Postural Control Deficit in Acute QTF Grade II Whiplash Injuries

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Background

Tetra-ataxiometric posturography in chronic pain patients after whiplash injuries has revealed an impaired regulation of balance. However, so far it is unclear if this is caused by the accident or other factors that are associated with the pain chronification process. Studies with patients with acute whiplash injuries have not been performed so far.


Research Purpose

The objective was to investigate the balance control in patients with acute QTF grade II whiplash injuries of the cervical spine.
40 patients with acute QTF grade II whiplash injuries and 40 healthy matched controls were examined on a dynamic posturography platform. The stability index $ST_\Sigma$ and the Fourier analysis $FA_\Sigma$ (0.10-1.00Hz) were established for eight standing positions and sum scores were calculated. The pain index was established using a visual analog scale ranging from 0-100. A follow-up examination was conducted after two months.

**Fig. 1:** Platforms with the force sensors (A – left heel, B – left toes, C – right heel, D – right toes) and the attachable foam plastic.
### Methods II

**Tab. 1: Tetra-ataxiametric posturography – Standing positions**

<table>
<thead>
<tr>
<th>Trial</th>
<th>Head position</th>
<th>Eyes</th>
<th>Platform</th>
<th>Trial purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neutral</td>
<td>open</td>
<td>solid</td>
<td>Neutral position</td>
</tr>
<tr>
<td>2</td>
<td>Neutral</td>
<td>closed</td>
<td>solid</td>
<td>Elimination of visual system</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>open</td>
<td>elastic</td>
<td>Elimination of somatosensory system</td>
</tr>
<tr>
<td>4</td>
<td>Neutral</td>
<td>closed</td>
<td>elastic</td>
<td>Elimination of somatosensory and visual system</td>
</tr>
<tr>
<td>5</td>
<td>Rotation to the right</td>
<td>closed</td>
<td>solid</td>
<td>Vestibular stress</td>
</tr>
<tr>
<td>6</td>
<td>Rotation to the left</td>
<td>closed</td>
<td>solid</td>
<td>Vestibular stress</td>
</tr>
<tr>
<td>7</td>
<td>Reclined</td>
<td>closed</td>
<td>solid</td>
<td>Vestibular and cervical stress</td>
</tr>
<tr>
<td>8</td>
<td>Inclined</td>
<td>closed</td>
<td>solid</td>
<td>Vestibular and cervical stress</td>
</tr>
</tbody>
</table>
Results I

The patients with acute whiplash injuries of the cervical spine achieved significantly poorer results for both $ST_\Sigma$ and $FA_\Sigma$ than the healthy controls. There were no differences between the eight standing positions for both $ST_\Sigma$ and $FA_\Sigma$.

Fig. 2: Comparison of the stability index ($ST_\Sigma$) and the frequency analysis ($FA_\Sigma$) between the acute examination of the patients (Pat 1) and the control group (Norm). The graphs show the median, 1st quartile (lower edge of box), 3rd quartile (upper edge of box), maximum and minimum (upper and lower end of range line) of the differences.
Results II

After two months 17 patients had no change in the pain development, 21 patients showed an improvement in the pain intensity and 2 patients deteriorated. The subgroup of patients with improvement of the pain intensity showed a significant improvement of the balance control concerning the $\text{FA}_\Sigma$ compared to patients with unchanged pain intensity.

![Figure 3: Comparison of the subgroups PU (pain unchanged) and PI (pain improved) concerning the stability index ($\text{ST}_\Sigma$) and the frequency analysis ($\text{FA}_\Sigma$) between the first (Pat 1) and second examination (Pat 2) of the patients. The graphs show the median, 1st quartile (lower edge of box), 3rd quartile (upper edge of box), maximum and minimum (upper and lower end of the range line) of the differences.](image)
Conclusion

- Patients with acute whiplash injuries have a reduced balance control as compared to matched controls.

- Patients, who reported on a reduction of the neck pain intensity showed a significant improvement of the balance control.

- In summary this study indicates that acute posttraumatic neck pain could be associated with reduction of the balance control.
Financial Disclosure

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