: describe manipulation by time (temporal trends), place (geographic distribution), person (both practitioner and patient) and to describe predictors for use of manipulation
- Definition of manipulation: high-velocity, low amplitude (HVLA) manipulation and low force techniques such as spinal mobilization (massage or other manual techniques excluded)

Methods

- Systematic review of English language literature
- Search Medline with dates 1980 through June 2011
- 822 citations identified then narrowed down to 75 that were included with 21 more added by reference lists
- Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) - consists of a 27-item checklist and was used as guide for methods/results
Results – Temporal Trends
- Indications are that spinal manipulation has increased in use the last few decades in U.S. and elsewhere
- Between 1974 and 1982: 7.5% received chiropractic
- Assuming most (>80%) chiropractic patients receive manipulation, about 4% of people in US in 1980 had spinal manipulation
- 10% had chiropractic care in 1990 with avg 13 visits/pt
- 7.6% in 1999, 7.4% in 2002, no change from 2002-2007

Results – Geographic Distribution
- Origins and most membership of chiropractic and osteopathy are in North America so literature base also mostly here
- Large differences in use within US regions
- Numbers of DCs and DOs have increased in Europe and Australia due to schools and integration into health care plans
- Chiropractic and osteopathy most common in Australia
- Chiropractic and naprapathy most common in Sweden
- Annual spinal manipulation rates are generally lower in England/Great Britain but similar in Japan and Italy

Results – Practitioners
- 94% of reimbursement sought for spinal manipulation in US is delivered by chiropractors, osteopaths 4%
- PTs are 3rd leading providers of manipulation but not common practice among North American/European PTs
- DCs likely deliver much of the spinal manipulations in Europe and Australia but less data available
- 12 month prevalence of use of DCs and DOs in Australia are 16.1% and 4.6% respectively
- Orthopedic surgeons in Germany are often trained in manipulation
Results – Patients

- Most commonly report symptoms of low back/neck
- 1991 – 2/3 of all visits were for head, neck back pain
- 1998 – 68% seek care for low back
- 2005 – 75% seek care for low back, neck, head pain
- DOs may be used more frequently for non-musculoskeletal conditions
- Chiropractic use in subgroups: long term lymphoma survivors (39%), primary care outpatients (34.5%), intercollegiate athletes and rehab outpatients (29%), MS patients (25.5%), chronic tension headache pts (22%)
- Patients report very good or excellent satisfaction
- 94% report immediate improvement at recent World Games

Table 1

<table>
<thead>
<tr>
<th>Socio-demographic</th>
<th>Evidence from the literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle-aged or older</td>
<td></td>
</tr>
<tr>
<td>High school or college educated</td>
<td></td>
</tr>
<tr>
<td>Married or single</td>
<td></td>
</tr>
<tr>
<td>Female or male</td>
<td></td>
</tr>
<tr>
<td>White or non-Hispanic</td>
<td></td>
</tr>
<tr>
<td>Living in a rural or urban area</td>
<td></td>
</tr>
<tr>
<td>Living in the West</td>
<td></td>
</tr>
<tr>
<td>Worse health status</td>
<td></td>
</tr>
<tr>
<td>Better overall health status</td>
<td></td>
</tr>
<tr>
<td>Multiple chronic conditions and activity limitations</td>
<td></td>
</tr>
<tr>
<td>Fewer disabling conditions and restricted-activity days</td>
<td></td>
</tr>
<tr>
<td>Lower stress levels</td>
<td></td>
</tr>
<tr>
<td>Less severe pain</td>
<td></td>
</tr>
<tr>
<td>Better personal injury</td>
<td></td>
</tr>
<tr>
<td>Higher use of conventional medical care</td>
<td></td>
</tr>
<tr>
<td>Higher use of complementary and alternative medical care</td>
<td></td>
</tr>
<tr>
<td>Difficulty accessing medical doctors</td>
<td></td>
</tr>
<tr>
<td>Adequate health insurance</td>
<td></td>
</tr>
</tbody>
</table>

Results – Children

- 2007 National Survey – 2.8% of children received chiropractic or osteopathic manipulation in past year
- Chiropractors are the most frequently seen alternative provider by children in Canada, US, Australia
- Pediatric chiropractic practice encompasses more non-musculoskeletal complaints
- Tertiary pediatric patients (e.g. cancer) may be more likely to seek chiropractic care
Conclusions

- Use of spinal manipulation has increased over the last few decades but recently rates of use have stabilized.
- Patients seek chiropractic care generally for musculoskeletal complaints.
- Manipulation is often used with other therapies.
- Although children receive spinal manipulation less frequently than adults, they are more likely than adults to have non-musculoskeletal ailments.
- Patients are generally very satisfied with care that includes spinal manipulation.

Background

- Neck and back pain is common in today’s society.
- It presents major economic burdens due to the high level of chronicity and the resulting long term disability that are associated with high health care costs and losses of productivity.
- As clinicians, we tend to focus on clinical practice guidelines regarding the effectiveness of our care as opposed to the cost-effectiveness of treatment.
- Obviously cost-effectiveness is an important consideration in allocating health care resources.
Background

- Economic evaluations are performed frequently alongside randomized controlled trials of treatment effectiveness and typically involve the identification, measurement, valuation and comparison of the costs and benefits of two or more alternative treatments.
- Economic evaluations are most beneficial when the treatments have been evaluated for efficacy, effectiveness and availability.
- Economic study of treatments provides us with the information of ‘value for money’.

- Spinal manipulative therapy (SMT) seems to provide greater improvements for pain and function than a placebo or no treatment but similar improvements to many competing treatments according to some recent research.
- While there seem to be favorable clinical effectiveness studies of chiropractic compared to other interventions, what about cost-effectiveness?
- This study aimed to investigate the cost-effectiveness of SMT compared to other treatment options for people with spinal pain of any duration.

Methods

- Clinical and economic databases were searched for studies evaluating the cost-effectiveness of SMT for spinal pain.
- Two authors independently screened search results, extracted data and assessed risk of bias using the Consensus on Health Economic Criteria (CHEC-list).
- The data derived from each study included: a) type and perspective of the economic evaluation, b) subjects, c) treatment comparisons, d) year, study duration, country and currency, e) comprehensive cost evaluation, and f) results.
Methods

- The primary outcome used was the relative cost-effectiveness of the interventions — usually reported as an incremental cost-effectiveness or cost-utility ratio (ICER).
- The ICER indicates the ratio of change in costs to the change in effects of the various treatments.
- ICER represents the incremental difference in costs between the competing treatment alternatives relative to the incremental difference in effects, and can be interpreted as the additional monetary investment needed for an intervention to gain one extra unit of effect compared to the alternative treatment.

Results

- The authors performed a systematic review and found six cost-effectiveness studies along with cost-utility analyses.
- The number of participants in each of the 6 studies ranged from 146 to 1334.
- All included studies had a low risk of bias scoring at least 16/19 on the CHEC-List.
- SMT was delivered by chiropractors, physiotherapists, and osteopaths with treatments involving a combination of manipulation, mobilization, and advice.

The 6 included studies

Results

- SMT was found to be a cost-effective treatment to manage neck and back pain when used alone or in combination with other techniques compared to GP (general practitioner) care, exercise and physiotherapy
- SMT demonstrated better cost-effectiveness and recovery over GP care for neck pain
- SMT was found to be a cost-effective treatment option compared to an exercise program in terms of pain, recovery and quality-adjusted life-years (QALYs) gained

Results

- SMT plus GP care was found to be a cost-effective treatment compared to GP care alone
- SMT plus GP care was also found to be a cost-effective treatment plan compared to GP care plus exercise
- Annual costs of a combined treatment approach (SMT plus advice and exercise) compared to GP care were lower and with respect to pain and disability outcomes, the data suggested the combined treatment was dominant over GP care

Conclusions

- In conclusion, this systematic review found SMT to be a cost-effective treatment to manage spinal pain
- The review supports the use of SMT in clinical practice as a cost-effective treatment when used alone or in combination with other treatment approaches
- The evidence was primarily based on single studies conducted in the UK and the Netherlands
- More high quality studies will help determine whether these findings are generalizable in different settings
Results

- Chiro group had lowest Rx rates across all drug categories (PT group highest for NSAIDs, muscle relaxant, oral steroids)

Across the five patterns, the greatest rates of incongruence were posted by the Complex MM approach
Background

- Low back pain (LBP) is a well-recognized public health problem
- The lifetime prevalence ranges from 11% to 84%
- Given the common nature of the condition, treatment options are plentiful, but there is no single standard approach to health care for LBP
- Current evidence suggests that the diagnostic testing for and treatment of low back pain do not conform to evidence-based practice
Background

• Care as well as use of advanced imaging and narcotics for lower back pain is very high
• The use of evidence-based treatments are low when compared with current best evidence and many treatments are over-utilized
• While the evidence accumulates and we begin to learn more about the physiological and biomechanical mechanisms of spinal manipulation (SM), we do not know the exact mechanisms yet

Clinical trials often rely on patient-perceived outcomes such as pain level and functional status
• While these measures are sometimes considered ‘soft’ by scientific researchers, their use flourishes and remains as a standard part of assessment
• The most commonly used patient-based outcome assessments in chiropractic SM research are a mix of both pain and functional health status measures, including the Visual Analogue Scale (VAS), the Numerical Rating Scale (NRS), the Roland Morris Disability Questionnaire (RM), the Oswestry Low Back Pain Disability Index (OSW) and the Short Form-36 (SF-36)

Purpose/Methods

• The purpose of this article was to describe the current literature on patient-centered outcomes in randomized controlled trials (RCT) of High Velocity Low Amplitude (HVLA) SM in patients with low back pain
• searched Pubmed, Index to Chiropractic Literature and the Cochrane Library for articles pertaining to patient centered outcomes of HVLA SM for low back pain
• HVLA SM was defined in this paper as manually delivered high velocity low amplitude force or thrust applied to a vertebral or pelvic joint with the intent of creating a momentary separation of joint surfaces and cavitation (although not a necessary component)
Methods

- Patient centered outcomes were defined as questionnaires completed by the patient relating to pain and/or physical, emotional or social functioning.
- In attempt to compare data from the studies found, data were primarily extracted in the form of means, standard deviations and confidence intervals.
- Thirty-eight papers were included in the analysis.

Results

- HVLA SM for LBP appears to convey a small but consistent treatment effect at least as large as that seen in other conservative methods of care.
- The conclusions of this paper are similar to previous reviews in that although the data are generally insufficient to make strong recommendations, SM appears to be one of several effective treatment options for both acute and chronic LBP.
- With respect to visual analogue scale scores, mean change scores were similar at both short term and long term follow-ups.

<table>
<thead>
<tr>
<th>Study</th>
<th>HVLA SM</th>
<th>No SM</th>
<th>Statistical Analysis</th>
<th>Mean Change at Short Term</th>
<th>Mean Change at Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith et al.</td>
<td>0.3</td>
<td>0.2</td>
<td>Student's t-test</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Johnson et al.</td>
<td>0.4</td>
<td>0.3</td>
<td>ANOVA</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Davis et al.</td>
<td>0.5</td>
<td>0.4</td>
<td>Mann-Whitney</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Brown et al.</td>
<td>0.6</td>
<td>0.5</td>
<td>Wilcoxon signed rank</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>White et al.</td>
<td>0.7</td>
<td>0.6</td>
<td>Chi-square</td>
<td>0.9</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Note: Statistical tests can vary in their sensitivity and power, and the specific results can be influenced by sample size, effect size, and other factors.
Results

- Between group (comparing one group to another) treatment effects tended to favor spinal manipulation but the differences were not clinically or statistically significant.
- Using the Roland Morris Disability Questionnaire, studies found within group (e.g., those within the spinal manipulation group) changes were higher in studies focused on acute LBP compared to chronic LBP and between group differences were inconsistent.
- Assessing the effect of SM on patient centered outcomes using the Oswestry Low Pain Disability Index showed that long term outcomes were similar to short-term outcomes.

Conclusions

- Due to differences and inconsistencies in reporting methods within the studies reviewed, it is difficult to draw solid conclusions.
- Future studies using patient-centered outcomes of high-velocity, low-amplitude spinal manipulation for low back pain would benefit from addressing these issues.

Summary of Outcome Measure Recommendations For Use In Clinical Practice

<table>
<thead>
<tr>
<th>Outcome Type</th>
<th>Recommended Measure(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Intensity</td>
<td>Numerical Rating Scale (VRS), 0-10</td>
</tr>
<tr>
<td></td>
<td>Visual Analog Scale (VAS)</td>
</tr>
<tr>
<td>Low Back Pain</td>
<td>Modified Oswestry Low Back Pain Disability Questionnaire (MBPQ)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck Pain</td>
<td>Neck Disability Index (NDI), 0-100</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Extremity</td>
<td>Modified Upper Limb Functional Index (ULFI), 0-64</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Extremity</td>
<td>Lower Extremity Functional Scale, 0-100</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Background

- It is reasonable to think that spinal manipulation which is a mechanically based treatment would have a mechanical derangement of the spine as a critical causal element
- The subluxation has been the historical reason for manipulation
- Vertebral subluxation is a biomechanical spine derangement thought to produce clinically significant effects by disturbing neurological function
- Subluxation determined usually by palpation or radiographic examination

Biomechanical Features - Subluxation

- DD Palmer – misalignment is hallmark feature
- Smith – intervertebral hypomobility
- Nowadays both misalignment and hypomobility are considered features but hypomobility has received more recent attention
- Chiropractors also recognize hypermobility as a result of trauma, connective tissue pathology or compensation to hypomobility
Hypomobility

- Patients with headache, neck, back, limb pain often have altered spine mobility
- Hypomobility has been identified as a key prognostic factor in studies developing clinical prediction rules for neck pain and low back pain
- Degenerative spine changes are associated with intersegmental hypomobility, even when the individuals have no history of low back pain complaints
- Clinical paradox: severity and disability of neck and back pain do not correspond to the degree of spinal degeneration observed with imaging

Hypermobility

- Hypermobile segments are not manipulation targets
- Compensatory hypermobility may occur in response to hypomobility elsewhere (adjacent segment disease)
- Such compensation occurs after spine fusion surgery or physiologically induced by adjacent hypomobility
- Demonstrated by the External Link Model
- Tx: adjust hypomobile segments and use stabilization exercise
Intervertebral Dyskinesia
- Can’t forget about the make up of the 3 joint complex
- Perhaps the quality rather than quantity of intervertebral motion is modified with subluxation
- Immobility/static postures create local tissue stresses
- Fatigue affects muscle recruitment patterns
- Increasingly suggested that a joint may have normal ROM but aberrant motion paths/coupled motions
- Spine buckling – rapidly developing spine instability
- Neutral zone – portion of joint ROM in a DOF around its neutral position up to beginning of some resistance

Theoretical Mechanisms - Subluxation
1) Encroachment of the intervertebral foramen (IVF) or spinal canal
2) Altered afferent input from spinal and paraspinal tissues
3) Dentate ligament mediated cord distortion

Encroachment of IVF/Canal - Subluxation
- Narrowing of the spinal canal and intervertebral foramen has been demonstrated in association with vertebral misalignments
- Several small animal models were developed to examine the putative neurophysiological consequences of IVF encroachment
- Vertebral canal and IVF stenosis, with encroachment upon neural structures can occur as a result of vertebral subluxation with osseous degeneration and/or soft-tissue changes
Altered Afferent Input - Subluxation

- Chiropractic theory posits that changes in intervertebral mobility or alignment provides altered afferent input to the central nervous system, causing neuroplastic changes that impact biological function.
- SM normalizes spine biomechanics, and as a consequence, normalizes afferent input to the central nervous system resulting in normalized neurological function and improved health outcomes.
- Activity dependent plasticity provides a mechanistic explanation for how brief mechanical loads that characterize SM can produce long-term changes in neurophysiology.

Dentate Ligament - Subluxation

- Grostic - (1) Direct mechanical irritation via dentate ligament traction, and (2) Venous occlusion and resultant local blood stasis and ischemia of the upper cervical cord, also produced by dentate ligament traction.
- Connective tissue bridge between the rectus capitus posterior minor (RCPm) and the spinal dura in the region of the posterior atlanto-occipital membrane.
- Bakris et al. argued that if a misaligned C1 vertebra can indeed produce relative ischemia of the brainstem circulation, this may increase systemic blood pressure via well known brainstem mechanisms.

Subluxation as Indicator for SM

- Small effect size so commonly reported in population-based clinical studies may be due largely to the heterogeneity of the study populations.
- VSC - subluxation is increasingly viewed as a contributory cause in a web of causation.
- VSC is a theoretical construct identifying causal pathways that integrate subluxation with diverse pathophysiological changes in nerve, muscle, ligamentous, vascular and connective tissues.
- Does adjusting the hypomobile segment matter?
Summary

- SM has been shown to be beneficial for painful conditions that are associated with large personal and economic costs on the patient and society.
- Little is known about the most fundamental aspects of this therapy and it is clear that the most effective applications of SM have not yet been realized.