



**SAPIENZA**  
UNIVERSITÀ DI ROMA



**UMBERTO I**  
POLICLINICO DI ROMA

**Master di II livello in Vestibologia Pratica**

**Direttore: Prof. Giovanni Ralli**

**Video Head Impulse Test**

***S. Quagliari***

UOC di Otorinolaringoiatria  
Fondazione IRCCS Policlinico San Matteo  
Università di Pavia

*Roma 14/07/18*

## *Head Impulse Test : letteratura*

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Arch Neurol. 1988 Jul;45(7):737-9.

### **A clinical sign of canal paresis.**

Halmagyi GM<sup>1</sup>, Curthoys IS.



***cHIT***  
***clinical Head Impulse Test***

## ***Head Impulse Test : letteratura***

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Ann Otolaryngol Chir Cervicofac. 2005 Apr;122(2):84-90.

### **[Curthoys and Halmagyi Head Impulse test: an analytical device].**

[Article in French]

Ulmer E<sup>1</sup>, Chays A.

**OBJECTIVES:** We describe hereafter a device which allows confirmation of the positive or negative test results for each of the six canals without increasing test duration.

**METHOD:** A high resolution and high light sensitivity video camera located in front of the patient's face at a distance of 80 cm is connected to a computer for automatic image analysis.

**RESULTS:** With this device, the practitioner can confirm a positive test by simple observation on the videooculocephaloscope (HIT scope) and record an image for later reference. With videooculocephalography (HIT graph), movements can be recorded for analysis to quantify the deficit of each semicircular canal.

### ***vHIT (video Impulse Test)***

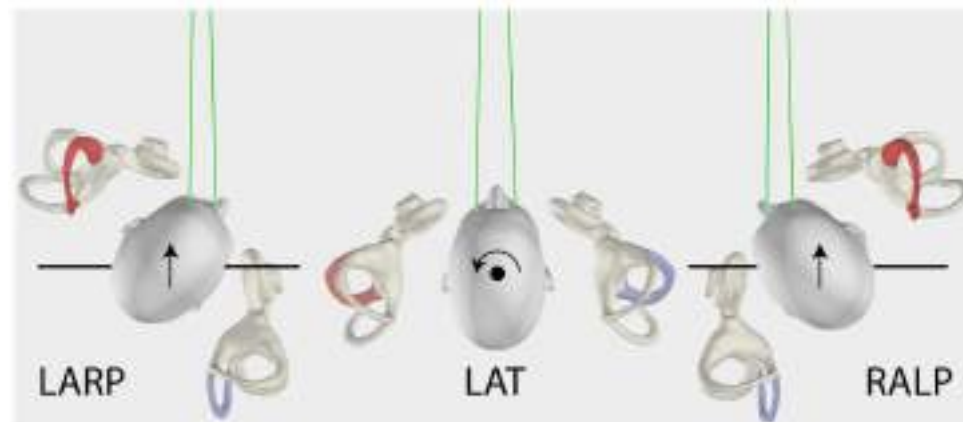
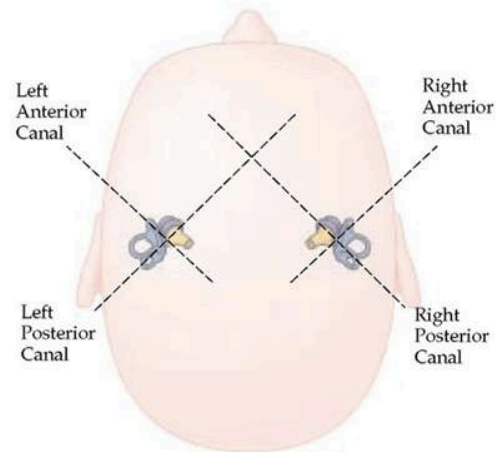
- . misurazione oggettiva del guadagno del VOR (occhi/testa =1)
- . valutazione saccadici (***covert***) che non sono visibili con il cHIT

## Head Impulse Test : letteratura

PLoS One. 2013 Apr 22;8(4):e61488. doi: 10.1371/journal.pone.0061488. Print 2013.

### The video Head Impulse Test (vHIT) detects vertical semicircular canal dysfunction.

Macdougall HG<sup>1</sup>, McGarvie LA, Halmagyi GM, Curthoys IS, Weber KP.



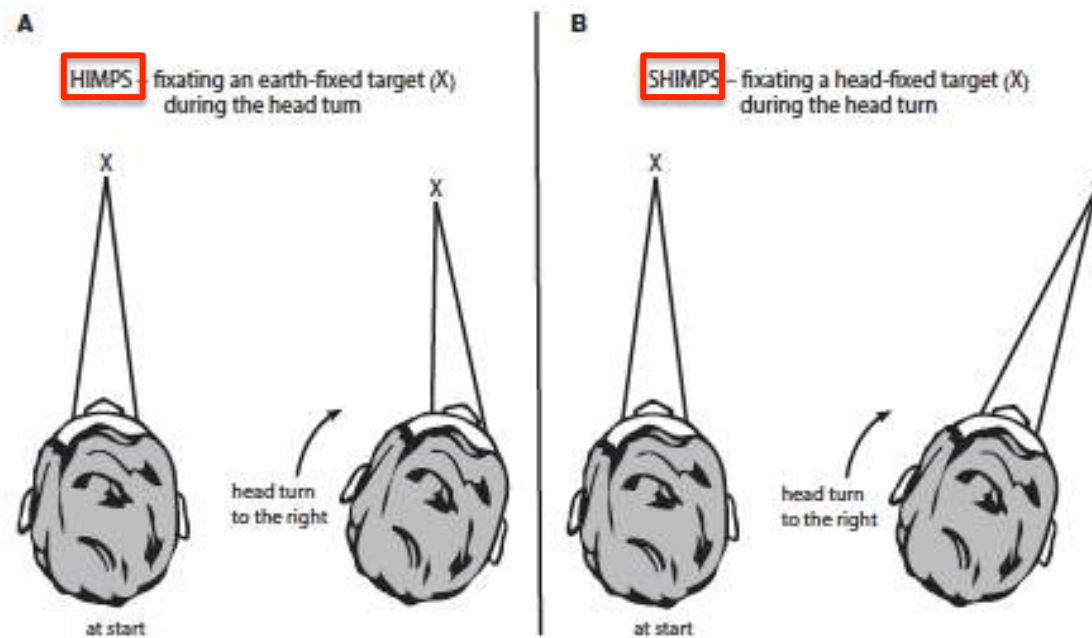
## Head Impulse Test : letteratura

Neurology. 2016 Jul 26;87(4):410-8. doi: 10.1212/WNL.0000000000002827. Epub 2016 Jun 1.

### A new saccadic indicator of peripheral vestibular function based on the video head impulse test.

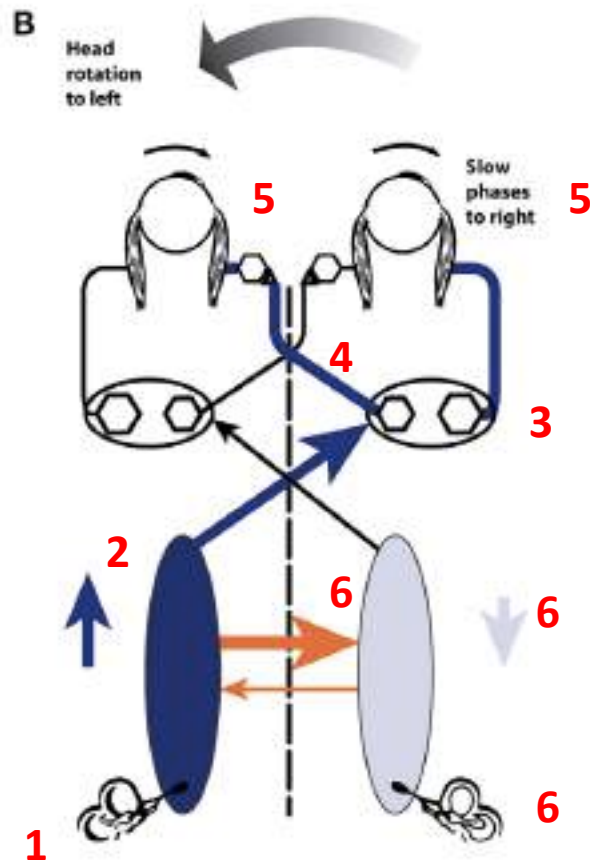
MacDougall HG<sup>1</sup>, McGarvie LA<sup>1</sup>, Halmagyi GM<sup>2</sup>, Rogers SJ<sup>1</sup>, Manzari L<sup>1</sup>, Burgess AM<sup>1</sup>, Curthoys IS<sup>1</sup>, Weber KP<sup>1</sup>.

*..from Head Impulse to SHIMPs..*



# Head Impulse Test : basi fisiopatologiche

## VOR (Riflesso Vestibolo Oculomotore)



## The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>, Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>

neurons to fire at a higher rate. This is the key—the normal compensatory eye movement response is due to the combined effect of two functional excitatory components—excitation and disinhibition. Note that the reduced activity in the right vestibular nucleus

HIT → fast and direct

Cellule I tipo

Fasiche

Apice e al centro della cresta ampollare

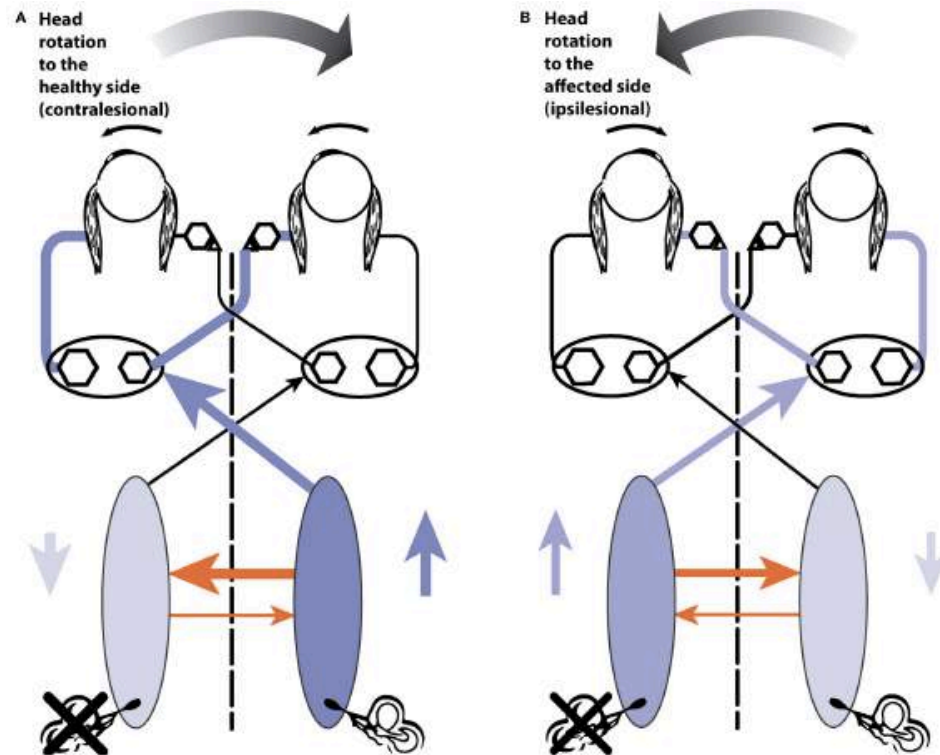
# Head Impulse Test : basi fisiopatologiche

## VOR (Riflesso Vestibolo Oculomotore)

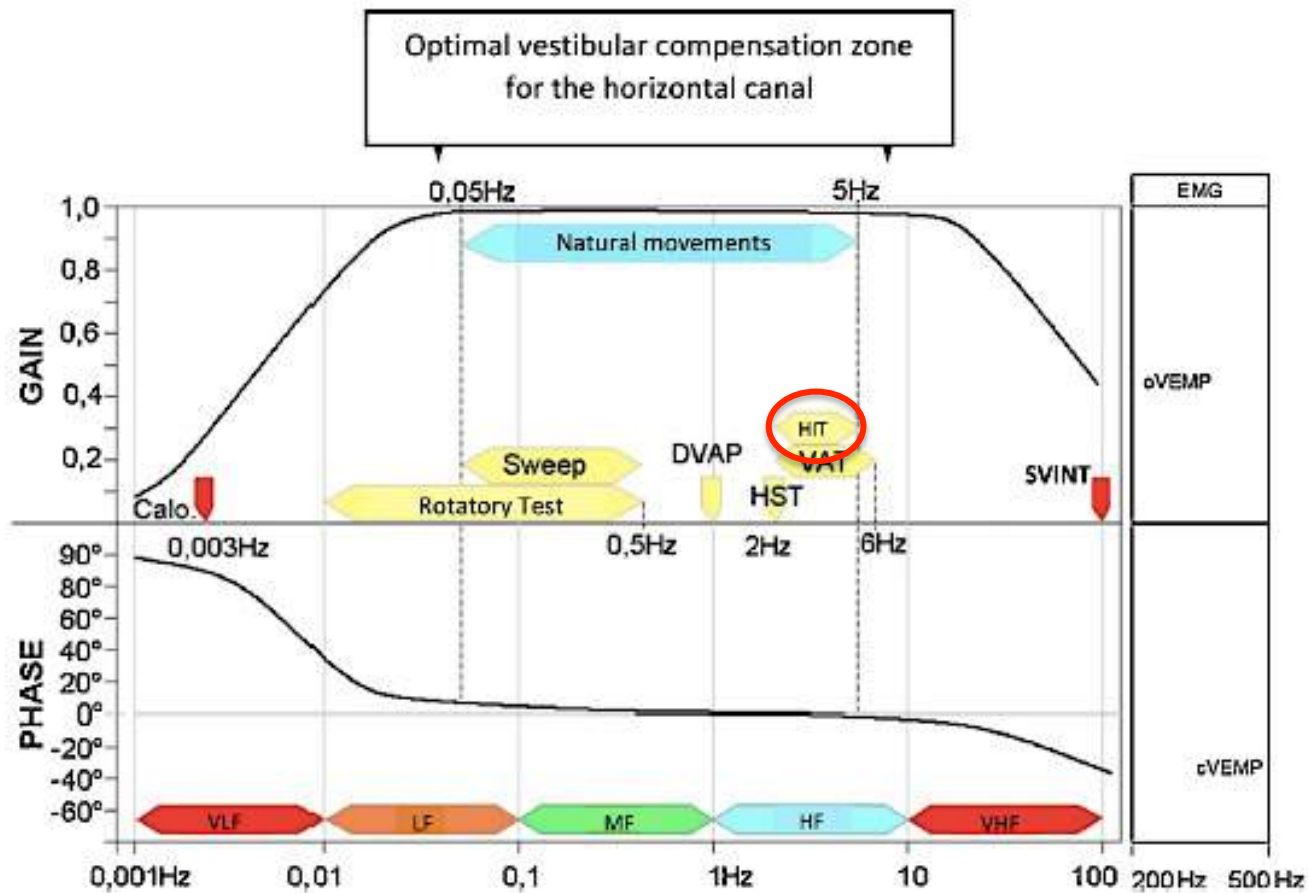


## The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>, Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>



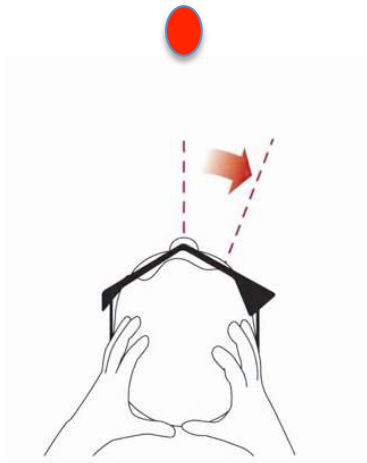
## Head Impulse Test : range di frequenza



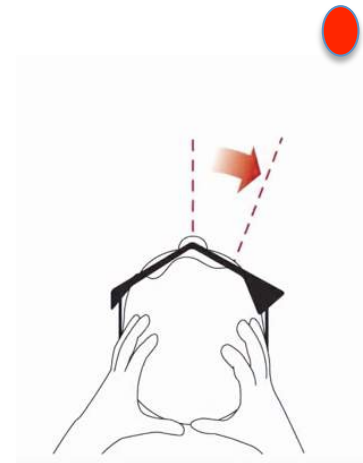


# Head Impulse Test : modalità di esecuzione

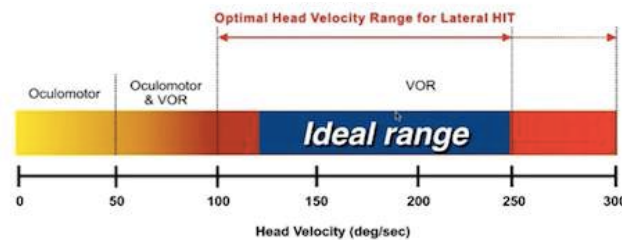
✧ **HIMP** test  
(*Head Impulse Paradigm*)



✧ **SHIMP** test  
(*Suppression Head Impulse Paradigm*)



- Paziente seduto
- Distanza paziente-mira: 1,5 m circa
- Movimenti rapidi (150/200 °sec) **random** della testa circa 15 ° destra/sinistra
- **Numero impulsi ?**



# Head Impulse Test : modalità di esecuzione

Journal of Clinical Neuroscience xxx (2014) xxx-xxx



Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: [www.elsevier.com/locate/jocn](http://www.elsevier.com/locate/jocn)



## Clinical Study

### Compensatory saccade differences between outward versus inward head impulses in chronic unilateral vestibular hypofunction

Seung-Han Lee<sup>a,b,c</sup>, David E. Newman-Toker<sup>a,d</sup>, David S. Zee<sup>a,d</sup>, Michael C. Schubert<sup>d,e,\*</sup>

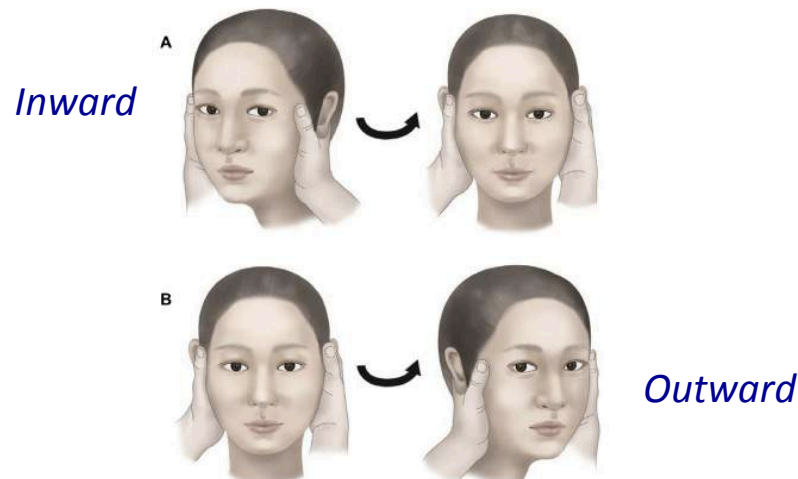
<sup>a</sup> Department of Neurology, Johns Hopkins School of Medicine, Baltimore, MD, USA

<sup>b</sup> Department of Neurology, Chonnam National University Medical School, Gwangju, South Korea

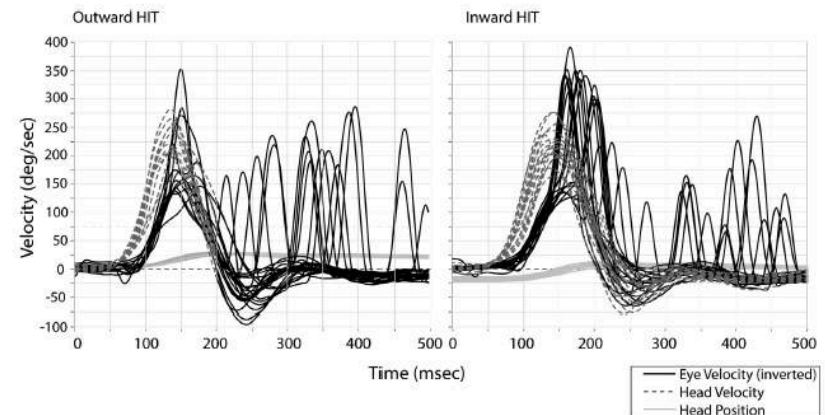
<sup>c</sup> Research Institute of Clinical Medicine of Chonnam National University Hospital, Gwangju, South Korea

<sup>d</sup> Department of Otolaryngology Head and Neck Surgery, Johns Hopkins School of Medicine, 601 North Caroline Street, Room 6245, Baltimore, MD 21287, USA

<sup>e</sup> Department of Physical Medicine and Rehabilitation, Johns Hopkins School of Medicine, Baltimore, MD, USA



S.-H. Lee et al. / Journal of Clinical Neuroscience xxx (2014) xxx-xxx



main results: (1) there is no difference in the type of compensatory saccade made during inward or outward directed HIT; (2) the recruitment of overt saccades depended on the presence of a visual

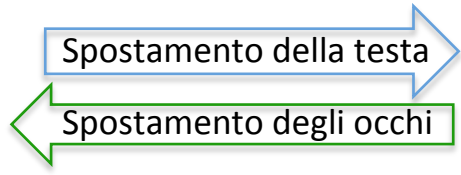
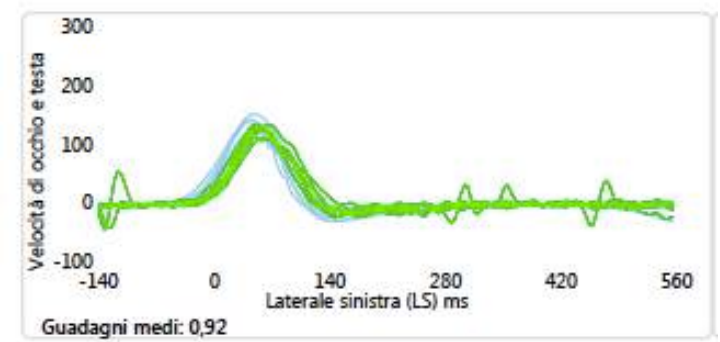
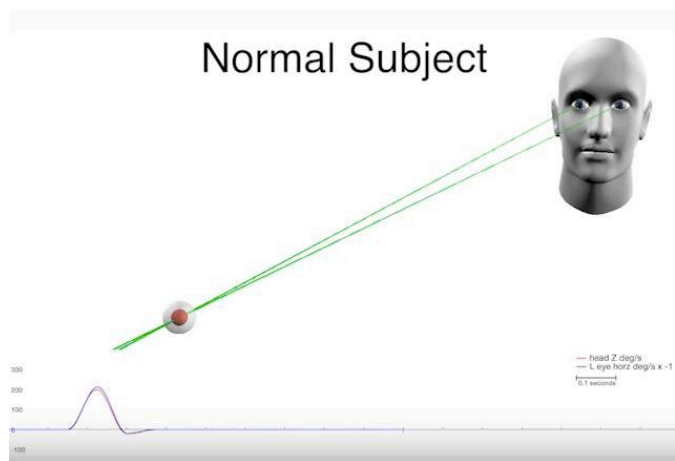
# Video Head Impulse Test

NEUROLOGY/2015/698563

## HIMP test

A new saccadic indicator of peripheral vestibular function based on the video head impulse test

Hamish G. MacDougall<sup>1+</sup>, PhD; Leigh A. McGarvie<sup>2</sup>, MBiomedE; G. Michael Halmagyi<sup>2</sup>, MD; Stephen J. Rogers<sup>1</sup>, MSc; L. Manzari<sup>3</sup>, MD; Ann M. Burgess<sup>1</sup>, PhD; Ian S. Curthoys<sup>1+</sup>, PhD; Konrad P. Weber<sup>4,5+</sup>, MD.



La stimolazione impulsiva del capo attiva il VOR che consente di mantenere la mira sulla fovea

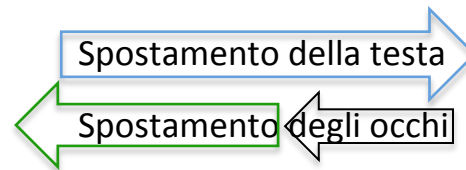
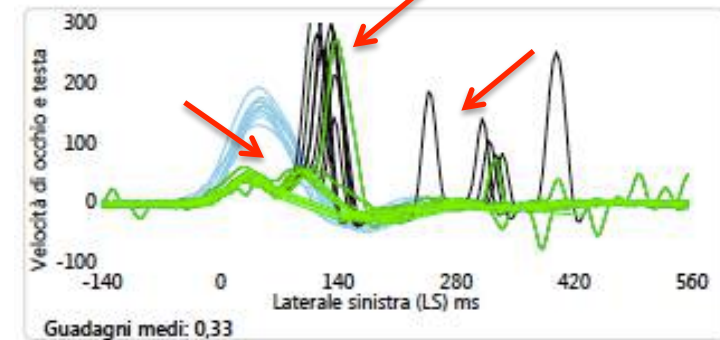
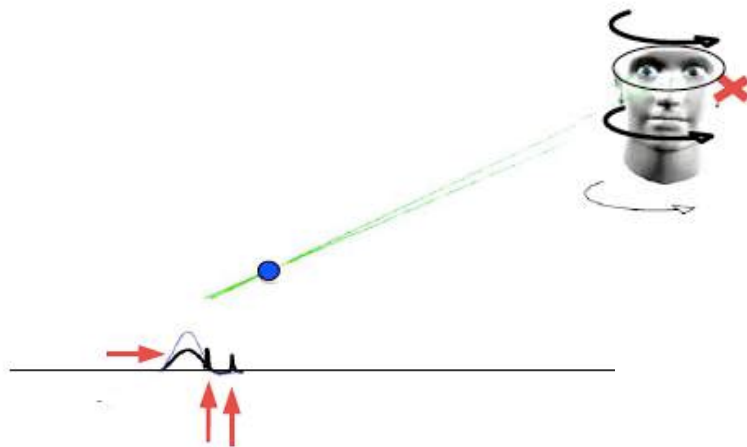
# Video Head Impulse Test

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Ridotta funzionalità canale → VOR ampiezza inferiore e l'errore viene corretto con movimenti saccadici

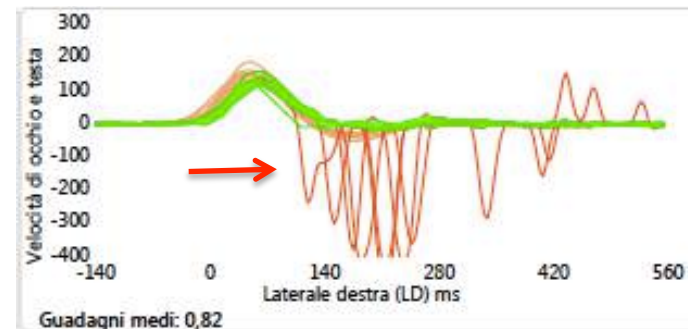
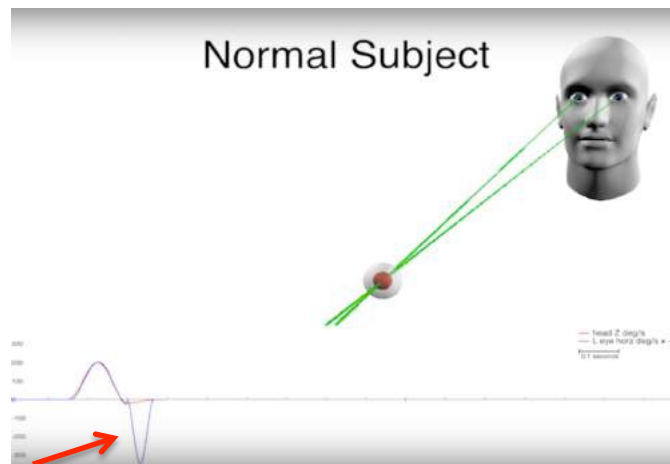
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VOR normale → al termine del movimento un movimento saccadico di rifissazione deve correggere il superamento della mira

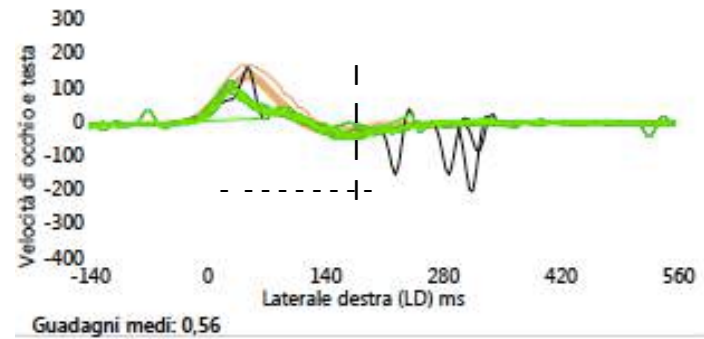
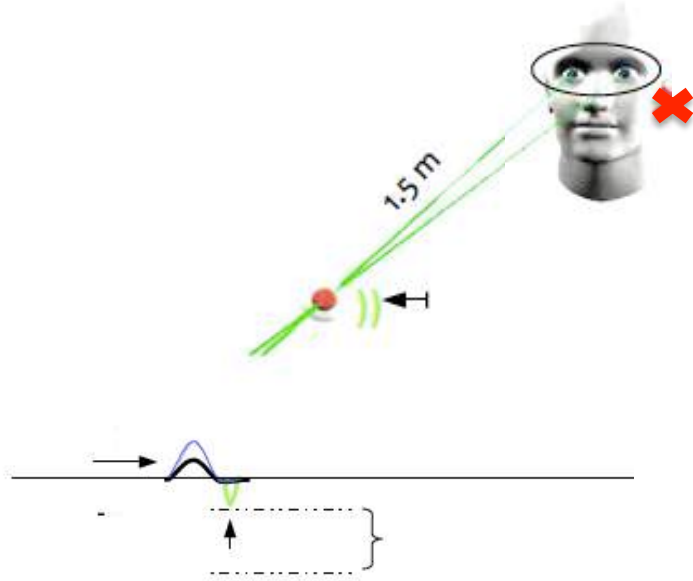
# Video Head Impulse Test

NEUROLOGY/2015/698563

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Ridotta funzionalità canalare → ridotto VOR → l'occhio segue la mira in modo preciso

# Video Head Impulse Test: parametri

## HIMP

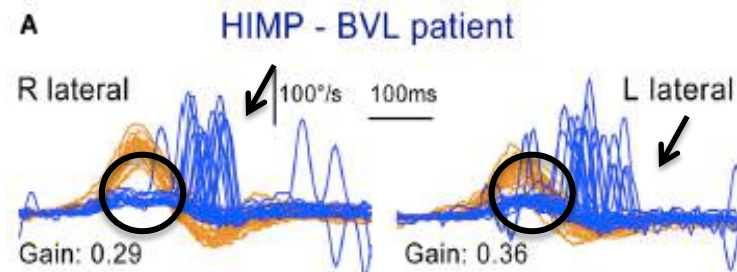
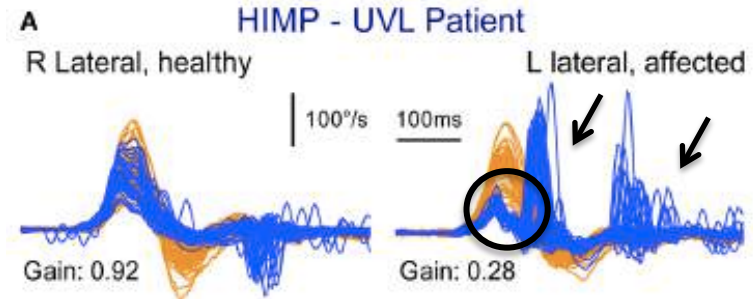
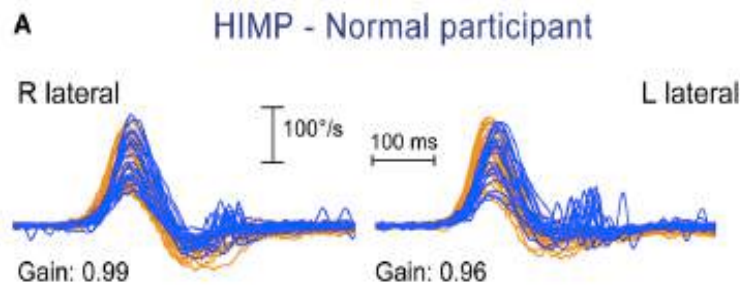
Guadagno / Ampiezza del VOR

Saccadici **COVERT / OVERT**



## The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>,  
Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>



*“usually less than 0.7”*

# Video Head Impulse Test: parametri

HIMP

Saccadici **OVERT**

✧ *Avvengono dopo il movimento della testa*

✧ *Latenza 150-250 ms*

Original Paper

Audiology & Neurology

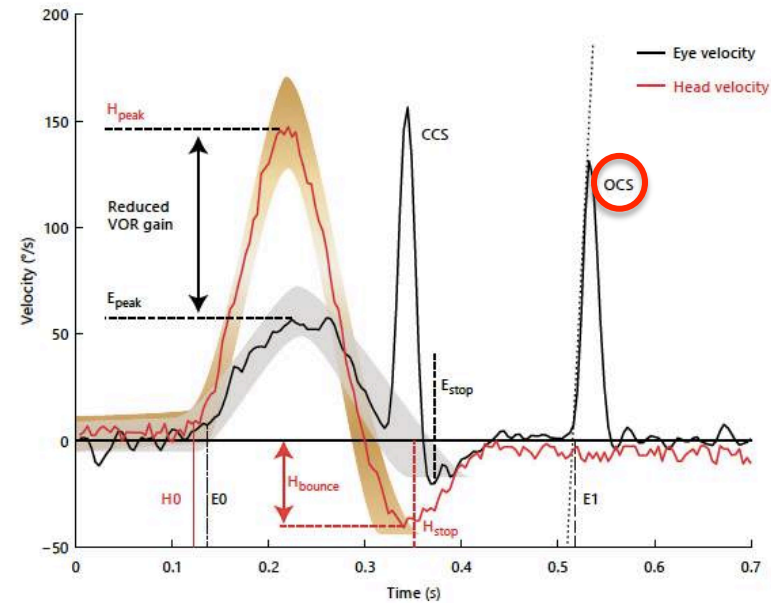
Audiol Neurotol 2015;20:39–50  
DOI: 10.1159/000362780

Received: October 7, 2013  
Accepted after revision: April 9, 2014  
Published online: December 9, 2014

## Quantifying the Vestibulo-Ocular Reflex with Video-Oculography: Nature and Frequency of Artifacts

Georgios Mantokoudis<sup>a</sup> Ali S. Saber Tehrani<sup>a</sup> Jorge C. Kattah<sup>c</sup>  
Karin Eibenberger<sup>b</sup> Cynthia I. Guede<sup>c</sup> David S. Zee<sup>a</sup> David E. Newman-Toker<sup>a, b</sup>

Departments of <sup>a</sup>Neurology and <sup>b</sup>Otolaryngology – Head and Neck Surgery, Johns Hopkins University School of Medicine, Baltimore, Md., and <sup>c</sup>University of Illinois College of Medicine, Peoria, Ill., USA





## Video Head Impulse Test: parametri


HIMP

The Cerebellum  
<https://doi.org/10.1007/s12311-017-0907-0>

ORIGINAL PAPER

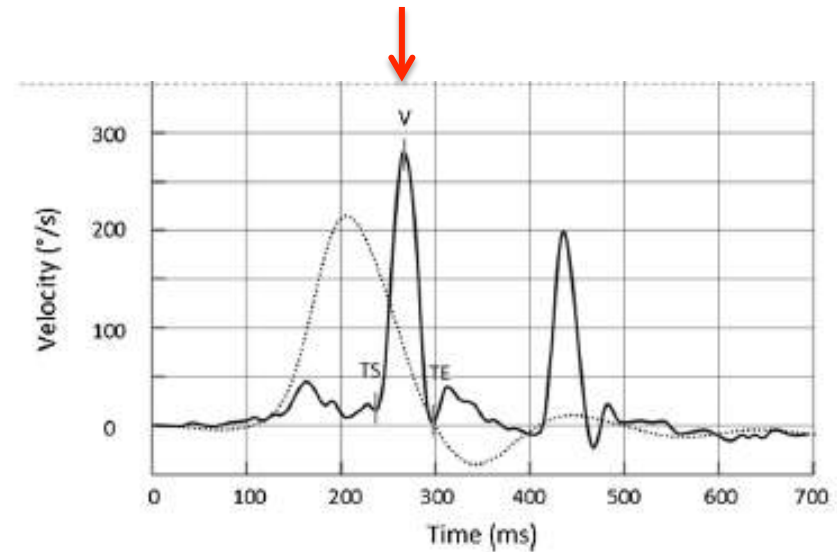


### Are Covert Saccade Functionally Relevant in Vestibular Hypofunction?

R. Hermann<sup>1,2,3</sup> · D. Pelisson<sup>2,3</sup> · O. Dumas<sup>4</sup> · Ch Urquizar<sup>2</sup> · E. Truy<sup>1,2,3</sup> · C. Tilikete<sup>2,3,5</sup> 

### Saccadici **COVERT**

- ✧ *Compaiono prima del termine del movimento della testa*
- ✧ *Latenza 100 ms dall'inizio a 100 ms dopo il termine del movimento*



# Video Head Impulse Test: parametri

HIMP

HEARING, BALANCE AND COMMUNICATION, 2017  
VOL. 15, NO. 3, 113-126  
<https://doi.org/10.1080/21695717.2017.1353774>

Taylor & Francis  
Taylor & Francis Group

REVIEW ARTICLE

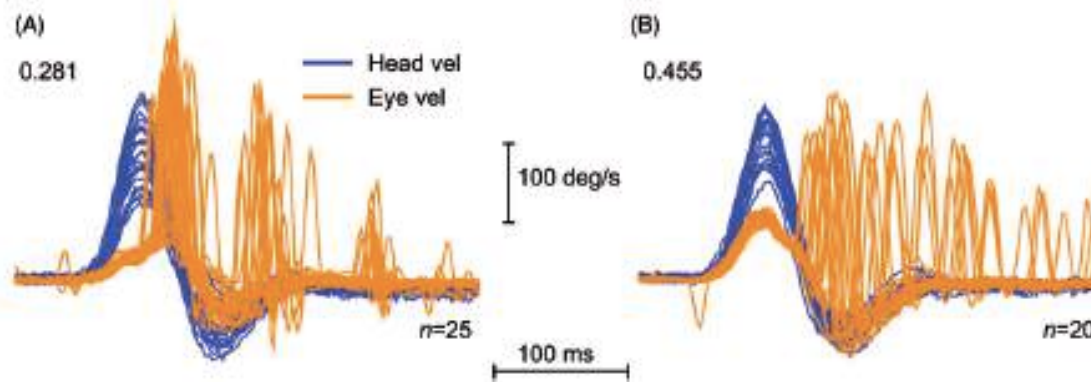
OPEN ACCESS [Check for updates](#)

## Clinical application of the head impulse test of semicircular canal function

I. S. Curthoys<sup>a</sup> and L. Manzari<sup>b</sup>

<sup>a</sup>Vestibular Research Laboratory, School of Psychology, University of Sydney, Sydney, Australia; <sup>b</sup>MSA ENT Academy Center, Cassino, Italy

### Saccadici **COVERT / OVERT**



✧ **Clustering** → indice del recupero di un deficit vestibolare

# Video Head Impulse Test: parametri

HIMP

Acta Oto-Laryngologica. 2015; 135: 886-894

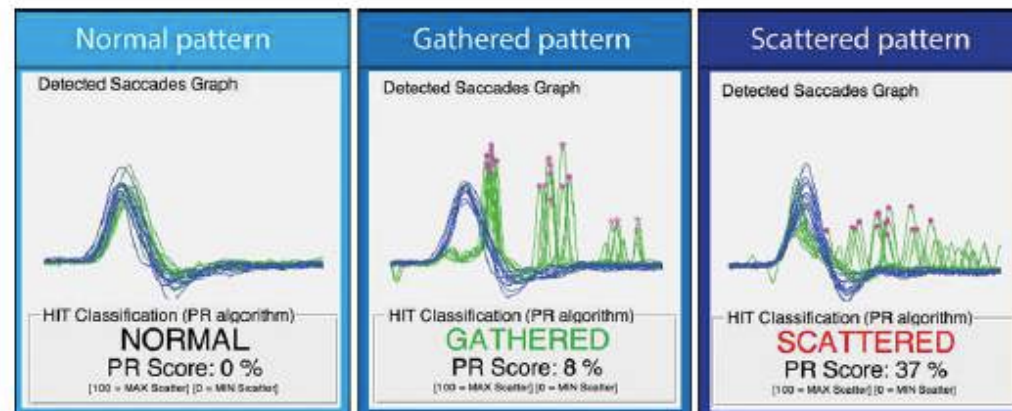
informa  
healthcare

ORIGINAL ARTICLE

## Classificazione dei saccadici

HITCal: a software tool for analysis of video head impulse test responses

JORGE REY-MARTINEZ<sup>1</sup>, ANGEL BATUECAS-CALETRIO<sup>2</sup>, EUSEBI MARTÍÑO<sup>3</sup> & NICOLÁS PEREZ FERNANDEZ<sup>4</sup>



# Video Head Impulse Test: parametri

HIMP

*The Laryngoscope*  
 © 2013 The American Laryngological,  
 Rhinological and Otological Society, Inc.

## The Vestibulo-Ocular Reflex and Subjective Balance After Vestibular Schwannoma Surgery

Angel Batuecas-Caletrio, MD, PhD; Santiago Santacruz-Ruiz, MD, PhD;  
 Angel Muñoz-Herrera, MD; Nicolas Perez-Fernandez, MD, PhD

Saccadici **COVERT**

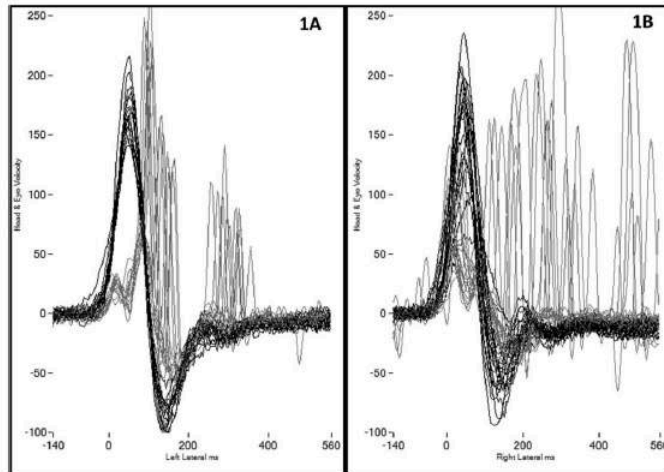


TABLE I. Results by Group.			
	Group A	Group B	Difference: <i>P</i> (test)
N	38	11	
Sex (male/female)	19/19	4/7	0.425 (chi-square)
Age	47 ± 12	57 ± 14	0.024 (t test)
Size (grade I, grade II, grade III, grade IV)	7, 12, 14, 5	2, 4, 3, 2	0.311 (chi-square)
Canal paresis (presurgical)	42 ± 18	26 ± 10	0.011 (t test)
Gain of VOR			
To operated side	0.3 ± 0.03	0.27 ± 0.05	0.223 (t test)
To normal side	0.8 ± 0.065	0.76 ± 0.049	0.429 (t test)
<b>DHI</b>			
Total score	<b>21 ± 8</b>	<b>47 ± 13</b>	<i>P</i> = 0.0002 (t test)
Emotional	7 ± 3	16 ± 5	<i>P</i> = 0.0003 (t test)
Functional	7 ± 5	16 ± 4	<i>P</i> = 0.0006 (t test)
Physical	6 ± 3	15 ± 5	<i>P</i> = 0.0004 (t test)

DHI = Dizziness Handicap Index; VOR = vestibulo-ocular reflex.

# Video Head Impulse Test: *parametri*

---

HIMP

## Saccadici **COVERT**

The Cerebellum  
<https://doi.org/10.1007/s12311-017-0907-0>

ORIGINAL PAPER



### Are Covert Saccade Functionally Relevant in Vestibular Hypofunction?

R. Hermann<sup>1,2,3</sup> · D. Pelisson<sup>2,3</sup> · O Dumas<sup>4</sup> · Ch Urquizar<sup>2</sup> · E. Truy<sup>1,2,3</sup> · C. Tilikete<sup>2,3,5</sup> 

It has recently been described that some patients with bilateral vestibular loss that do not report oscillopsia develop a covert compensatory saccade (opposite to the direction of the head

### Visual Performance and Perception as a Target of Saccadic Strategies in Patients With Unilateral Vestibular Loss

Gabriel Trinidad-Ruiz,<sup>1</sup> Jorge Rey-Martinez,<sup>2</sup> Angel Batuecas-Caletrio,<sup>3</sup> Eusebi Matíño-Soler,<sup>4</sup> and Nicolas Perez-Fernandez<sup>5</sup>

The goal of this study was to evaluate in patients with bilateral vestibular hypofunction (BVH) the potential functional impact of covert saccades (CS) on visual performance. To our

# Video Head Impulse Test: parametri

SHIMP



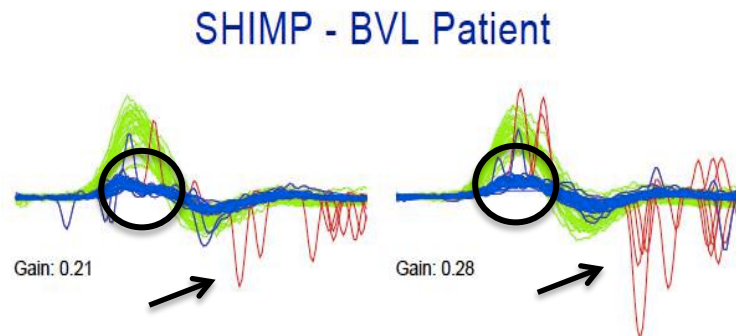
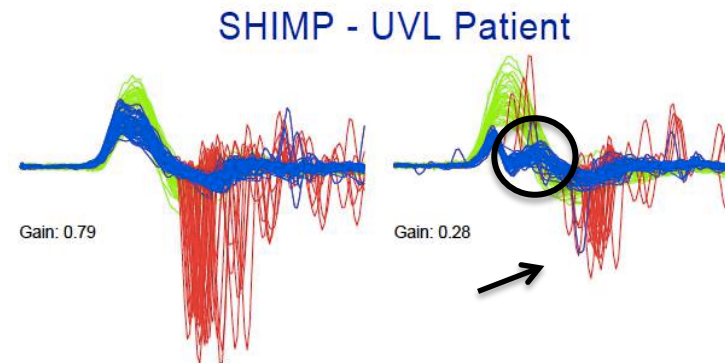
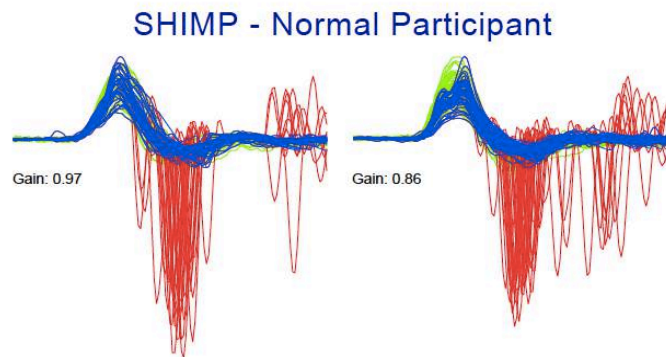
Zurich Open Repository and Archive  
University of Zurich  
Main Library  
Strickhofstrasse 39  
CH-8057 Zurich  
www.zora.uzh.ch

Year: 2016

## Ampiezza del VOR

A new saccadic indicator of peripheral vestibular function based on the video head impulse test

MacDougall, H G; McGarvie, L A; Halmagyi, G M; Rogers, S J; Manzari, L; Burgess, A M; Curthoys, I S; Weber, K P



## Video Head Impulse Test: parametri



SHIMP

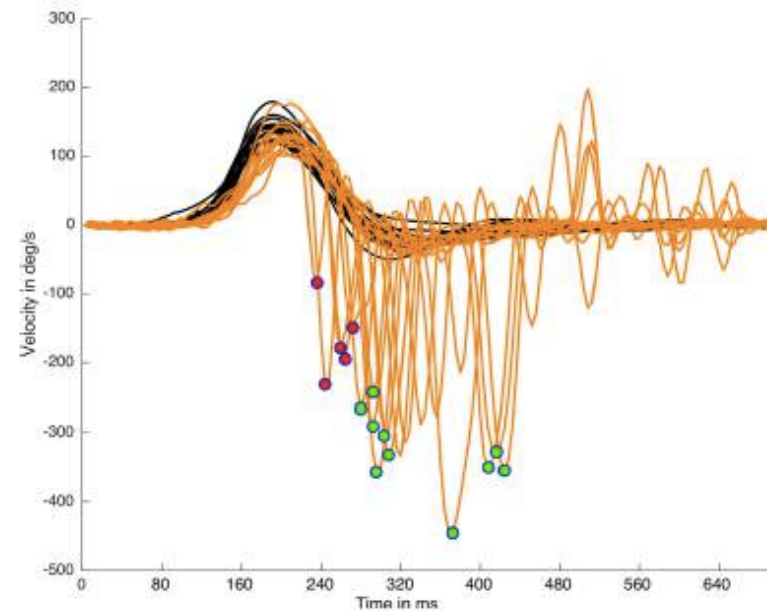
Saccadici di rifissazione

- ✧ **Latenza > 80 ms**
- ✧ **Ampiezza 350-400°/sec**

*The Laryngoscope*  
© 2014 The American Laryngological,  
Rhino-logical and Otolological Society, Inc.

### Vestibulo-Ocular Reflex Gain Values in the Suppression Head Impulse Test of Healthy Subjects

Jorge Rey-Martinez, MD, PhD ; Izaskun Thomas-Arrizabalaga, MD;  
Juan Manuel Espinosa-Sanchez, MD; Angel Batuecas-Caletrio, MD, PhD; Gabriel Trinidad-Ruiz, MD, PhD;  
Eusebi Matño-Soler, MD, PhD; Nicolas Perez-Fernandez, MD, PhD 



# Video Head Impulse Test: parametri



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UZH

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CH-8057 Zurich  
www.zora.uzh.ch

Year: 2016

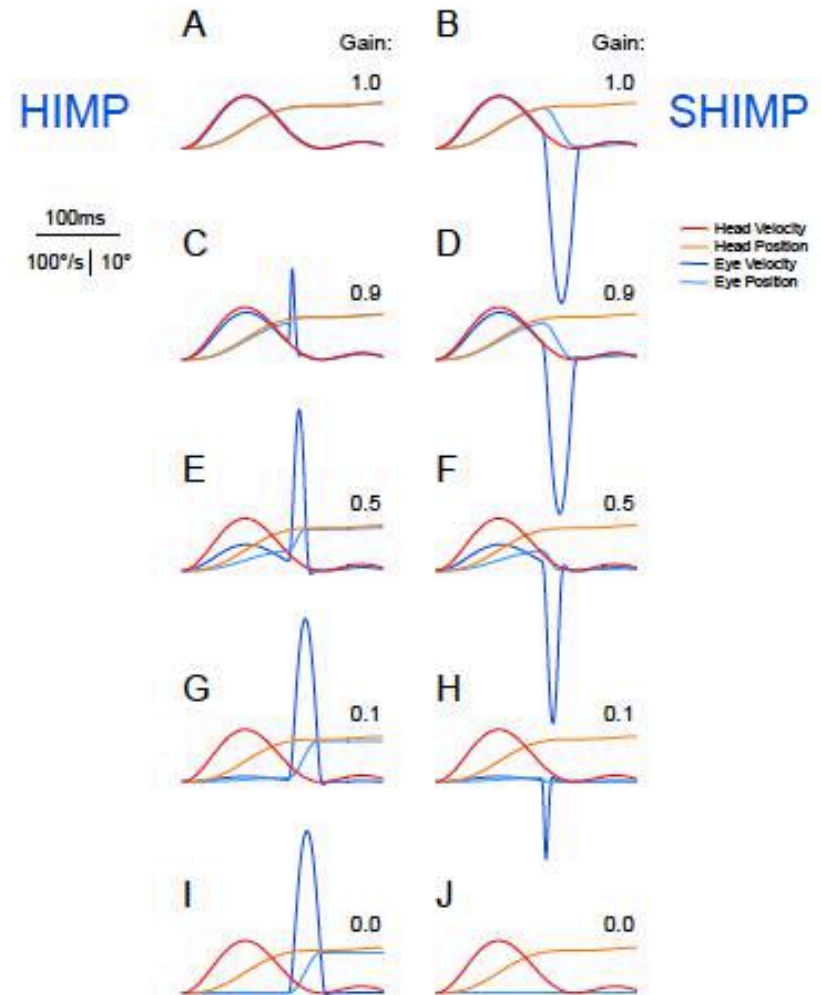
A new saccadic indicator of peripheral vestibular function based on the video head impulse test

MacDougall, H G; McGarvie, L A; Halmagyi, G M; Rogers, S J; Manzari, L; Burgess, A M; Curthoys, I S; Weber, K P

*Saccadici diverso significato*

**Ridotta**      funzionalità canalare      **HIMP**

**Conservata**      funzionalità canalare      **SHIMP**





# Video Head Impulse Test: applicazioni cliniche

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## The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>,  
Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>

<sup>1</sup>Neurology Department, Institute of Clinical Neurosciences, Royal Prince Alfred Hospital, Camperdown, NSW, Australia, <sup>2</sup>Vestibular Research Laboratory, School of Psychology, The University of Sydney, Sydney, NSW, Australia, <sup>3</sup>Department of Ophthalmology, University Hospital Zurich, University of Zurich, Zurich, Switzerland, <sup>4</sup>Department of Neurology, University Hospital Zurich, University of Zurich, Zurich, Switzerland

*“..with the use of vHIT or all six SCCs in daily clinical practice, not only are classic vestibular disease patterns , such as superior vestibular neuritis (VN) confirmed, but also new and exciting disease patterna are emerging..”*

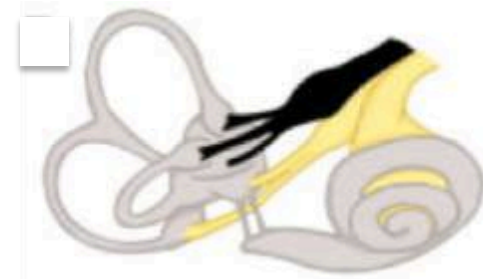
## ***Video Head Impulse Test: applicazioni cliniche***

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### ***Deficit Vestibolare Acuto***

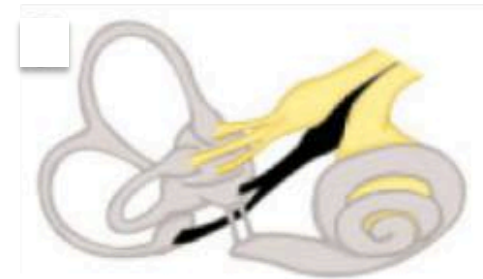
✧ **Deficit parziale**

Nervo vestibolare superiore



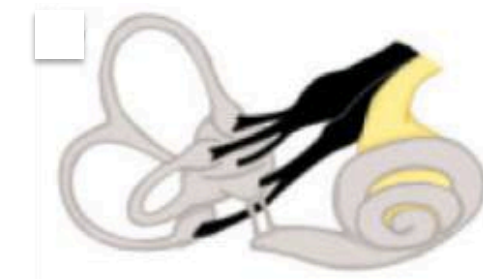
✧ **Deficit parziale**

Nervo vestibolare inferiore



✧ **Deficit totale**

Nervo vestibolare superiore/inferiore



# Video Head Impulse Test: applicazioni cliniche

## Deficit Vestibolare Acuto parziale nervo vestibolare superiore

### Referto valutazione vestibolare

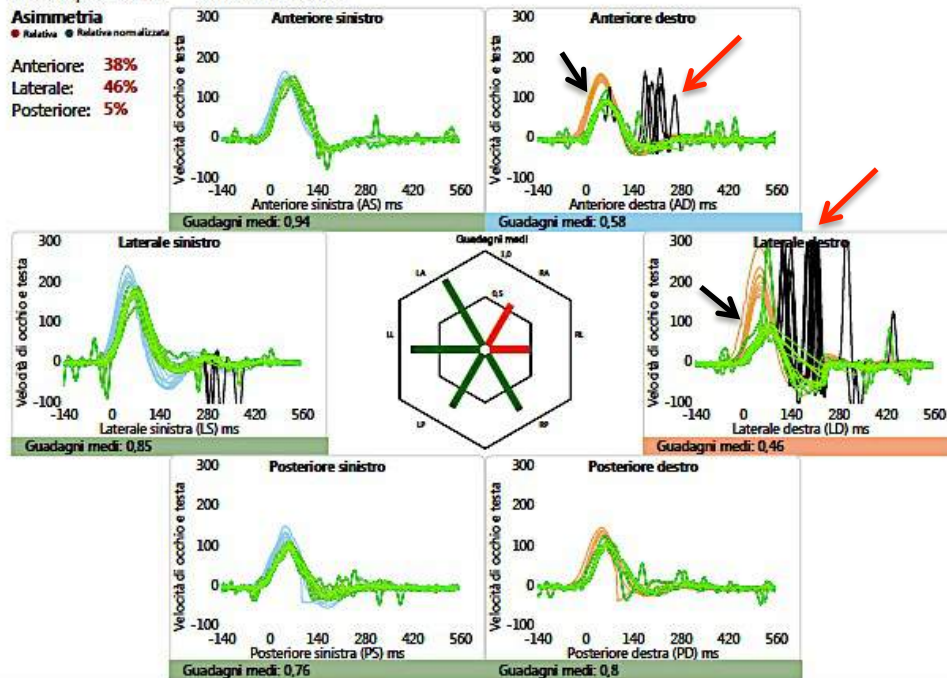
Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia

Nome paziente: [redacted] Medico ref.: Deficit destro  
Data di nascita: 26/09/1993  
Sesso: Maschile

### Impulso della testa

Prova impulso laterale: 11/06/2018 11:58:16  
Prova impulso LARP: 11/06/2018 12:00:37  
Prova impulso RALP: 11/06/2018 12:01:33

**Asimmetria**  
● Relativa ● Relativa normalizzata  
Anteriore: 38%  
Laterale: 46%  
Posteriore: 5%



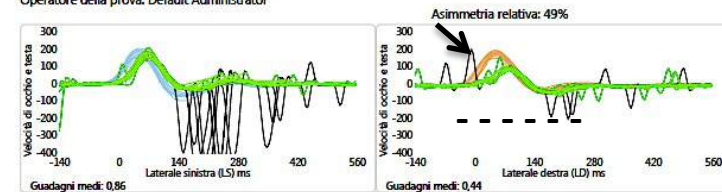
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia

Nome paziente: [redacted] Medico ref.: Deficit destro  
Data di nascita: 26/09/1993  
Sesso: Maschile

### Impulso della testa

Test laterale SHIMP: 11/06/2018 12:02:38  
Operatore della prova: Default Administrator



Acta Oto-Laryngologica, 2012; 132: 1288-1294

informa  
healthcare

ORIGINAL ARTICLE

### Clinical characteristics of inferior vestibular neuritis

YASUHIRO CHIHARA<sup>1,2,3</sup>, SHINICHI IWASAKI<sup>1</sup>, TOSHIHISA MUROFUSHI<sup>3,4</sup>,  
MASATO YAGI<sup>3</sup>, AKI INOUE<sup>1</sup>, CHISATO FUJIMOTO<sup>1</sup>, NAOYA EGAMI<sup>1</sup>,  
MUNETAKA USHIO<sup>1</sup>, SHOTARO KARINO<sup>1</sup>, KEIKO SUGASAWA<sup>1</sup> &  
TATSUYA YAMASOBA<sup>1</sup>

the different prevalence of involvement of the superior and inferior vestibular nerves. Gianoli et al. have shown that the bony canal of the superior vestibular nerve is longer and has more spicules than the singular nerve and the inferior vestibular nerve [14]. Due to

## ***Video Head Impulse Test: applicazioni cliniche***

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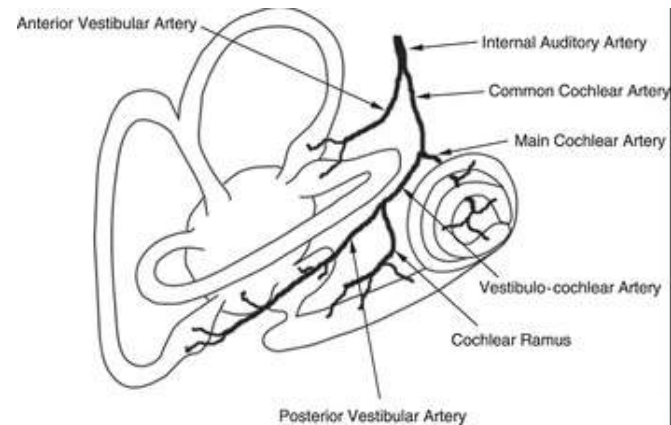
### ***Deficit Vestibolare Acuto parziale nervo vestibolare superiore***

Acta Otorrinolaringol Esp. 1998 Nov-Dec;49(8):599-602.

#### **[Ischemia of the anterior vestibular artery (Lindsay-Hemenway syndrome). Review and comments].**

[Article in Spanish]

Pardal Refoyo JL<sup>1</sup>, Pérez Plasencia D, Beltrán Mateos LD.



# Video Head Impulse Test: applicazioni cliniche

## Deficit Vestibolare Acuto parziale nervo vestibolare inferiore

### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia

Nome paziente: Temporaneo, Paziente  
ID paziente: 20170530123737  
Data di nascita: 01/01/0001  
Sesso: Non specificato

Acta Oto-Laryngologica, 2012; 132: 1288-1294

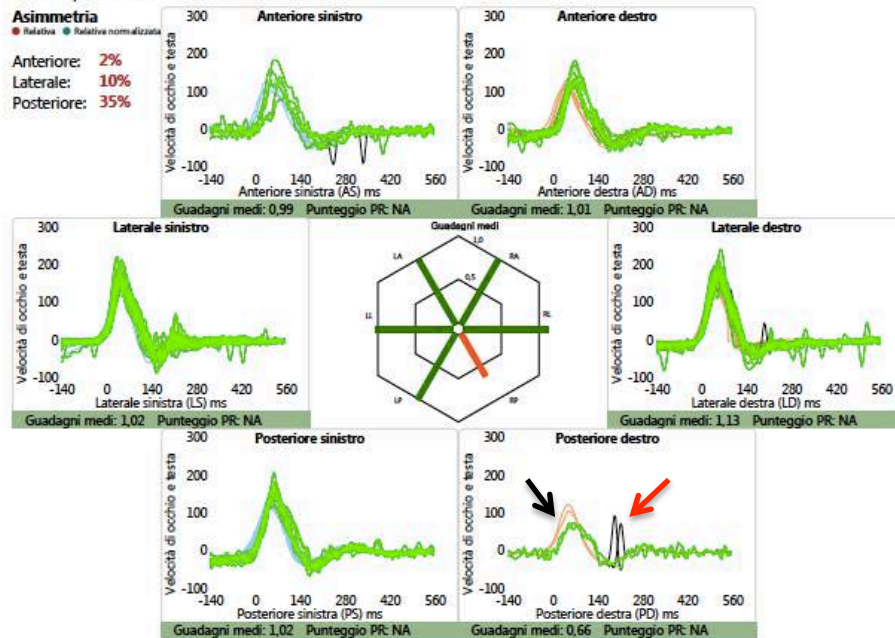
informa  
healthcare

### Impulso della testa

Prova impulso laterale: 30/05/2017 12:38:23  
Prova impulso LARP: 30/05/2017 12:42:01  
Prova impulso RALP: 30/05/2017 12:46:23

#### Asimmetria

Anteriore: 2%  
Laterale: 10%  
Posteriore: 35%



### ORIGINAL ARTICLE

### Clinical characteristics of inferior vestibular neuritis

YASUHIRO CHIHARA<sup>1,2,3</sup>, SHINICHI IWASAKI<sup>1</sup>, TOSHIHISA MUROFUSHI<sup>3,4</sup>,  
MASATO YAGI<sup>3</sup>, AKI INOUE<sup>1</sup>, CHISATO FUJIMOTO<sup>1</sup>, NAOYA EGAMI<sup>1</sup>,  
MUNETAKA USHIO<sup>1</sup>, SHOTARO KARINO<sup>1</sup>, KEIKO SUGASAWA<sup>1</sup> &  
TATSUYA YAMASOBA<sup>1</sup>

- ✧ 18 %
- ✧ No patients with IVN showed PPV (post)
- ✧ Patients with IVN were younger

# Video Head Impulse Test: applicazioni cliniche

## Deficit Vestibolare Acuto totale

### Referto valutazione vestibolare

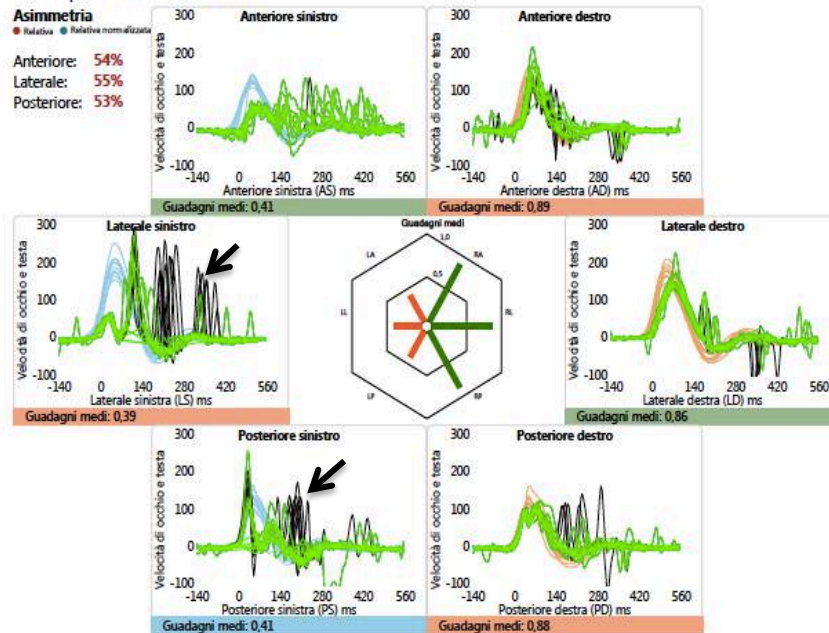
Università Studi di Pavia - Polic San Matteo  
Dip.Sienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: [redacted] Medico ref.: Deficit vestibolare sinistro  
Data di nascita: 13/02/1975  
Sesso: Maschile

### Impulso della testa

Prova impulso laterale: 05/07/2018 11:54:11  
Prova impulso LARP: 05/07/2018 11:56:13  
Prova impulso RALP: 05/07/2018 11:58:11

**Asimmetria**  
● Relativa ● Relativa normalizzata  
Anteriore: 54%  
Laterale: 55%  
Posteriore: 53%



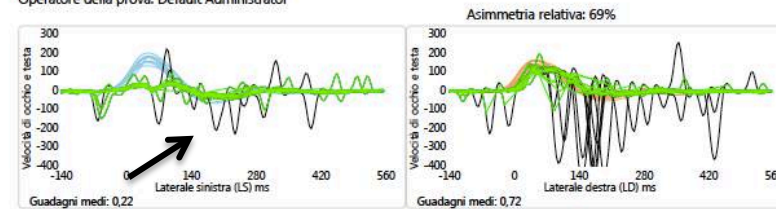
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Sienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: [redacted] Medico ref.: SHIMP deficit  
Data di nascita: 13/02/1975  
Sesso: Maschile

### Impulso della testa

Test laterale SHIMP: 05/07/2018 12:10:44  
Operatore della prova: Default Administrator



# Video Head Impulse Test: applicazioni cliniche

## Deficit vestibolare bilaterale

### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: M, F  
Data di nascita: 10/09/1952  
Sesso: Femminile

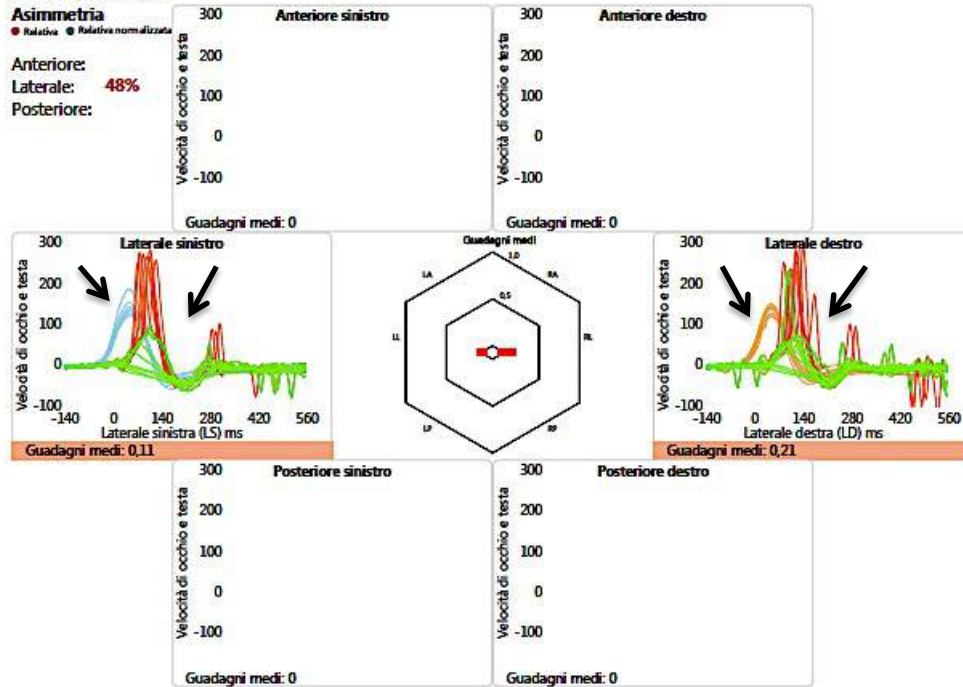
Medico ref.: ENS

### Impulso della testa

Prova impulso laterale: 04/06/2018 17:59:16  
Prova impulso LARP:  
Prova impulso RALP:

#### Asimmetria

Anteriore:  
Laterale: **48%**  
Posteriore:



### Referto valutazione vestibolare

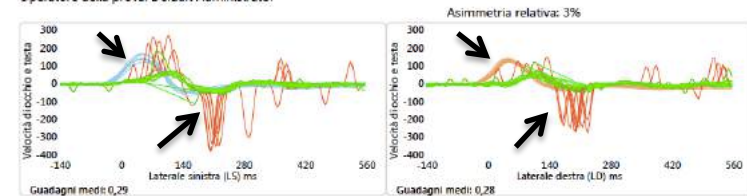
Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: M, F  
Data di nascita: 10/09/1952  
Sesso: Femminile

Medico ref.: ENS

### Impulso della testa

Test laterale SHIMP: 04/06/2018 18:00:45  
Operatore della prova: Default Administrator



# Video Head Impulse Test: applicazioni cliniche

## CANVAS

Journal of Vestibular Research 24 (2014) 465–474  
 DOI 10.3233/VES-140536  
 IOS Press

### CANVAS an update: Clinical presentation, investigation and management

David J. Szmulewicz<sup>a,\*</sup>, Catriona A. McLean<sup>b</sup>, Hamish G. MacDougall<sup>c</sup>, Leslie Roberts<sup>d</sup>, Elsdon Storey<sup>e</sup> and G. Michael Halmagyi<sup>f</sup>

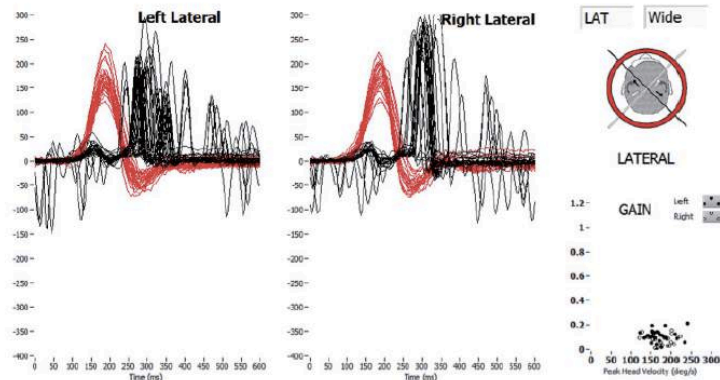
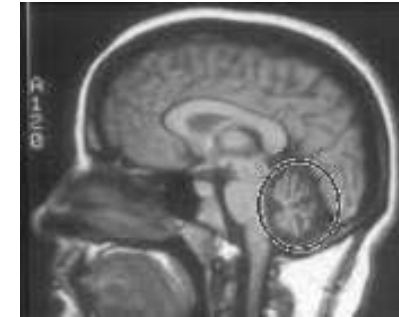


Table 1  
 Clinical evaluation of the potential CANVAS patient

Component of the CANVAS triad	Abnormality	Clinical examination finding	Suggested/Preferred investigative modalities
Bilateral vestibulopathy	Decreased VOR gain bilaterally Abnormal VVOR	Bi-directionally abnormal horizontal head impulse test Saccadic bedside VVOR	Rapid video-oculography <sup>3</sup> (see Fig. 2), video nystagmography or rotational chair testing
Cerebellar impairment	Cerebellar atrophy	N/A	MRI evidence of anterior and dorsal vermal atrophy, and laterally, hemispheric atrophy predominantly affecting crus I (see Fig. 6)
	Cerebellar dysarthria	Dysarthric speech	Formal speech therapy (speech pathology) assessment, including swallow assessment where clinically indicated
	Appendicular ataxia	For example, evidence of upper and lower limb dysmetria, intention tremor & dyssynergia	N/A
Somatosensory impairment	Dysphagia of cerebellar origin	N/A	Video fluoroscopy
	Cerebellar oculomotor abnormalities	Impaired smooth pursuit and *VOR suppression; gaze-evoked nystagmus; dysmetric saccades to target; rebound nystagmus, pure vertical or torsional nystagmus	Rapid video-oculography <sup>3</sup> , video nystagmography, rotational chair testing (see Figs 3 and 4)
Additional requirement	Neurophysiological evidence of a neuropathy	Sensory deficit in one or more of light touch, pin prick, vibration or proprioception.	Neurophysiological studies demonstrating reduced or absent SNAPs in a pattern indicative of a neuropathy or neuronopathy
Additional requirement	Exclusion of genetic ataxias able to be gene tested, particularly SCA3 and Friedreich's ataxia		



# Video Head Impulse Test: applicazioni cliniche

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## The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>,  
Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>

<sup>1</sup>Neurology Department, Institute of Clinical Neurosciences, Royal Prince Alfred Hospital, Camperdown, NSW, Australia, <sup>2</sup>Vestibular Research Laboratory, School of Psychology, The University of Sydney, Sydney, NSW, Australia, <sup>3</sup>Department of Ophthalmology, University Hospital Zurich, University of Zurich, Zurich, Switzerland, <sup>4</sup>Department of Neurology, University Hospital Zurich, University of Zurich, Zurich, Switzerland

*“..it is the **most important** test un differentiating central from peripheral vestibular disorders...”*



# Video Head Impulse Test: applicazioni cliniche

## Deficit Vestibolare Acuto diagnosi differenziale

### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip. Scienze Vestibologia  
via Golgi 19  
Pavia,

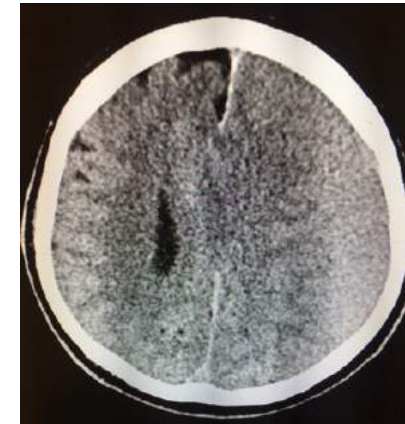
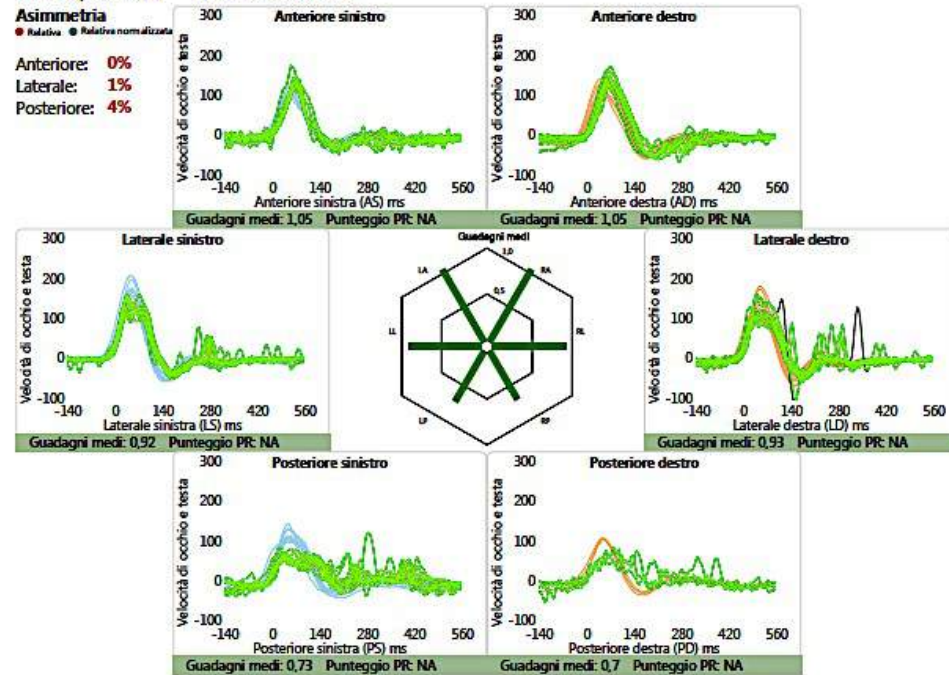
Nome paziente: ██████████  
Data di nascita: 06/01/1949  
Sesso: Maschile

### Impulso della testa

Prova impulso laterale: 05/06/2017 11:38:19  
Prova impulso LARP: 05/06/2017 11:40:12  
Prova impulso RALP: 05/06/2017 11:44:40

#### Asimmetria

Anteriore: 0%  
Laterale: 1%  
Posteriore: 4%



*Video Head Impulse Test: applicazioni cliniche*

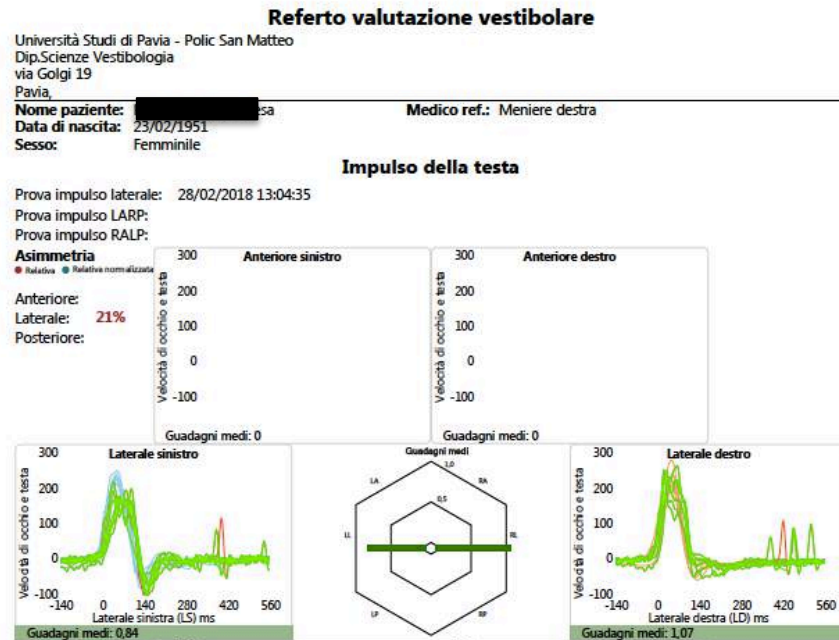
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# Video Head Impulse Test: applicazioni cliniche

## Malattia di Meniere

Ann. N.Y. Acad. Sci. ISSN 0077-8923

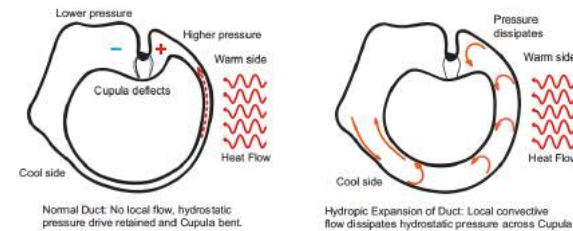


ANNALS OF THE NEW YORK ACADEMY OF SCIENCES  
Issue: *Dizziness and Balance Disorders*

### What does the head impulse test versus caloric dissociation reveal about vestibular dysfunction in Ménière's disease?

Leigh A. McGarvie,<sup>1</sup> Ian S. Curthoys,<sup>2</sup> Hamish G. MacDougall,<sup>2</sup> and G. Michael Halmagyi<sup>1</sup>

<sup>1</sup>Institute of Clinical Neurosciences, Royal Prince Alfred Hospital, Camperdown, NSW, Australia. <sup>2</sup>Vestibular Research Laboratory, School of Psychology, University of Sydney, NSW, Australia



sults, coupled with the fluctuating caloric results in early MD, make the **different-frequency mechanism highly unlikely to be the source of the dissociation between the caloric and vHIT in the test results in MD.** In light of these new data, we think it is time

**caloric test** in this disease is more likely to be an indication of hydroptic expansion of the horizontal membranous duct, rather than a loss of function.

# Video Head Impulse Test: applicazioni cliniche

## Malattia di Meniere

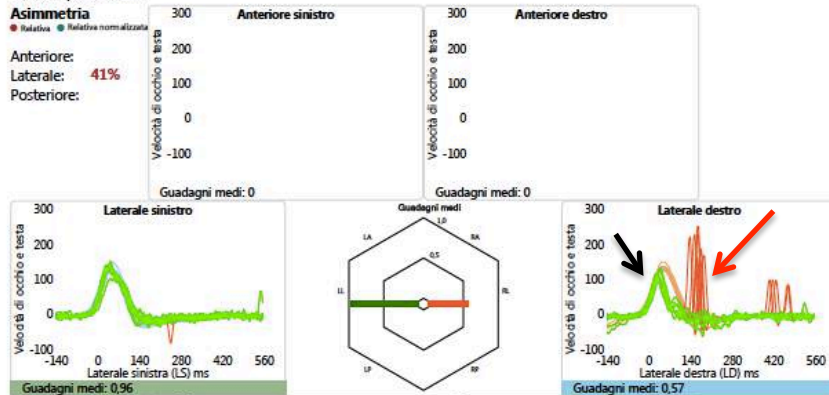
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: R. [redacted] sa1 Medico ref.: CTR a 1 mese di genta per MdM dx  
Data di nascita: 23/02/1951  
Sesso: Femminile

### Impulso della testa

Prova impulso laterale: 11/04/2018 15:02:59  
Prova impulso LARP:  
Prova impulso RALP:



Otology & Neurotology  
37:380-384 © 2016, Otology & Neurotology, Inc.

### Assessment of Vestibulo-oculomotor Reflex in Ménière's Disease: Defining an Instrumental Profile

Niccolò Cerchiai, Elena Navari, Iacopo Dallan, Stefano Sellari-Franceschini, and Augusto P. Casani

Department of Medical and Surgical Pathology, ENT Section, Pisa University Hospital, Pisa, Italy

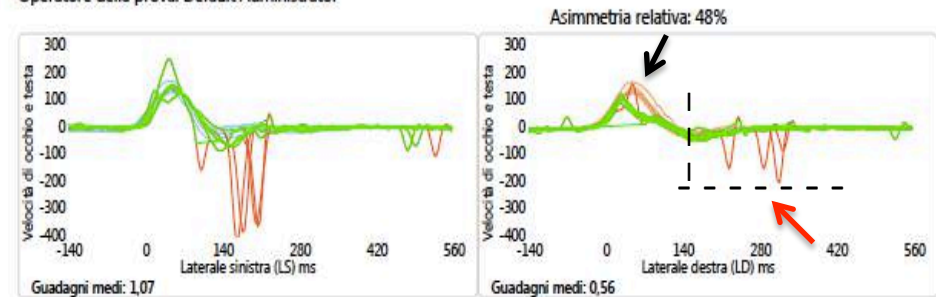
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: R. [redacted] resal1 Medico ref.: CTR a 1 mese di genta per MdM dx  
Data di nascita: 23/02/1951  
Sesso: Femminile

### Impulso della testa

Test laterale SHIMP: 11/04/2018 15:04:52  
Operatore della prova: Default Administrator



A reduction in HF-VOR on vHIT in an MD can represent a good indicator of an effective treatment with ITG.

# Video Head Impulse Test: applicazioni cliniche

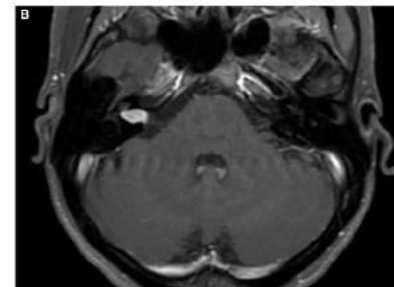
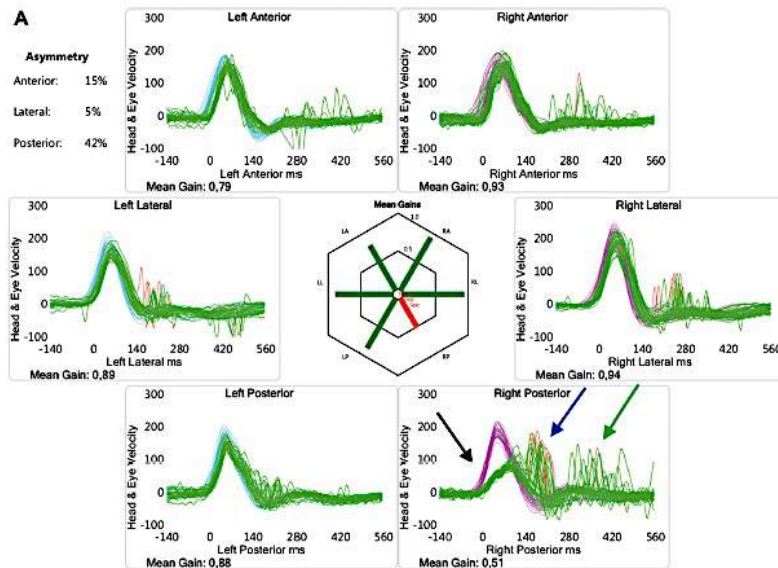
## Neurinoma

Felipe Constanzo, MD<sup>\*</sup>  
Patricia Sens, MD, PhD<sup>\*</sup>  
Bernardo Corrêa de  
Almeida Teixeira, MD<sup>5</sup>  
Ricardo Ramina, MD, PhD<sup>\*</sup>

### Video Head Impulse Test to Preoperatively Identify the Nerve of Origin of Vestibular Schwannomas

Operative Neurosurgery 0:1-7, 2018

DOI: 10.1093/ons/opy103



located near the internal acoustic meatus.<sup>2,3</sup> The relevance of identifying the nerve of origin in VS lies in its prognostic factor for hearing preservation after surgery,<sup>4-7</sup> with tumors arising from

# Video Head Impulse Test: applicazioni cliniche

## Impianto cocleare

*The Laryngoscope*  
© 2015 The American Laryngological,  
Rhinological and Otological Society, Inc.

### Vestibular Function in Cochlear Implantation: Correlating Objectiveness and Subjectiveness

Angel Batuecas-Caletrio, MD, PhD; Micah Klumpp, PhD; Santiago Santaacruz-Ruiz, MD, PhD;  
Fernando Benito Gonzalez, MD; Enrique Gonzalez Sánchez, MD; Moises Arriaga, MD

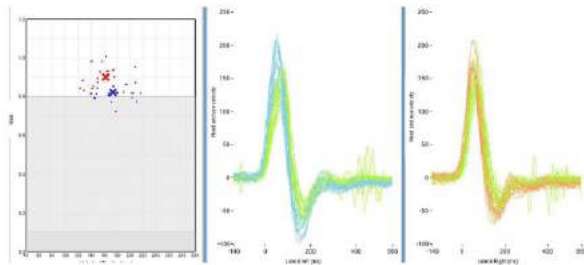


Fig. 1. Before surgery. The video head impulse test showing normal vestibular function. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

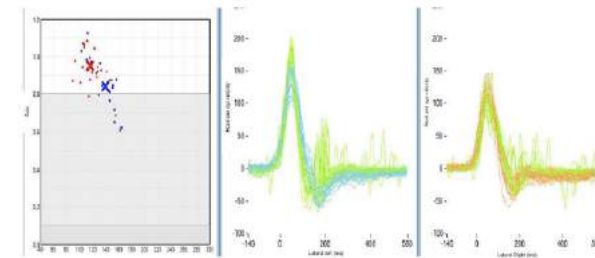


Fig. 2. After surgery (left cochlear implantation). Only saccades appear in the video head impulse test. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

In our opinion, vHIT is an excellent procedure to test vestibular function before and after some otologic surgeries such as CI. It could offer more information about vestibular changes than other test-like calorics.



# Video Head Impulse Test: applicazioni cliniche

## Compenso vestibolare

## HIMP

### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: G [REDACTED]  
Data di nascita: 13/05/1949  
Sesso: Maschile

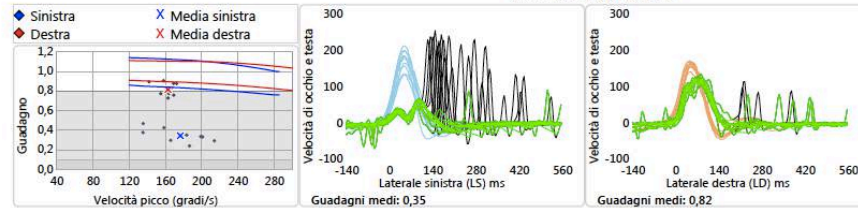
Data referto: 19/04/2017

Operatore referto: Default Administrator

### Impulso della testa

Prova impulso laterale: 19/04/2017 14:40:16  
Operatore della prova: Default Administrator

$\bar{x}$  Sinistra: 0,35,  $\alpha$ : 0,06       $\bar{x}$  Destra: 0,82,  $\alpha$ : 0,06  
Asimmetria relativa: 57%



### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia,

Nome paziente: G [REDACTED]  
Data di nascita: 13/05/1949  
Sesso: Maschile

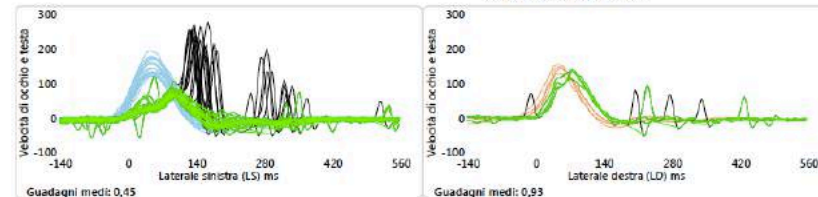
Data referto: 18/01/2018

Operatore referto: Default Administrator

### Impulso della testa

Prova impulso laterale: 18/10/2017 14:27:59  
Operatore della prova: Default Administrator

Asimmetria relativa: 52%



# Video Head Impulse Test: applicazioni cliniche

## Compenso vestibolare

## SHIMP

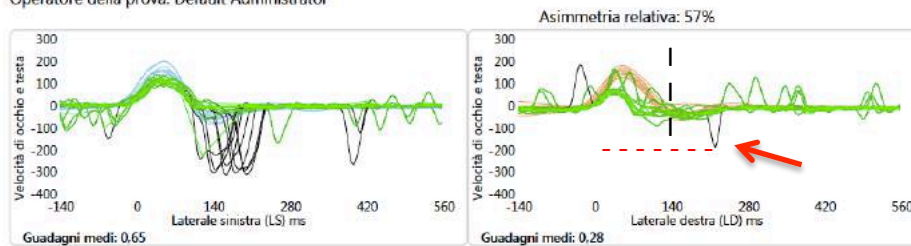
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia.

Nome paziente: ██████████  
Data di nascita: 19/06/1970  
Sesso: Maschile  
Medico ref.: Deficit destro acuto

### Impulso della testa

Test laterale SHIMP: 22/02/2018 12:23:19  
Operatore della prova: Default Administrator



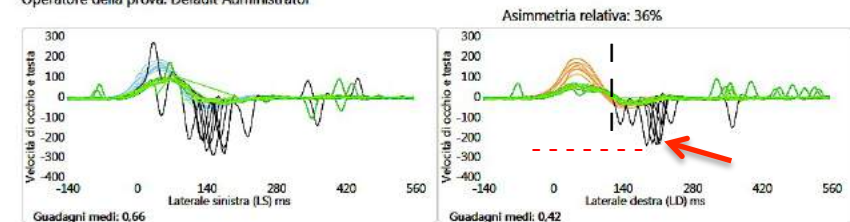
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia.

Nome paziente: ██████████  
Data di nascita: 19/06/1970  
Sesso: Maschile  
Medico ref.: Deficit vestibolare acuto dx a 15 giorni

### Impulso della testa

Test laterale SHIMP: 07/03/2018 12:32:33  
Operatore della prova: Default Administrator



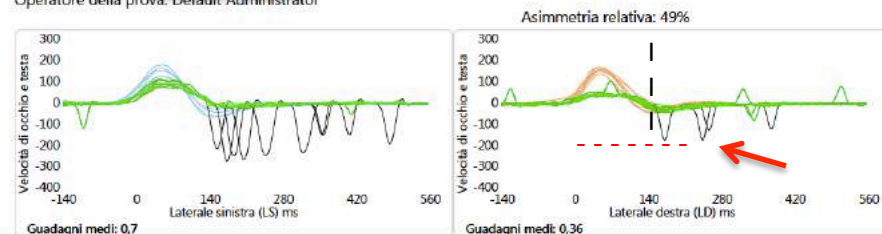
### Referto valutazione vestibolare

Università Studi di Pavia - Polic San Matteo  
Dip.Scienze Vestibologia  
via Golgi 19  
Pavia.

Nome paziente: ██████████  
Data di nascita: 19/06/1970  
Sesso: Maschile  
Medico ref.: Deficit acuto dx a 5 giorni

### Impulso della testa

Test laterale SHIMP: 26/02/2018 11:02:43  
Operatore della prova: Default Administrator



# Video Head Impulse Test: applicazioni cliniche

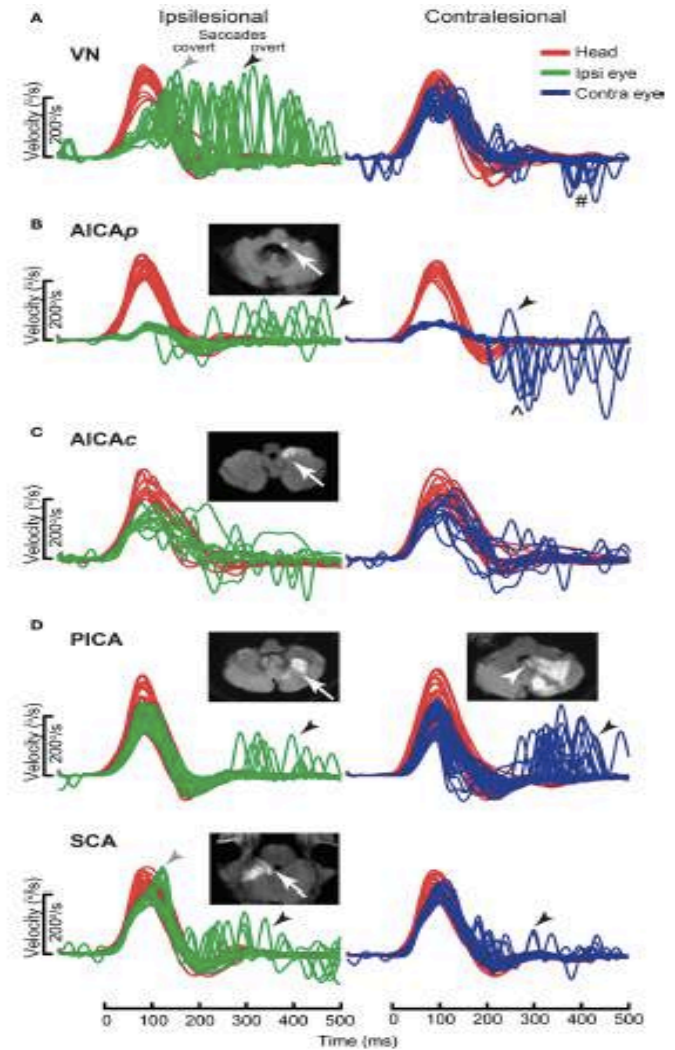
## Patologie centrali



### The Video Head Impulse Test

G. M. Halmagyi<sup>1\*</sup>, Luke Chen<sup>1</sup>, Hamish G. MacDougall<sup>2</sup>, Konrad P. Weber<sup>3,4</sup>,  
Leigh A. McGarvie<sup>1</sup> and Ian S. Curthoys<sup>2</sup>

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## Video Head Impulse Tests with a Remote Camera System: Normative Values of Semicircular Canal Vestibulo-Ocular Reflex Gain in Infants and Children

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Video head impulse test is a valid, practical, and rapid diagnostic tool for detecting vestibular deficits in children as young as 3 months of age. Unlike HIT performed only by

different ages. While VOR gain is reported to remain relatively constant after the age of 16 (5, 7), there is a rapid increase until about the age of 6, following by a more moderate evolution to adult levels.

## Video Head Impulse Test

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### Effect of Aging and Direction of Impulse in Video Head Impulse Test

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Tae Hwan Kim, MD ; Min-Beom Kim, MD, PhD

Analyzing the age groups, one study reported that VOR gain reduction occurred at age 71 years in the horizontal canal, but the number of subjects was relatively small.<sup>9</sup> Our study makes confirmation of this result with the large sample size. However, unlike the horizontal canal, VOR gain in vertical canal (posterior canal and anterior canal) declined after the age of 80 years.]

## ***Video Head Impulse Test***

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### ***Quando fare il vHIT ?***

- . In emergenza in caso di vertigine acuta isolata e presenza di ny spontaneo
- . Nel paziente in follow-up per deficit vestibolare acuto
- . Nel paziente con traumi cranici
- . Nel paziente con malattia di Meniere : bilancio della funzionalità vestibolare
- . Nel paziente con malattia di Meniere dopo trattamento con gentamicina IT
- . Nel paziente con HST positivo
- . In pazienti sottoposti a trattamento con farmaci ototossici

## ***Video Head Impulse Test***

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### ***Concludendo...***

- . Stimolo fisiologico
- . Semplice applicazione (bambini/anziani)
- . Ripetibile
- . Accuratezza diagnostica
- . Diagnosi differenziale
- . Valutazione delle risposte alle terapie
- . Aiuto nella prognosi

