Strength and power characteristics and balance of pre-puberty and puberty aged blind and sighted boys

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Introduction
Blind children are reported to be significantly below the physical fitness norms of their sighted peers. They have also reported to show worse performance both in static and dynamic balance tasks (Short & Winnick 1986, Pereira 1990). Thus, the objective of this study was to investigate possible differences between isometric and dynamic muscle strength performances and balance of blind pre-puberty and puberty aged boys compared to those with normal sight.

Methods
Eight blind (9-12 years old) pre-puberty aged and eight blind (15-18 years old) puberty aged school boys from the Jyväskylä School for the Blind volunteered for the study. Nine pre-puberty and eight puberty aged sighted boys from the regular schools of the county served as controls. Neuromuscular function was measured using several isometric muscle strength tests of the lower and upper extremities and trunk and various dynamic performance (vertical jump, multiple 5 jump, fitness ball throwing) tests and muscle electromyography (EMG). Balance was tested by a modified Flamingo test and body composition by assessing muscle mass thickness of the right upper and lower extremities with a compound ultra-sonic scanner and percent of body fat by the bioimpedance analyser.

Results
There was no difference in the muscle mass thickness and maximal strength of the upper and lower extremities, and the trunk or in vertical jump between the blind and sighted boys. The antagonist biceps femoris co-activation during the leg extension and the antagonist co-activation of the biceps brachii during the upper extremity extension were also comparable. However, 5-jump and fitness ball throwing distances were significantly shorter in both blind groups compared to the age matched sighted groups (Table 1). One-leg stance of the pre-puberty aged sighted boys was 109(67)s and in blind boys 32(12)s and in the puberty aged boys 120(57)s and 31(8)s, respectively. When the vision was blocked in the sighted boys, the differences between the blind and sighted boys disappeared.

<table>
<thead>
<tr>
<th></th>
<th>Pre-puberty aged</th>
<th></th>
<th>Puberty aged</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Blind N=8</td>
<td>Normal sighted N=9</td>
<td>P-value</td>
<td>Blind N=8</td>
</tr>
<tr>
<td>Vertical jump, cm</td>
<td>15 (7)</td>
<td>17 (3)</td>
<td>0.44</td>
<td>31 (8)</td>
</tr>
<tr>
<td>Fitness ball, sitting, m</td>
<td>2.47 (0.59)</td>
<td>3.35 (0.76)</td>
<td>0.040</td>
<td>5.03 (76)</td>
</tr>
<tr>
<td>Fitness ball, standing, m</td>
<td>3.22 (0.88)</td>
<td>5.10 (1.14)</td>
<td>0.0092</td>
<td>6.83 (67)</td>
</tr>
<tr>
<td>5-jump, m</td>
<td>5.39 (2.10)</td>
<td>7.74 (84)</td>
<td>0.030</td>
<td>8.81 (1.43)</td>
</tr>
</tbody>
</table>

Permutation test with Hommel’s adjustment
Permutation type Hotelling test: pre-puberty aged boys p=0.014, puberty aged boys p=0.0056

Discussion
The data indicated that maximal strength of the lower and upper extremities and voluntary neural control of force production during the isometric actions involving no joint movements were highly similar between the blind and sighted boys of the same age groups. However, the performance of the blind boys was significantly lower in the throwing and multiple long jumping requiring explosive strength and coordination of dynamic multi-joint actions of the neuromuscular system compared to their sighted pears. The blind boys had also significantly worse balance, but when the vision was blocked in the sighted boys, their one-leg stance results dropped down to the same level with the blind boys.

References: