Osteopathic Manipulative Medicine Vs. Counseling in the Treatment of Sports-Related Concussion: Comparative Balance Assessment

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Background & Hypothesis

• The CDC estimates the annual burden of concussion in the United States to be roughly 1.4-3.8 million (1).
• Addressing somatic dysfunctions that contribute to mild traumatic brain injury/concussion (mTBI) symptoms with Osteopathic Manipulative Medicine (OMM) serves as a potential option (2).
• Sensory Organization Testing (SOT) and the Sideline Concussion Assessment Tool (SCAT) can assess impaired balance and track improvement and compare outcomes between control subjects and those treated with (Osteopathic Manipulative Medicine) OMM following concussion (2).
• Subjects treated with OMM have shown symptomatic improvement after one OMM treatment (3)

Subjects & Protocol

• In post-concussive collegiate athletes, we expect SOT scores and SCAT sub-scores to improve by the subject's second visit to the NYIT-COM Academic Healthcare Center (AHCC).
• Additionally, we expect SOT scores and SCAT sub-scores to improve by a greater margin in subjects treated with OMM than those who received education and counseling alone.
• Significance: Improvement in balance assessment through the use of SCAT and SOT helps maximize the efficacy of OMM in treating post-concussive symptoms.

Materials & Methods

Results

Conclusion
Subjects and Protocol

- Subjects: collegiate athletes from New York Institute of Technology and Long Island University Post, both in Old Westbury, NY
- Subjects recruited, assessed, and treated between Nov. 2015 – Jan. 2019
- Intervention: 30 min. Education (Sports Medicine or NMM/OMM Physician) or OMM protocol (NMM/OMM Physician) – see Fig. 2.
- Inclusion Criteria: ICD-9/10 diagnosis of concussion, clearance to participate in the study by AHCC physician, age between 18-50
- Exclusion: life-threatening medical event including hemorrhage or hematoma, seizures, loss of consciousness > 2 minutes
- Subjects recruited consecutively and not matched by age, gender, or sport

Fig 1 (Abridged). Timeline of post-concussive AHCC visits. Click to expand

Fig 2 (Abridged). Subject population. Click to expand

<table>
<thead>
<tr>
<th>Concussive Event</th>
<th>Visit 1 (+24-48h)</th>
<th>Visit 2 (+48-72h)</th>
<th>Visit 3 (7 days post visit 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 Subjects</td>
<td>15 Counseled</td>
<td>17 Received OMM</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Subject demographics. Click to expand

<table>
<thead>
<tr>
<th></th>
<th>OMM</th>
<th>Counseling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Age (mean [SD])</td>
<td>20.1 (2.27)</td>
<td>19.5 (1.4)</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Most common sport (%)</td>
<td>Lacrosse (24%)</td>
<td>Lacrosse (35%)</td>
</tr>
</tbody>
</table>
Materials and Methods

- Prospective randomized controlled trial
- Investigators blinded assignment prior to treatment initiation
- Tools:
  - Sensory Organization Testing (NeuroCom): composite score increases with better postural control
  - Sub-Score of the Sideline Concussion Assessment Tool-5 (SCAT): seven symptoms rated in severity 1-6; increasing score indicates worse symptom profile
  - Education (control subjects): based on CDC’s *What to Expect After a Concussion*
  - Data analysis: Generalized Estimating Equations via SPSS Version 25 (IBM). $\alpha$ set to 0.05
  - IRB approved (BHS-1139), ClinicalTrials.gov listing NCT02750566
Thirty-two subjects were included: 15 received counseling alone, 17 received OMM. Composite scores of SOT, as well as a SCAT sub-score (select symptoms) were compared within- and between groups using a Generalized Estimating Equations model. Single visit differences in SOT and SCAT scores between groups were non-statistically significant at all visits (Table 1A, B). Within-groups analysis of SOT and SCAT sub-scores over time were statistically significant over 3 visits for both groups (both p<0.0001).
These data show time-dependent improvement in post-concussion balance symptoms via SOT and SCAT sub-score regardless of intervention or lack thereof.

Although subjects treated with OMM may report benefit, alternate testing protocols or severities of included subjects’ injuries are needed in order to display such effects.

- Greater sample sizes will help increase power
- The use of OMM in the setting of more severe head injuries may show a more pronounced therapeutic benefit
- Incorporation of more SOT administrations to account for a potential learned effect (4)
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Figure 1. Timeline of post-concussive visits at AHCC.

Figure 2. Subject recruitment.

33 patients recruited

- Lost to follow-up: 1

- Counseling: 15
- OMM: 17

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**METHODS**

- Cranial: including cranial sutures, cranial rhythmic impulse, cranial strains patterns, occipitomastoid & occipitoatlantal SD
- Spinal exam: cervical, thoracic, lumbar, sacrum SD
- Rib cage: thoracic outlet, sternum, clavicle, thoracic diaphragm, rib SD
- Pelvis & Extremities for SD if pertinent to injury or patient complaint

**Osteopathic Structural Exam (OSE)**

- Cranial: Occipitoatlantal decompression, V-spread, venous sinus drainage, BMT, CV4
- Spine: BLT, MET, FPR, ART, HVLA, CS as appropriate
- Ribcage: thoracic outlet release, abdominal diaphragm doming

**Treatment**

- Circulatory Model
- Improvement of lymphatic and Glymphatic Flow
- Biomechanical model - Decrease musculoskeletal restrictions and pain
- Neurologic model – remove restrictions on nerves

**Goals**

- Figure 3. OMM Treatment Protocol. Treatment was tailored to OSE findings, but techniques listed were standard. BMT = balanced membranous tension, CV4 = compression of the 4\(^{th}\) ventricle, FPR = facilitated positional release, ART = articulatory.

- Figure 4. Educational Materials (“What to Expect After a Concussion” by CDC)
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METHODS

Subjects: In-Depth
Study Protocol
Symptom and Balance Scoring
Graphical Trends
Pairwise Comparisons

Figure 5A. Sideline Concussion Assessment Tool – 5 (symptoms used for sub-scoring enlarged)

Figure 5B. Sample Sensory Organization Test Data Output
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Figure 6A: Mean SOT Composite scores by visit

Figure 6B: Mean SCAT sub-score by visit
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### Table 1A (SOT) and B (SCAT sub-score) pair-wise comparisons: Statistically significant score changes noticed by at least the third visit for both outcome measures and treatment groups. No differences between groups at single visits shown to be statistically significantly different. Statistically significant measurements in green type.

<table>
<thead>
<tr>
<th>A</th>
<th>Visit</th>
<th>Abs. Difference</th>
<th>Std. Error</th>
<th>Sig. (p-value)</th>
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<tbody>
<tr>
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<td>1-2</td>
<td>4.37</td>
<td>2.87</td>
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<td>4.56</td>
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<td></td>
<td>1-3</td>
<td>8.94</td>
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<td></td>
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<table>
<thead>
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<th>B</th>
<th>Visit</th>
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<td>1-3</td>
<td>4.71</td>
<td>1.98</td>
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