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## Update on Head Impulse Test

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Since the introduction by Halmagyi in 1988, the head impulse test (HIT) has been the most effective method of detecting loss of vestibular function at the bedside. To test the horizontal vestibulo-ocular reflex (VOR), the examiner asks the patient to fixate upon a target in front of the eyes, and then briskly turns the patient's head horizontally. The head rotation impulse should be unpredictable with a low amplitude (10-20°) and a high acceleration (2,000-4,000°/second). If the VOR is working normally, the head impulse will generate a compensatory eye movement in the direction opposite to the head rotation with an equal amplitude, holding the gaze steady. In contrast, the head impulse toward the side of a peripheral vestibular lesion would give rise to one or two compensatory refixation saccades at the end of head motion to bring the image of the target back to the fovea. These corrective saccades (overt saccades) indicate a decreased VOR gain in patients with peripheral vestibular deficits. The function of the vertical semicircular canals can also be assessed with vertical head impulses, in which the patient's head is rotated vertically in the plane of either the right anterior canal (AC)-left posterior canal (PC) or left AC-right PC. By virtue of evaluating the vertical canal function with the HIT, it became possible to diagnose subtypes of vestibular neuritis.

Later it was also recognized that the HIT is mostly normal in central vestibular lesions while overt saccades are observed in most patients with acute peripheral vestibular disorders. This finding, along with skew deviation and direction-changing nystagmus, became one of the most important signs in diagnosing acute vertigo from central lesions in the acronym of HINTS (head impulse negative, direction-changing nystagmus, and test of skew). Accordingly, a central pathology should therefore be suspected if a patient with acute vertigo and spontaneous nystagmus exhibits a normal HIT. The refixation saccades may occur in the planes other than stimulated (i.e., vertical catch-up saccade after horizontal rotation; perverted refixation saccades) or in the opposite direction (i.e. in the direction of head rotation; reversed refixation saccades). These findings also indicate a pathology involving the central vestibular structures, especially the cerebellum.

However, a bedside head impulse test may be negative when the vestibular deficits are partial or the covert saccades, the saccades that are occurring during the head rotation and mostly imperceptible to the naked eye, complement the vestibular deficits. In acute vertigo, spontaneous nystagmus also interferes with assessment of bedside HIT. Even though the scleral search coil technique has been the gold standard for measurement of the HIT, video-based equipments become popular for their easy applicability and acceptable accuracy. Recent studies have explored the HIT in patients with various central vestibular disorders, and have increasingly found decreased VOR gains during HIT in patients with lesions involving various brainstem and cerebellar vestibular structures.

The HIT paved the way to evaluate vestibular function during high frequency and high acceleration stimuli, and now became an indispensable tool in evaluating the patients with dizziness.

**Key Words:** Head impulse test, Vestibulo-ocular reflex

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