Exercise for Postural Kyphosis in Individuals with Osteoporosis

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Aging and Falls
Falls and Injuries

- Falls represent a significant health risk in the elderly with osteoporosis
  - result in injuries that require medical attention

Rates of ER visits for injurious falls among elderly people.
*(Population Division, U.S. Census Bureau, 2006)*
Sequelae of aging in musculoskeletal system

- Changes in postural alignment - *kyphosis*
- Osteoporotic fractures
- Shifts of center of mass position
- Increase demand of force capacity

Passive bone

Osteoporosis
Decline in bone mineral density

- Loss of bone mass
- Vertebrae height decrease

Sequelae of aging in motor control system

Active muscle

Sarcopenia
Decline in muscle mass

- Loss of lean skeletal muscle
- Muscle strength decrease

Control coordination

- Loss of error-compensation
- Adaptation ability decrease

Fall and fracture

Hypothetical Model for Effects of Aging on Upright Balance

(Hsu* et al, J Formos Med Assoc, 2014)
Upright Balance

• Stability in upright position
  – keeping the vertical projection of the whole body center of mass within the base of support
Postural Kyphosis in Osteoporosis

Images showing the progression of postural kyphosis over time.
Purpose

Myofascial release technique (Baldwin et al 2013)

- To relieve pain
- To increase joint mobility
- To improve posture

Aim of this study

- To investigate the immediate effects of **stretching exercise** and **myofascial release** on kyphotic posture in individuals with osteoporosis and osteopenia
## Participants

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>• aged &gt; 40 years old</td>
<td>• neurological disorders</td>
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<tr>
<td>• had a DXA scan within the last year with a T-score (spine or hip) &lt; -1</td>
<td>• sensory impairments</td>
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<tr>
<td>• were able to stand and walk independently for 5 min</td>
<td>• cancer, severe back pain with Faces Pain Scale (FPS) &gt; 7</td>
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<td>• any known pain, pathology or surgery of the shoulder joints</td>
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**Thirty-three** osteoporotic and osteopenic women were recruited
Interventions

Stretching Exercise- Trunk Muscle

Myofascial Release- Pectoralis Minor
Outcomes Measures

Faces Pain Scale for back pain

Trunk flexion & extension

Occiput-wall distance

Pectoralis Minor Length

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Paired-t test was used to compare pre- and post-intervention for all outcome measurements.

Significance level was set at $p < 0.05$.

SPSS v18.0 was used for all statistical analysis.

Data are presented as mean $\pm$ D.
## Demographic Data of the Participants

<table>
<thead>
<tr>
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<th>Mean ± SD</th>
<th>Range</th>
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<tbody>
<tr>
<td><strong>n = 33</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years old)</td>
<td>72.4 ± 10.5</td>
<td>44 – 89</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>152.8 ± 4.8</td>
<td>142 – 167</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>58.6 ± 10.6</td>
<td>42 – 74</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.1 ± 4.7</td>
<td>18.0 – 31.6</td>
</tr>
<tr>
<td>DXA T-score of the spine</td>
<td>-2.7 ± 1.0</td>
<td>-4.3 – -0.7</td>
</tr>
<tr>
<td>DXA T-score of the right hip joint</td>
<td>-1.9 ± 0.2</td>
<td>-3.0 – -1.2</td>
</tr>
<tr>
<td>Kyphosis angle in X-ray (degree)</td>
<td>33.6 ± 12.4</td>
<td>15.9 – 49.7</td>
</tr>
<tr>
<td>FPS of the back pain</td>
<td>3.1 ± 2.5</td>
<td>0 – 7</td>
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### Number of participants

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<tbody>
<tr>
<td>History of vertebral compression fractures</td>
<td>15</td>
</tr>
<tr>
<td>History of falls</td>
<td>10</td>
</tr>
</tbody>
</table>
Results

Trunk flexion & extension  Pectoralis Minor Length  Occiput-wall distance

Faces Pain Scale for back pain

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Conclusions

Single session of myofascial release and stretching exercise on postural correction may have immediate beneficial effects

- back pain
- kyphosis
- trunk mobility

Future studies should investigate the long-term effects of this intervention technique
Sequelae of aging in musculoskeletal system:
- Changes in postural alignment (kyphosis)
- Osteoporotic fractures
- Shifts of center of mass position
- Increase demand of force capacity
- Poor upright balance
- Fall and fracture

Sequelae of aging in motor control system:
- Osteoporosis
- Decline in bone mineral density
- Sarcopenia
- Decline in muscle mass
- Loss of lean skeletal muscle
- Muscle strength decrease
- Loss of bone mass
- Vertebrae height decrease

Control coordination

Ongoing and Future Studies
- Exercise Training Using Perturbation Treadmill

Passive bone
- Osteoporosis
- Decline in bone mineral density
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- Vertebrae height decrease

Active muscle
- Sarcopenia
- Decline in muscle mass
- Loss of lean skeletal muscle
- Muscle strength decrease

Wei-Li Hsu, PT, PhD
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    ✓ Neurosurgery Department
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    ✓ Institute of Applied Mechanics
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    ✓ Department of Mechanical Engineering
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Thanks for your attention!