

Innovative Use of Google Cardboard in Clinical Examination of Patients of Vertigo

Aditya M Yeolekar , Kiran J Shinde and Haris Qadri

Department of ENT & Head and Neck Surgery, Smt. Kashibai Navale Medical College, Pune, India.

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ABSTRACT

BACKGROUND: Vertigo is 1 of the most prominent and frequent neurological symptom. It is estimated that about 30% of all people need medical care once in their life due to this index symptom. The neurological expertise required is usually scarce in underprivileged areas. One has to look for spontaneous nystagmus, and perform Dix–Hallpike maneuver and Head Impulse test specifically to differentiate central from peripheral vertigo. The nystagmus, that is spontaneous, involuntary to-and-fro movement of the eyeball which aids in the diagnosis, can be better elicited by Frenzel glasses, Munich glasses. These devices consist of the combination of magnifying glasses and a lighting system to detect eye movements better than routine examination.

OBJECTIVE: To test usefulness of modified Google cardboard as Frenzel glasses in poor resource setting.

STUDY DESIGN: A modified Google cardboard was used in 52 consecutive cases of vertigo and compared with examination with naked eye. The device consists of 2 magnifying lenses, 1 for each eye with power of +24 dioptres.

OBSERVATION: The tool was found to be better for identifying spontaneous nystagmus, in Dix–Hallpike maneuver and during head impulse test as compared with the naked eye owing to the property of magnification and inhibition of fixation. Being a cheaper alternative and handy, it could be carried by every doctor in any setting.

KEYWORDS: Google cardboard, virtual reality, vertigo, Frenzel glasses, vestibular rehabilitation

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CORRESPONDING AUTHOR: Aditya M Yeolekar, Department of ENT & Head and Neck Surgery, Smt. Kashibai Navale Medical College, Narhe, Pune 411021, India. Email: adidoc@gmail.com

Introduction

The term “vertigo” implies a dysequilibrium, an effect of dysfunction of central or peripheral vestibular system. True vertigo usually implies spinning or sensation of rotation. Dizziness broadly includes presyncope, feeling of light headedness, imbalance, and vertigo. It also encompasses other disorders due to cardiovascular, metabolic illness and neurological conditions. It is estimated that about 30% of all people need medical care once in their life due to this index symptom of dizziness.¹ In emergency units, dizziness is as frequent as 12% of all neurological presentations.^{2,3} Clinically acute dizziness can be separated into frequent peripheral syndromes including benign paroxysmal positional vertigo (BPPV), vestibular neuritis, Meniere disease or vestibular migraine, and central—a stroke in the posterior circulation or more rarely a tumor in the posterior fossa. The burden of neurological disorders is increasing.⁴ In addition, neurophobia among students, residents, and general practitioners is widespread and leads to discomfort in caring for dizzy patients.⁵ Thus, it is imperative to diagnose the cause of dizziness precisely using clinical and resource-saving techniques. It is generally recommended to elaborate what the patient exactly means by dizziness, detailed history, and duration of attacks.^{6,7} Associated symptoms like diplopia, dysarthria, dysphagia, dysaesthesia, and dysmetria should be noted. The “HINTS test” is commonly employed to identify stroke in

the posterior circulation, which means that normal head impulse test, positive gaze-evoked nystagmus and positive skew deviation.^{8,9} Examination of eye movements allows differentiating between a peripheral and a central oculomotor disorder and thus can be an indicator for stroke. A spontaneous nystagmus of peripheral vestibular origin is always unidirectional, predominantly horizontal with a rotational component and increases when fixation is removed (Frenzel or Munich glasses, penlight-cover test).¹⁰ Considering the index symptom dizziness due to positional vertigo, the Dix–Hallpike maneuver should be performed. The head impulse test introduced by Halmagyi and Curthoys (1988) is mostly positive in the case of an acute peripheral vestibulopathy and rather rarely normal in these patients when performed clinically.¹¹ The spontaneous nystagmus on head shake test, head impulse test, and Dix–Hallpike maneuver can better be done using Frenzel glasses or a Video-Nystagmography console. The optical and video are the 2 variants of Frenzel glasses available (Figure 1).

In essence, Frenzel glasses are a pair of magnifying glasses (+20 dioptres) that are worn by the patient and an illuminating system. On using Frenzel goggles, the nystagmus is better seen as a result of eyes being magnified and inhibition of visual fixation. Video-Frenzel glasses are glasses that can be connected to a TV screen or a computer. This allows one to see very small amount of nystagmus from across the room. There





Figure 1. Conventional Frenzel glasses.

Google Cardboard



Figure 2. Google cardboard.

are 6 sources of the optical Frenzel glasses that are known. Baxter (cat # Au5050), ICS Medical, Nagashima, Bausch and Lomb (same as Baxter), US Neurologicals (Blessing goggles), and Do it yourself.¹² Another alternative is Munich glasses, which are remarkably cheaper and can be carried in the doctor's coat and serve the same purpose of detecting nystagmus after suppression of fixation.¹³

Materials and Methods

The Google cardboard (Figure 2) was bought online (less than 10 dollars). The Google Cardboard is a device made by engineers as a prototype to understand and build on Virtual Reality Console. It is essentially a foldable cardboard box with glasses fitted for viewing. One can mount a smart phone on to it and experience a basic virtual reality experience by running VR videos or applications on it. While wearing it on self, the author realized it was inhibiting visual fixation. The power of lens was calculated, which was +24 dioptres, similar to that in Frenzel glasses. The Google cardboard was cut out in such a way that on wearing it, the eyes of the subject were clearly visible (Figure 3).



Figure 3. Modified Google cardboard.

A prospective study was carried out at a tertiary care hospital after obtaining approval from ethical committee. It aimed at testing usefulness of Google cardboard for identifying spontaneous nystagmus, Dix-Hallpike maneuver, and Head Impulse test as compared with the naked eye. Fifty-two consecutive adult cases of vertigo attending outpatient department in tertiary care hospital were enrolled after informed consent. Two independent doctors examined patients of vertigo by modified Google cardboard and naked eye (the order was changed alternately).

Observations

It was felt by the examining ENT surgeons that the pickup rate of nystagmus was better on using the modified Google cardboard box as compared with naked eye due to magnification and inhibition of visual fixation. Also the modified tool was light weight and small in dimension, enough to carry around in an apron pocket. It was user-friendly for mounting it on subject's eyes. The drawback is that unlike Frenzel glasses, it does not have an inbuilt lighting system.

Results

The study included 52 patients, 20 male and 32 female patients. The age ranged from 18 to 66 years. All were examined by modified Google cardboard and naked eye by 2 independent doctors alternately. The diagnosis reached was as follows: (1) BPPV—20 patients, (2) Acute vestibular neuronitis—18 patients, and (3) Meniere disease—2 patients. Twelve patients were found to be having imbalance/atypical vertigo secondary to Diabetes Mellitus (DM), Hypertension, Vertebro-basilar insufficiency, and peripheral neuropathy.

It was found that pickup rate of nystagmus was more using the tool used as illustrated in Table 1. Spontaneous nystagmus by head shake test was better elicited in 18 patients of vestibular neuronitis by using card board as compared with only 9 patients by naked eye (a gain of 50%). Also 30% of patients of BPPV (6/20) were missed on naked eye examination as compared with Google cardboard (14/20). It was also found that fine nystagmus in patients at recovery stage of vestibular neuronitis was elicited better using the device. The authors felt it to be clinically significant.

Table 1. Pickup rate of nystagmus.

NYSTAGMUS PICKUP BY	GOOGLE CARDBOARD	NAKED EYE
BPPV	20/20	14/20
Vestibular neuronitis	18/18	9/18

Abbreviation: BPPV, benign paroxysmal positional vertigo.

Discussion

The Frenzel glasses being expensive, modified Google cardboard VR box can be used as a cheaper alternative to detect nystagmus better. It is useful during head impulse test of Halmagyi, the head shake test, and Dix–Hallpike test at the bedside. This can be used by every doctor in rural settings in developing countries and in less equipped hospitals considering the cost of conventional Frenzel glasses.

The limitations of the study are as follows: (1) the drawback of this device is lack of illumination. Therefore, it has to be used in a well-lit room and cannot be used in a dark room. (2) The number of subjects being very small in subgroups of vertigo, the statistical analysis is not performed. (3) The reliability of the examiners seeing with naked eye cannot be calculated as it is subjective.

Another cheaper modification of VR box made up of plastic with external illumination is studied and researched on to eliminate the shortcomings of modified Google cardboard box.

Conclusions

The modified Google cardboard can be used to detect spontaneous nystagmus in an emergency/bedside setting with better accuracy than naked eye in absence of Frenzel or Munich glasses owing to its property of magnification and inhibition of visual fixation. This will result in better diagnosis of the type of peripheral vertigo and subsequent treatment. A larger study needs to be carried out at multiple centers to validate these results.

Authors' Note

The manuscript has been read and approved by all the authors, the requirements for authorship as stated earlier in this document have been met, and each author believes that the manuscript represents honest work.

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Author Contributions

AMY: original idea. Study protocol.study execution.

HQ and KJS: technical inputs and manuscript assistance.

ORCID iD

Aditya M Yeolekar  <https://orcid.org/0000-0002-0379-0576>

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