Does Sensory Reception and Integration Differ between Older Adults With and Without Fibromyalgia?

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Introduction
Fibromyalgia syndrome (FMS) is characterized by widespread musculoskeletal pain, stiffness, fatigue, cognitive symptoms, and varied bodily symptoms [1]. The prevalence of FMS among females by age and cohort has been estimated to be 2 to 5% in the U.S. [2]. Impaired postural control has been found in females with FMS, particularly in the domain of central sensory reception and integration abilities [3]. Cognitive symptoms among females with FMS may be related to poor postural control [4, 5]. This study aimed to investigate (i) differences in central sensory reception and integration abilities for postural control between age-matched older females with and without FMS, and (ii) the influence of a secondary verbal fluency task on altered sensory environments.

Sensory Organization Test®
The Sensory Organization Test® (SOT; SMART Balance Master System, NeuroCom International Inc., Clackamas, Oregon) was used to quantify an individual's ability to effectively sense inputs from the visual, somatosensory, and vestibular systems while supporting postural control, a measure of central sensory reception and integration abilities. Six specific sensory conditions were presented during the SOT (Figure 1) [6]. Participants were instructed to stand quietly with their eyes open or closed and with or without visual information. The Sensory Organization Test® (SOT; SMART Balance Master System, NeuroCom International Inc., Clackamas, Oregon) was used to quantify an individual's ability to effectively sense inputs from the visual, somatosensory, and vestibular systems while supporting postural control.

Methods
Participants
Ten community-dwelling older females with FMS (42 ± 4.7 years) and eight age-matched healthy control females (41 ± 3.4 years) were recruited (Table 1).

Instruments
- Health Activity Questionnaire for demographic information and medical history
- The Revised Fibromyalgia Impact Questionnaire (FIQ) [2] for participants with FMS
- The Symptom Impact Questionnaire (SIQ) [2] for participants without FMS

Procedure
A single 90-minute testing session was conducted as follows:

1. 20-sec trial/condition
2. Dual-task SOT:
   - Cognitive Task Practice: 0.8 (0.21)
   - Cognitive Task: 6.50 (0.48)
3. Single-task SOT:
   - Visual Condition: 66.08 (0.48)
   - Eyes Closed: 65.49 (0.48)

Results

1. Group performance differences in the single-task condition were not statistically significant between females with and without FMS in sensory reception and integration abilities. In sensory conditions one through four, both groups demonstrated signiﬁcantly higher instability in sensory condition one of the dual-task condition when compared to the single-task condition. Finally, a greater degree in postural instability was evident in the FMS group in sensory condition 1 of the dual-task condition (Figure 2).

2. While none of the participants in the HC group experienced any falls in either task condition, those falls were recorded for the FMS group in sensory condition 1 of the single- and dual-task condition tasks with significantly higher incidence of falls evident for the FMS group in sensory condition 1 in both the single- and dual-task condition tasks (p < 0.01 and p < 0.05, respectively).

3. Domain 2: Overall Impact of Symptoms

<table>
<thead>
<tr>
<th>Domain</th>
<th>HC Group (N=8)</th>
<th>FMS Group (N=10)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall history (%)</td>
<td>50.0 (25.0)</td>
<td>50.0 (25.0)</td>
<td>0.7</td>
</tr>
<tr>
<td>Years of FM diagnosis (N)</td>
<td>10-15 years</td>
<td>6-10 years</td>
<td>0.04</td>
</tr>
<tr>
<td>10-15 years</td>
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<td>0</td>
<td></td>
</tr>
<tr>
<td>16-20 years</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Greater than 20 years</td>
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<td>0</td>
<td></td>
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</tbody>
</table>

4. Postural Control Between Age-Matched Older Females With and Without FMS, and (ii) the Influence of a Secondary Verbal Fluency Task on Altered Sensory Environments.

Table 1: Demographics and Symptoms

<table>
<thead>
<tr>
<th>Domain</th>
<th>HC Group (N=8)</th>
<th>FMS Group (N=10)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M/D)</td>
<td>64.0 (8.42)</td>
<td>65.5 (8.42)</td>
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<tr>
<td>Number of Medical Conditions (M/D)</td>
<td>4.96</td>
<td>2.08 (0.83)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Fall history (%)</td>
<td>50.0 (25.0)</td>
<td>50.0 (25.0)</td>
<td>0.7</td>
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<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
This preliminary study demonstrated that overall levels of postural stability were lower in the FMS group when compared to the HC group under different sensory conditions as indicated by the FMS group demonstrating significantly higher postural instability in sensory condition 2 of the dual-task condition (p < 0.01). The significant influence of secondary verbal fluency on postural instability in sensory condition 1 of the dual-task condition suggests that women with FMS are particularly vulnerable to a loss of balance if exposed to sensory environments (e.g., low lighting combined with compliant surfaces).

References

Figure 1. The six sensory conditions of the Sensory Organization Test® (SOT; SMART Balance Master System, NeuroCom International Inc., Clackamas, Oregon).

Figure 2. Interaction between Task Condition, Sensory Condition, and Group. (A. Performance of participants with FMS. B. Performance of participants without FMS.)