

## Abstract

Changes in vestibular, visual, or proprioceptive inputs may lead to an adjustment in the perception of verticality, and this may further lead to different postural behavior. A typical manifestation of poor perception of verticality is impaired postural stability. This work deals with physiological changes in the perception of verticality when changing the position of the head in space.

The aim of this work is to examine in more detail the changes in the perception of verticality during head tilt in a healthy sample of probands. The assumptions derived from the current knowledge were experimentally verified on a healthy sample. The test group of probands consisted of 51 individuals - 22 men and 29 women (ranging from 19 to 42 years). None of the examined persons were monitored for diseases of the vestibular apparatus, stability disorders, or visual disturbances of the central cause at the time of the examination or in the past. Subjective visual vertical (SVV) testing was performed sitting using a device from the company Synapsis. This took place in four consecutive situations: Upright without correction, immediately after tilting to a lateroflexion of 20 °, after remaining 5 minutes in lateroflexion and after returning to straightness without correction. Six test values were obtained in each position and the arithmetic mean was calculated. In the case of normal distribution, the data were evaluated by T-tests, for abnormal distribution we used ANOVA tests.

The mean deviation of the healthy population was measured at  $1.26^\circ \pm 0.901$ . There was a statistically significant increase in deviations after the change to side-tilt condition ( $2.09^\circ \pm 1.48$ ) and subsequently a further increase in deviations when staying in this position ( $3.45^\circ \pm 3.15$ ). The direction of SVV movement showed a more or less symmetrical distribution to the right and left side without a logical trend. Remaining in the side-tilt position indicated a trend of SVV movement to the left, independent of the head position. After returning to the subjectively upright posture, the position of the head and SVV remained deflected in the direction of the previous tilt. Prolonged stretching of the neck muscles led to an increase in deviations, and the return from lateroflexion brought with it a change in proprioception, which was reflected in the position of the head and the direction of the SVV deviations toward the previous tilt.

These results confirm that there is a deterioration in the ability to determine the verticality when side-tilting, which progresses with prolonged holding. Although the analysis of the direction of SVV deviations did not show a direction-specific phenomenon, the behavior of SVV after returning to the verticals points to a significant share of proprioceptive information in the assessment of verticality. Furthermore, women seem to achieve slightly more accurate results in the evaluation in side-tilted conditions.

## **Keywords**

Subjective visual vertical, verticality perception, vestibular system, head tilt, head posture