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Basic Interpretative Parameters Of The VHIT

PRODUCT INSIGHTS

author:
Enrico Armato, Dr.

This document provides a comprehensive overview of how to perform the video Head Impulse Test, starting from the physiological bases up to daily diagnostics. SYNAPSYS VHIT is a unique system that represents a fundamental step forward in the evaluation of the vestibular system. It does not require the patient to wear any goggles; all results are obtained from the analysis of the patient's head and eye movements, recorded by a remote camera.

THE FIRST PAPER ON A RECORDING DEVICE

The first worldwide paper, dealing with a recording device, was written by Erik Ulmer in 2005.


Ann Otolaryngol Chir Cervicofac, 2005, 122, 2, 84-90
© Masson, Paris, 2005.

ARTICLE ORIGINAL

« Head Impulse test de Curthoys & Halmagyi »

Un dispositif d'analyse

E. Ulmer (1), A. Chays (2)

Curthoys and Halmagyi Head Impulse Test: an Analytical Device

LE TEST DE CURTHOYS & HALMAGYI

ACCELEROMETER OR REMOTE CAMERA?

There are two types of devices for recording the vHIT: one with a remote camera (Synapsys) and one with an accelerometer placed on the patient's head (Natus ex GN-Otometrics, Interacustics EyeSeeCam and other manufacturers).

Here we will summarize the main advantages of the "No Google" philosophy, i.e., the device with remote camera which does not involve positioning the mask on the patient's head:

- Absence of devices placed on the patient's face:
  - The mask could not accidentally be moved
  - No interference with the handling of the patient's head.
  - No device to sanitize
- Simultaneous binocular record for the LSC:
  - The eye (right, left, both) to be analyzed can be chosen
- Automatic detection of eye position and stimulation plan:
  - The position of the eye (in the center, on the right or on the left) is automatically recognized, without manual intervention

  - The stimulation plan is automatically recognized, without manual intervention

- A minimum of five impulses is sufficient for each canal:

  - Shorter examination
  - More comfortable examination for the patient

- Face size (children) is no longer a problem:

  - Thanks to Sylvette Wiener-Vacher - Hôpital R. Debré – Paris

Further characteristics specific to the Synapsys vHIT device with remote camera also warrant mentioning:

- Graph of the gaze line's orientation:

  - Evaluation not only of the velocity graph (the most common), but also of the line of the gaze. This tells us if the gaze can stay on/return to target, the velocity graph does not provide this information.

- Possible to review the video of each impulsive movement:

  - Precise evaluation of eye movements in slow motion (discover any artifacts!)

- Graphical and numerical analysis of covert saccades:

  - Calculation of the apparent gain after covert saccade

GENERAL INTERPRETATION OF THE VHIT

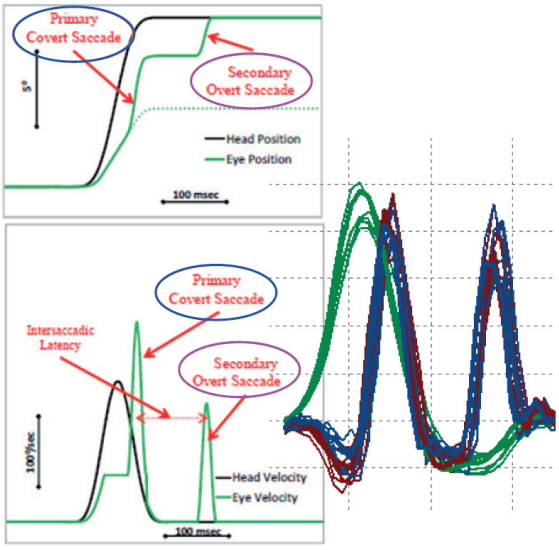
The general interpretation of vHIT is based on three elements:

1. Catch-Up Saccades (corrective saccades)
2. VOR gain, i.e., the ratio between the velocity of the slow phase of the eye and the velocity of the head
3. VOR morphology.

CATCH-UP SACCADES (CORRECTIVE SACCADES)

Corrective saccade movements allow the line of gaze to be repositioned on the target. If they occur after the movement of the head, they are known as overt: they are visible to the naked eye and can be recognized during the bedside examination by an examiner with minimal experience.

Corrective saccades that occur during movement of the head are named covert: these are not recognizable to the naked eye and require the use of specific instrumental devices to be identified. Typically, they appear at the end of movement of the head because of their latency. Covert saccades, however, may not position the line of sight correctly: a secondary corrective saccade (usually overt) will be necessary to reposition the gaze on the target. Secondary saccades usually have the same latency as the primary but a lower amplitude.



VOR GAIN

VOR gain quantifies the relationship between the slow phase of the VOR and the impulsive movement of the head. The value is a dimensionless number that is derived from the quotient between the eye velocity (OUT) and the head velocity (IN), although one can use other parameters such as the acceleration or position (likely leading to diversity in the results). Interpreting VOR gain is complicated and requires a thorough knowledge of how it has been calculated and how it relates to the function of the semicircular canals.

In the case where there is a unilateral lesion, the VOR gain will be reduced bilaterally but in a much more significant way after impulses executed toward the injured side (especially in the acute phase). The

presence of corrective saccadic movements associated with a significant gain asymmetry is a sign of unilateral lesion even if the VOR gain values prove to be within normal limits. In unilateral lesions the gain decreases rapidly with increasing velocity.

In the case where there is a bilateral lesion, the presence of corrective saccades, the reduction of gain and the absence of significant asymmetries will be noticed on both sides. Even in bilateral lesions, the VOR gain's reduction will go at the same rate as the increase in velocity.

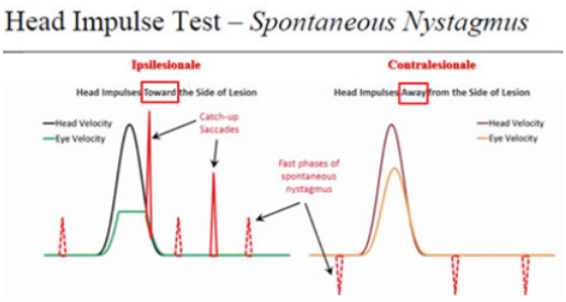
In order to prevent contributions of a visual nature while the vHIT is being carried out, the impulsive movements need to be performed above a certain velocity threshold that will be different between horizontal and vertical canals. For the first, velocities above 200°/sec are recommended; for the latter, you will have to perform rotations above 150°/sec. The more the velocities are reduced compared to those indicated, the higher the percentage of possible false negatives.

VOR MORPHOLOGY

Analyzing morphology of the VOR (together with the chronology of corrective saccades) is a benchmark in interpreting vHIT.

One crucial element is the recognition of a spontaneous nystagmus on the eye velocity trace. The differential diagnosis between nystagmus and corrective saccades uses the following criteria (Barin K, 2014):

- Unlike corrective saccades, nystagmus spikes can occur both before and after impulsive head movements;
- The nystagmus velocity is usually much slower than that of saccadic movements;
- In the presence of a contralesional nystagmus, the spikes manifest themselves in the opposite direction from that of the eyes when the impulsive movements are towards the healthy side.



Schematic representation of the morphology of the VHIT with ipsilesional and contralesional impulses, in case of the presence of spontaneous Ny (Barin K, 2014).

Recent papers from the literature suggest that the presence of repeatable corrective saccades may indicate a VOR deficit, since regardless of the gain value, they suggest a pathological vHIT. It is therefore advisable to evaluate both the corrective saccade and the gain of the vHIT to understand the vestibular hypofunction.

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INVENTIS S.r.l.
CORSO STATI UNITI, 1/3
35127 PADOVA – ITALIA
TEL: +39.049.8962 844
FAX: +39.049.8966 343
info@inventis.it
www.inventis.it