CLINICAL STUDY

ANALYSIS OF DIFFERENT HAND PLACEMENT TECHNIQUES IN REMOTE CAMERA VIDEO HEAD IMPULSE SYSTEM

Nilüfer BAL[2], PhD; Erdem Emre YILMAZ[1], MsC; Meliha BAŞÖZ BEHMEN[1], MsC; Özge Gedik TOKER[1], PhD; Necla SİLAHTAR[1], Aud; Feyza Nur İLERİ[1], Aud

[1]Bezmialem Vakıf Üniversitesi, Sağlık Bilimleri Fakültesi, Odyoloji Bölümü, İstanbul, Turkey [2]Marmara Üniversitesi Tıp Fakültesi, KBB Anabilim Dalı, İstanbul, Turkey

SUMMARY

Objective: To investigate the effects of different hand placement techniques on remote camera vHIT system.

Materials and methods: A total of 34 healthy adult participants were included in the study. Hands around the chin and hands on top of the head techniques were used to obtain horizontal vHIT responses. Gain, accuracy, and asymmetry parameters were calculated and compared between the two techniques.

Results: There were no statistically significant differences between the two hand placement techniques for the horizontal semicircular canals in terms of gain, accuracy and asymmetry parameters.

Conclusion: Hand placement techniques do not significantly affect vHIT responses in remote camera systems. Unlike goggle-based systems, where hand placement techniques showed variable effects on gain and velocity values, remote camera system technology appears to mitigate the effects of hand placement. Nevertheless, further research is needed to investigate the optimal methods of evaluation for different vHIT systems and for different populations of people with vestibular disorders.

Keywords: Video head impulse test, remote camera system, hand placement techniques, vHIT

UZAK KAMERA VHİT SİSTEMİNDE FARKLI EL YERLEŞTİRME TEKNİKLERİNİN ANALİZİ

ÖZET

Amaç: Farklı el yerleştirme tekniklerinin uzak kamera Horizontal kanal Video Head Impulse Test (vHIT) yanıtları üzerindeki etkilerini araştırmaktır.

Yöntem ve Gereçler: Çalışmaya 34 sağlıklı yetişkin katılımcı dahil edilmiştir. Horizontal vHIT cevaplarını elde etmek için eller çenenin etrafında ve eller başın üstünde olma üzere 2 farklı teknik kullanıldı. Kazanç, doğruluk ve asimetri parametreleri hesaplandı ve iki teknik arasında karşılaştırılmıştır.

Bulgular: Horizontal semisirküler kanalları için iki farklı el yerleştirme tekniği arasında kazanç, doğruluk ve asimetri parametreleri açısından istatistiksel olarak anlamlı bir fark bulunmamıştır.

Tartışma ve Sonuçlar: El yerleştirme teknikleri uzak kamera sistemlerinde vHIT yanıtlarını önemli ölçüde etkilememektedir. El yerleştirme tekniklerinin kazanç ve hız değerleri üzerinde farklı etkiler gösterdiği gözlük tabanlı sistemlerin aksine, uzak kamera sistemlerinde kullanılan teknolojinin el yerleştirmenin etkisini azalttığı görülmektedir. Bununla birlikte, farklı vHIT sistemleri ve vestibüler patolojileri olan popülasyonlar için en uygun değerlendirme yöntemlerini araştırmak için daha fazla araştırma yapılması gerekmektedir.

Anahtar Sözcükler: Video baş itme testi, uzak kamera sistem, el yerleştirme teknikleri, vHIT

INTRODUCTION

The vestibulocular reflex (VOR) is responsible for the stabilization of the retinal image through the compensation of head movements by eye movements. Ideally, the eyes move in opposite direction and at the same speed on the axis of instantaneous head movement[1].

Corresponding Author: Erdem Emre YILMAZ MD. Bezmialem Vakıf Üniversitesi, Sağlık Bilimleri Fakültesi, Odyoloji Bölümü, İstanbul, Turkey, E-mail: eyilmaz1@bezmialem.edu.tr

Received: 24 November 2023, revised for: 17 June 2024, accepted for publication: 18 June 2024

Cite this article: Bal N., Yılmaz E. E., Başöz Behmen M., Gedik Toker Ö., Silahtar N., İleri F. N. Analysis Of Different Hand Placement Techniques In Remote Camera Video Head Impulse System. KBB-Forum 2024;23(2):060-063

The sensitivity range of the vestibular system is greater than the range which is required for daily activities. The response properties of the vestibular system are primarily effective between 0.05 and 6 Hz[2]. VOR evaluation in humans can be performed with different tests. Bithermal caloric test is the oldest and most frequently used. However, it offers lower frequency (0,003) assessment[3],. Another test, the rotational chair, allows evaluation only in the mid-frequency range (0,01Hz - 0,64Hz)[3]. These costly tests can be inconvenient for both the patients and the clinicians[5]. As the vHIT stimulates at higher frequencies, it has the potential to assess the head movements that occur in the natural range of activities of daily living[6].

Since the development of the vHIT, various vHIT systems have been commercially available, every system has its own unique gain

calculation method and method for monitoring head and eye movements[9]. There are two types of systems available. One type is lightweight goggles with high-speed cameras and velocity sensors[10]. Another type is a remote camera system that is placed 1 meter away from the patients to detect eye movements. The latter type does not contain any attachments to the patients, making remote camera systems children-friendly[11]. In both systems, the general technique for assessing the horizontal VHIT is very similar and requires the examiner to push the patient's head passively[8,12]. However, the location of hand placement varies depending on the clinician, such as on the top of the head and chin or both jaw joints 12,16. So far, no articles have been published on clinician hand position when using a remote HIT setup. Therefore, the aim of this study was to observe the differences in hand placement techniques in a healthy adult population. We did not expect to see any difference in horizontal vHIT responses when using different hand placement techniques.

MATERIAL and METHODS

This study was conducted at the Audiology and Speech Pathology Clinic of Bezmialem Vakif University Medical Practice and Research Center in accordance Declaration of Helsinki ethical principles. The study's purpose and detailed information about the procedure were explained to the participants. Written informed consent was obtained from all participants. The study protocol was approved by the Bezmialem Vakif University Ethical Committee (22/407).

14 female (mean age 44,9±14,8) and 20 male (mean age 40,42±17,27) healthy participants (Table 1) were recruited into the study. None of the participants had neurologic, or otologic conditions and a history of vertigo. Participants" air conduction hearing thresholds at 500, 1000, 2000, and 4000Hz were below 25 dB HL.

Horizontal vHIT responses were obtained using Synapsys vHIT Ulmer II (Marseilles, France) system on each participant in a single session by a single clinician. Participants were seated in a chair for evaluation, and all testing was performed in a well-lit room. Participants were seated 90cm away from the camera and instructed to stare at the dots that were 200cm from their eye levels. The clinician stood behind the participants and rotated the participant's head in a horizontal plane at 10 to 20 degrees angle abruptly, and unpredictably. Head impulses were randomly administered from the central position. A minimum of 10 responses were gathered in each direction. Hands around the chin and hands on top of the head techniques were used to obtain the results.

Gain, accuracy, and asymmetry parameters (%) were calculated by the Synapsys vHIT system during the measurements. These parameters from two different techniques were compared statistically.

Statistical analysis were conducted using the Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistical analysis of the mean and standard deviation (std.) of the data were performed. Shapiro Wilks test was used for normality. The significance of the difference between the measurement pairs was evaluated with the paired samples t-test and Wilcoxon signed-rank test. Statistical significance was set at $p < 0.05$.

RESULTS

34 participants between the ages of 22 and 67 years were included in the study. The mean age value was 43,05 years. Gain, asymmetry, and accuracy values of lateral semicircular canals were calculated and analyzed between the two different techniques.

For the hands-on-the-head technique, the left and right horizontal canal average gain values were 0,96 (std: 0,06) and 0,95 (std: 0,05) respectively. Average accuracy values were 0,04 (std: 0,03) and 0,05(std: 0,04) respectively ($p>0,05$, Table 2).

The average asymmetry ratio was % 0,02 (std: 0,02) For the hands on the chin technique, left and right horizontal canal average gain values were 0,97 (std: 0,06) and 0,96 (std: 0,06) respectively. Average accuracy values were 0,05 (std: 0,05) and 0,05(std: 0,04) respectively ($p>0,05$, Table 2).

The average asymmetry ratio was 0,02 (std: 0,02).

There was no statistically significant difference in the gain, accuracy, and asymmetry parameters between the two different techniques ($p>0,05$, Table 2).

Table 1: Demographic data of the participants

	Number	Percentage(%)	Age (Mean±Std)
Male	14	41,2	40,42±17,27
Female	20	58,8	44,9±14,8
Total	34	100,0	43,05±16,02

Table 2: vHIT results of both techniques

		Gain	p Value	Accuracy	p Value
Left	Hands on Head	0,96±0,06	0,95	0,05±0,03	0,37
	Hands Around Chin	0,97±0,07		0,06±0,05	
Right	Hands on Head	0,96±0,06	0,25	0,06±0,04	0,24
	Hands Around Chin	0,97±0,06		0,05±0,05	
Asymmetry	Hands on Head	0,02±0,02	0,913		
	Hands Around Chin	0,02±0,02			

DISCUSSION

The vHIT is a relatively new tool that allows clinicians to examine six semicircular canals separately. Clinicians can use different hand placement techniques to obtain the necessary responses with different types of vHIT equipment[12]. To date, articles have been written on the effects of hand placement techniques mostly by using googled systems therefore this study aims to find out the effects of different hand placement techniques on the remote camera vHIT system. Remote camera vHIT systems are useful especially in pediatric population since no equipment is attached to the head. while testing with goggled vHIT systems, there is a risk of slippage during the testing[13].

When head movement's and compensatory eye movement's velocity are the same, the gain value equals 1.0. There have been many studies that investigated normative values for vHIT to distinguish pathologic patients from healthy people[14,15]. In terms of lateral semicircular canals, Gedik et al.[15] have included 199 healthy participants in their study. Participants were separated into two groups depending on their ages. The group aged between 20 to 39's right lateral canal gain was 0,98 and the other group aged between 40 to 60'right lateral canal gain was 0,93. The same groups left lateral canal gains were 0,98 and 0,94 respectively. According to Treviño-González et al.[14], the right lateral canal gain was 0,99 and the left lateral canal gain was 0.97. In their study asymmetry ratio was found as 3.46%. In our adult study group, right lateral canal and left lateral canal gains were 0.96 and 0.97 respectively in both groups. Also asymmetry ratio found as 2% for both groups. In terms of gain and asymmetry, our results and literature are similar.

In our study, we did not find any statistically significant difference between the two techniques. According to Patterson et al. study, the hands-on head technique provides higher gain and lower velocity values for the health group[12]. In their study, Fu et al., chin technique provided lower gain values for healthy and unilateral vestibular neuritis groups[16]. Both mentioned studies have used goggled vHIT systems for measurements. The difference between our study and these studies might be the system that has been used.

Our study has several limitations. The first one is, that our study group only had healthy volunteers. We were not able to find out whether unilateral or bilateral pathologies might be affected by the hand placement technique. The second is number of participants. Third, only one examiner performed the vHIT since techniques might be affected by the examiner's dominant hand or muscle strength.

In this study, gain, accuracy, and asymmetry values were found in line with the literature and no difference was found between the two different techniques to obtain the vHIT responses. This is the first study to compare different techniques on remote camera systems. Our results have shown that recording and analysing systems in remote camera do not affect the results whereas it has significant effects on goggled systems according to the literature. For both systems, literature on hand placement techniques is insufficient. Further studies are necessary to establish the most appropriate evaluation method.

REFERENCES

1. Fetter M. Vestibulo-ocular reflex. Neuro-Ophthalmology. 2007;40:35-51.
2. Zalewski CK, McCaslin DL, Carlson ML. Rotary chair testing. Diagnosis Treat Vestib Disord. Published online 2019:75-98.
3. Hannigan IP, Welgampola MS, Watson SRD. Dissociation of caloric and head impulse tests: a marker of Meniere's disease. J Neurol. 2021;268(2):431-439.
4. Janky KL, Patterson J. The relationship between rotary chair and video head impulse testing in children and young adults with cochlear implants. Am J Audiol. 2020;29(4):898-906.
5. Chen L, Halmagyi GM. Video head impulse testing: from bench to bedside. In: Seminars in Neurology. Vol 40. Thieme Medical Publishers; 2020:5-17.
6. Petrak MR, Bahner C, Beck DL. Video head impulse testing (vHIT): VOR analysis of high frequency vestibular activity. Hear Rev. Published online 2013.
7. Halmagyi GM, Chen L, MacDougall HG, Weber KP, McGarvie LA, Curthoys IS. The video head impulse test. Front Neurol. 2017; 8: 258. Published online 2017.
8. Weber KP, Aw ST, Todd MJ, McGarvie LA, Curthoys IS, Halmagyi GM. Head impulse test in unilateral vestibular loss: vestibulo-ocular reflex and catch-up saccades. Neurology. 2008;70(6):454-463.
9. Van Dooren TS, Starkov D, Lucieer FMP, et al. Comparison of three video head impulse test systems for the diagnosis of bilateral vestibulopathy. J Neurol. 2020;267:256-264.
10. Hougaard DD, Abrahamsen ER. Testing of All Six Semicircular Canals with Video Head Impulse Test Systems. MyJoVE Corporation; 2016.
11. Ertugrul G. Clinical use of child-friendly video head impulse test in dizzy children. Am J Otolaryngol. 2022;43(3):103432.
12. Patterson JN, Bassett AM, Mollak CM, Honaker JA. Effects of hand placement technique on the video head impulse test (vHIT) in younger and older adults. Otol Neurotol. 2015;36(6):1061-1068.
13. Wiener-Vacher SR, Wiener SI. Video head impulse tests with a remote camera system: normative values of semicircular canal vestibulo-ocular reflex gain in infants and children. Front Neurol. 2017;8:434.
14. Treviño-González JL, Maldonado-Chapa F, González-Cantú A, Soto-Galindo GA, Morales-del Ángel JA. Age adjusted normative data for video head impulse test in healthy subjects. Am J Otolaryngol. 2021;42(6):103160.
15. Gedik Ö, Bal N, Özdemir S, et al. Comparison of vHIT findings in individuals aged between 20-39 and 40-60 years. INDIAN J Otol. 2022;27(4).
16. Fu W, He F, Zhao R, et al. Effects of hand positions during video head-impulse test (vHIT) in patients with unilateral vestibular neuritis. Front Neurol. 2018;9:531.