White Paper - Subjective Visual Vertical

The Subjective Visual Vertical (SVV) represents a method to test an individual's ability to adjust a luminous line to be parallel with true vertical in the absence of any other visual cues. The sensory information required to perform this task is provided predominantly by the vestibular organs of the inner ear, and in particular by the utricles (Clarke et al, 2003).

The vestibular organs consist of the three semicircular canals, which transduce angular acceleration, and the two otolith organs, the utricle and saccule. The otolith organs transduce linear acceleration, including gravity, with respect to the head. Of critical importance, the information from the otolith organs facilitates correct perception of the orientation of the head with respect to gravity. The otolith organs function so that any linear acceleration displaces the otoconial mass and applies a shear force on the embedded sensory hair bundles against the otolith maculae. This results in a potential change in the sensory cell and consequently a change in the discharge rate of the primary afferent vestibular nerve. Since the earth's gravity constitutes a constant linear acceleration, the orientation of the head relative to gravity is constantly signaled from the otolith organs to the central nervous system (Clarke, 2002). As a result, the individual is able to accurately estimate the so-called SVV. Any dysfunction of the otolith apparatus is usually accompanied by incorrect spatial orientation and postural instability. The estimation of the SVV thus serves as a diagnostic indicator of otolith (utricular) function (Clarke et al, 2001).

The SVV is determined by presenting the patient with a luminous line in otherwise total darkness and requesting that he/she rotate the line to be in a vertical alignment (Clarke et al, 2003). The deviation of the set angle of the luminous line from the tilt angle of the head is then determined. With no rotation and with the head in the upright position, the tilt angle will be zero and testing performed in this way is known as the static SVV. It is possible to also perform static SVV tests with the head tilted toward the left and right in order to measure perceived verticality. However, static SVV testing provides simultaneous stimulation of the otolith organs. Dynamic SVV testing completed during unilateral centrifugation permits exclusive stimulation to the right or to the left utricle for improved specificity (Clarke et al, 2001).

For the static SVV, normal individuals are able to adjust the luminous line to within a few degrees of the gravitational vertical. Patients with unilateral otolith abnormalities will deflect the top of the line (SVV) toward the dysfunctional side. The published data shows ±2.0° as the normal tolerance (Akin & Murnane, 2009). In the acute stage of a peripheral vestibular lesion such as vestibular neuritis, the static SVV shows an increase in deviation (>2°) toward the side of the lesion (Byun et al, 2010). There is no significant change in SVV with aging (Kobayashi et al, 2002).

The SVV test is recommended for use as a bedside test for acute vertigo, brainstem infarcts, and oculomotor disorders and the test can be used to monitor recovery/compensation of acute lesions. It is considered a novel approach to assessment of otolith function that can be easily incorporated into the clinical test battery (Clarke et al, 2001).

References

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