



# Unveiling Positioning Nystagmus in Patients of Horizontal Semicircular Canal Benign Paroxysmal Positional Vertigo by Diagnostic Head-Shaking in the Yaw Plane

Ajay Kumar Vats<sup>1</sup>

<sup>1</sup>Chaudhary Hospital and Medical Research Centre Private Limited, Udaipur, Rajasthan, India

**Address for correspondence** Ajay Kumar Vats, MBBS, MD (Medicine), DM (Neurology), Chaudhary Hospital and Medical Research Centre Private Limited, 472-473, Sector 4, Hiran Magri, Udaipur PIN CODE 313002, Rajasthan, India (e-mail: vatsneuro@gmail.com).

Ann Otol Neurotol

## Abstract

**Background** The diagnosis of benign paroxysmal positional vertigo (BPPV) is largely dependent on elicitation of positioning nystagmus on the diagnostic positional tests, namely Dix-Hallpike and supine roll tests (DHT and SRT, respectively), in patients complaining of vertigo, which occurs when patient's head moves relative to the gravity. The pattern of elicited positioning nystagmus localizes as well as lateralizes the diseased canal, and the therapeutic positioning maneuver is accordingly undertaken.

**Aim** The diagnostic positional tests, at times fail to elicit positional nystagmus, leaving clinician in a state of dilemma, when examining a patient who is currently experiencing paroxysms of vertigo triggered by positional change. In two patients with history consistent with BPPV but with negative positional tests initially, head shaking for 10 seconds in the yaw axis was done, and Dix-Hallpike and supine roll tests were repeated. The aim of head shaking for 10 seconds was to unveil positional nystagmus, to precisely localize and lateralize the diseased semicircular canal.

**Results and Discussion** In the two cases of horizontal semicircular canal BPPV (HSC-BPPV) reported here, the DHT and/or SRT initially failed to elicit positional nystagmus but head shaking for 10 seconds in the left Dix-Hallpike position in case one and with the head anteflexed 30-degrees in the sitting position in the case two, unveiled horizontal positional nystagmus on ensuing SRT. The use of head-shaking in the yaw plane to unveil a horizontal positioning nystagmus in cases where a conventional positional test (DHT and SRT) has failed to elicit the PN, has not been reported in the literature hitherto.

**Conclusion** After precise localization and lateralization of the diseased canal, both patients successfully underwent successful treatment with Gufoni maneuver. A verifying SRT done at 1 hour and/or at 24 hours follow-up was negative. In patients, who are currently experiencing paroxysms of vertigo triggered by the change of position of head relative to the gravity; head-shaking for few seconds just prior to the positioning test, can unveil positional nystagmus not elucidated with the conventionally performed positional tests.

## Keywords

- ▶ benign paroxysmal positional vertigo
- ▶ Dix-Hallpike test
- ▶ Gufoni maneuver
- ▶ positional nystagmus
- ▶ supine roll test

received  
June 23, 2019  
accepted  
July 2, 2019

DOI <https://doi.org/10.1055/s-0039-1695678>  
ISSN 2581-9607

©2019 Indian Society of Otolaryngology

License terms



## Introduction

The diagnosis, localization, and lateralization of benign paroxysmal positional vertigo (BPPV) is largely dependent on the elicitation of positioning nystagmus on the diagnostic positional tests, namely Dix-Hallpike and supine roll tests (DHT and SRT respectively), in patients complaining of vertigo that occurs when patient's head moves in relation to gravity. The typical situations in which BPPV attacks occur are lying supine on bed, assuming lateral recumbent positions, extending neck, and bending forward. However, the diagnostic positional tests at times fail to show positioning nystagmus, even if meticulously sought. Such a situation leaves the clinician in a state of dilemma when examining a patient who is currently experiencing paroxysms of vertigo triggered by positional change. The elicitation of positional nystagmus (PN) was considered mandatory by Dix and Hallpike, who were first to develop objective criteria for BPPV diagnosis.<sup>1</sup> The Bárány society has classified the cases of canalolithiasis of the posterior semicircular canal (PSC) without PN as "Possible benign paroxysmal positional vertigo" while all other variants of BPPV without elicitable PN, that are not attributable to posterior canalolithiasis are lumped under an ambiguous heading of "Probable benign paroxysmal positional vertigo, spontaneously resolved."<sup>2</sup> However, all efforts should be made to unveil a PN before arriving to such a diagnosis, as ability to elicit it is not merely reassuring to the clinician in arriving at an accurate diagnosis but also precisely guides the treatment, which involves repositioning maneuvers, in which the head along with body of the patient, diagnosed to have BPPV, are sequentially oriented in such a manner that the otoconial debris is moved from its ostensible location within the involved semicircular canal under the gravitational force toward the utricle by observing the patterns of nystagmus elicited on the diagnostic positional tests. I report here two cases of horizontal semicircular canal BPPV (HSC-BPPV), in whom initially both DHT and/or SRT did not reveal positioning nystagmus but head shaking in the yaw plane elicited horizontal PN on the positional test ensuing within a minute after head shaking. Head shaking in yaw plane to increase the diagnostic yield of positional test in the HSC-BPPV has not been reported hitherto and this is the first case reporting of two such cases who failed to show PN on the conventional diagnostic positional tests. The diagnostic head-shaking for 10 seconds led to the diagnosis of this purely clinical vestibular disorder.

### Case 1 Description

A 35-year-old male patient was seen on February 15, 2019, with 3 days history of intermittent true external vertigo lasting less than a minute on lying supine on the bed, assuming supine to sitting position as well as on assuming left lateral recumbent position. There was no history of staggering, diplopia, dysarthria, difficulty in swallowing, hiccups, drooping of upper eyelids, facial, or limb weakness. The neurological examination revealed normal cranial nerve examination, power was grade 5/5 in all four limbs with normal deep

tendon reflexes, and bilateral plantar reflexes were flexor. The examination of cerebellar system revealed no spontaneous or gaze evoked nystagmus and no appendicular or axial incoordination was observed. The oto-neurological examination revealed normal vertical and horizontal saccadic and smooth pursuit eye movements. The head impulse test was bilaterally normal. The Dix-Hallpike and supine roll tests done initially on both sides did not reveal any type of positioning nystagmus (**Supplementary videos 1 and 2**). As the patient was suspected to have left PSC involvement on the basis of history of vertigo on assuming left rather than both lateral recumbent positions as well on assuming sitting position from the supine and vice versa, the patient's head was taken to left Dix-Hallpike position and was briskly shaken side to side in yaw plane for 10 seconds but no positioning nystagmus could be elicited immediately on stopping the head shake (**Supplementary video 3**). As the suspicion of left PSC benign paroxysmal positional vertigo (PSC-BPPV) was very strong, the Dix-Hallpike test to left was repeated again third time, within 1 minute of head shaking, which unexpectedly showed an apogeotropic horizontal positioning nystagmus lasting around 12 seconds (**Supplementary video 4**). As the horizontal positioning nystagmus occurs with the involvement of the HSC, it was decided to do a repeat supine roll test. The repeat supine roll test showed a geotropic PN on the left as well as to the right side (**Supplementary video 5**). The visibly stronger geotropic PN on the left lateralized as well as localized the diseased canal to be the left HSC, with possible long posterior arm horizontal canalolithiasis. A diagnosis of left HSC-BPPV (geotropic variant) was established and patient was treated with two sequences of Gufoni maneuver at an interval of 1 hour. The Gufoni maneuver for the left geotropic HSC-BPPV was performed by making the patient sit on the edge of the couch with both lower limbs dangling down and briskly moving the patient from sitting to right (contralesional) lateral recumbent position and maintaining the latter position for 1 minute. Thereafter, patient's head was turned ~45° downward in the yaw plane and maintained for 2 minutes, after which he was taken to the upright sitting position (**Supplementary video 6**). The supine roll test performed after 1 hour of treatment with second sequence of Gufoni maneuver did not show any nystagmus on either side (**Supplementary video 7**). The patient was telephonically contacted after 24 hours and he reported himself to be vertigo free.

### Case 2 Description

A 48-year-old male patient was seen on May 28, 2019 with 1 day-history of intermittent true external vertigo lasting less than a minute, triggered by lying on bed, assuming supine to sitting as well as either of the lateral recumbent positions. There was no history of staggering, diplopia, dysarthria, difficulty in swallowing, hiccups, drooping of upper eyelids, facial or limb weakness. The neurological examination revealed normal cranial nerve examination, power was grade 5/5 in all four limbs with normal deep tendon reflexes, and bilateral plantar reflexes were flexor. The examination of cerebellar system revealed no spontaneous or gaze evoked

nystagmus and no appendicular or axial incoordination was observed. The oto-neurological examination revealed normal vertical and horizontal saccadic and smooth pursuit eye movements. The head impulse test was bilaterally normal. The supine roll tests done initially on both sides did not reveal any type of PN (**Supplementary video 8**). The patient was made to sit again with both lower limbs placed along the long axis of the examination couch. His head was anteflexed 30 degrees in the pitch plane and was briskly shaken in excursions of 30 degrees side-to-side in the yaw plane for around 10 seconds. Immediately, thereafter he was taken to supine neutral position on a 4-inch-thick pillow so that as his head landed on the pillow it got 30 degrees anteflexed. The head was briskly rotated to the left and maintained for 10 seconds and as no PN was seen, it was then brought back to the neutral position. Then it was briskly rotated to his right and maintained for 15 seconds and as no PN was seen, it was then brought back to the neutral position. Maintaining the patient in supine position, the SRT was again repeated first to the left and then to the right and at this time a geotropic PN was elicited on both sides, which was visibly stronger on the right compared with the left, localizing the diseased canal as the right H-SCC (**Supplementary video 9**). The patient was treated with Gufoni maneuvers twice at an interval of 1 hour, for the geotropic variant of the right HSC-BPPV. The Gufoni maneuver for the right geotropic HSC-BPPV was performed by making the patient sit on the edge of the couch with both lower limbs dangling down and briskly moving the patient from sitting to left (contralesional) lateral recumbent position and maintaining the latter position for 1 minute. Thereafter, patient's head was rotated ~45 degrees downward in the yaw plane and maintained for 2 minutes, after which he was taken to the upright sitting position (**Supplementary video 10**). A supine roll test done at 1 and at 24 hours (**Supplementary videos 11 and 12**) after the second sequence of Gufoni maneuver did not show any PN indicating cure.

## Discussion

A small amount of statoconia is believed to be present in the semicircular canals (SCC) of asymptomatic individuals, which are absorbed within few hours or days, without triggering any symptoms. A paroxysm of positional vertigo is triggered during head movement only when more otoconial debris from the utricular macula enters the SCC and increases the otoconial mass beyond a critical threshold to activate the nerve endings to precipitate an attack of BPPV. There are studies that have discussed the clinical entity "BPPV without nystagmus"—a condition in which attacks of vertigo occur with changes in the position of head in absence of an elicitable PN.<sup>3-8</sup> Presumably on the basis of these studies reporting improvement in positional vertigo after a therapeutic positional maneuver in patients with a typical history of BPPV, the consensus document of the committee for the classification of vestibular disorders of the Bárány society has classified the cases of canalolithiasis of the posterior SCC without PN under the heading "Possible benign paroxysmal positional vertigo." It is believed that in such

cases mass of the otoconial debris in the posterior SCC has not reached the critical threshold to stimulate the vestibulo-ocular reflex but is sufficient to evoke the vertigo with changes in the position of head relative to the gravity.<sup>9</sup> In the Bárány society classification proposed in 2015, all other variants of BPPV without an elicitable PN, which are not attributable to posterior canalolithiasis, are lumped under an ambiguous heading "Probable benign paroxysmal positional vertigo, spontaneously resolved." However, the situations where a clinician examines a patient currently experiencing the typical symptoms of BPPV and fails to elicit a positioning nystagmus on positional tests (DHT and SRT) are extremely annoying. It is therefore imperative to try by all possible methods, to elicit a PN to precisely localize, as well as lateralize the diseased SCC before allowing an adjective like possible or probable being prefixed to the diagnosis of a disease whose diagnosis is entirely clinical. In a study of 81 patients diagnosed with unilateral PSC-BPPV, 12 patients who did not elicit PN initially on a conventional DHT were subjected to head shaking DHT (HSDHT), consisting of head shaking for five times with 30 degrees of excursion in the yaw plane with head maintained in the Dix-Hallpike position. All 12 patients who were subjected to HSDHT elicited upbeat torsional PN, increasing the diagnostic yield by 14.8%.<sup>10</sup> The use of head-shaking in the yaw plane to unveil a horizontal positioning nystagmus in cases where a conventional positional test (DHT and SRT) has failed to elicit the PN has not been reported in the literature hitherto. The case number one described here, who historically appeared to have a left PSC-BPPV (history of vertigo on left and not on right lateral recumbent position and on assuming supine to sitting positions and vice versa), had initially failed to show PN on DHT and SRT. Thereafter, he was subjected to head-shaking in yaw plane in the left Dix-Hallpike position and the ensuing DHT and SRT triggered an apogeotropic and geotropic PN, respectively, finally leading to the diagnosis of left geotropic variant of HSC-BPPV. He was successfully treated with two sequences of Gufoni maneuvers at an interval of 1 hour, with follow-up at 1 hour and telephonically 24 hours after second sequence of Gufoni maneuver. The case number two described here, who historically appeared to have HSC-BPPV (vertigo episodes triggered by taking sitting to supine positions and vice versa as well as on taking either of the lateral recumbent positions), initially failed to show PN on SRT. In sitting position, he was subjected to head-shaking in yaw plane with head 30 degrees anteflexed in the pitch plane and the ensuing SRT after few attempts triggered bilateral geotropic horizontal PN (stronger on the right side), finally leading to the diagnosis of right geotropic variant of HSC-BPPV. He was successfully treated using Gufoni maneuvers, with follow-ups at 1 and 24 hours.

## Conclusions

The diagnosis of BPPV is entirely dependent on the demonstration of PN on the diagnostic positional tests, namely DHT and SRT. It is extremely annoying for a clinician examining a patient currently experiencing paroxysms

of vertigo triggered by the change in position of head but in whom meticulously performed positional tests do not elicit PN. In such a situation, it is imperative to re-examine the patient after some time. Head shaking during DHT has shown to increase the diagnostic yield of the PSC-BPPV in one observational study of 81 patients but there are no such previous reports or studies about HSC-BPPV. The cases presented here with supporting videos indicate that head shaking may unveil a PN not seen on conventional positional tests in cases of HSC-BPPV but more studies are required to prove this.

#### Disclaimers

The views expressed in the submitted article are author's own and not an official position of the institution to which author is affiliated.

#### Funding

None.

#### Conflict of Interest Statement

The author whose name is listed above certifies that he has no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

#### Acknowledgments

Thank you to Renith Kurian, videographer, for volunteering his time to make video recording of the diagnostic and

therapeutic maneuvers and precisely capturing the nystagmus during the entire diagnostic and treatment period.

#### References

- 1 Dix MR, Hallpike CS. The pathology, symptomatology and diagnosis of certain common disorders of the vestibular system. *Ann Otol Rhinol Laryngol* 1952;61(4):987–1016
- 2 von Brevern M, Bertholon P, Brandt T, et al. Benign paroxysmal positional vertigo: diagnostic criteria. *J Vestib Res* 2015;25(3–4):105–117
- 3 Tirelli G, D'Orlando E, Giacomarra V, Russolo M. Benign positional vertigo without detectable nystagmus. *Laryngoscope* 2001;111(6):1053–1056
- 4 Haynes DS, Resser JR, Labadie RF, et al. Treatment of benign positional vertigo using the semont maneuver: efficacy in patients presenting without nystagmus. *Laryngoscope* 2002;112(5):796–801
- 5 Anagnostou E, Mandellos D, Patelarou A, Anastasopoulos D. [Benign paroxysmal positional vertigo with and without manifest positional nystagmus: an 18-month follow-up study of 70 patients] *HNO* 2007;55(3):190–194
- 6 Zhang JH, Huang J, Zhao ZX, et al. [Clinical features and therapy of subjective benign paroxysmal positional vertigo]. *Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi* 2007;42(3):177–180
- 7 Johkura K, Momoo T, Kuroiwa Y. Positional nystagmus in patients with chronic dizziness. *J Neurol Neurosurg Psychiatry* 2008;79(12):1324–1326
- 8 Caldas MA, Ganança CF, Ganança FF, Ganança MM, Caovilla HH. Clinical features of benign paroxysmal positional vertigo. *Rev Bras Otorrinolaringol (Engl Ed)* 2009;75(4):502–506
- 9 House MG, Honrubia V. Theoretical models for the mechanisms of benign paroxysmal positional vertigo. *Audiol Neurotol* 2003;8(2):91–99
- 10 Kaplan DM, Slovik Y, Joshua BZ, Puterman M, Kraus M. Head shaking during Dix-Hallpike exam increases the diagnostic yield of posterior semicircular canal BPPV. *Otol Neurotol* 2013;34(8):1444–1447

**Supplementary Video 1**

Initial Dix-Hallpike test bilateral negative. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The Dix-Hallpike test was performed by making the patient sit on the examination couch with both lower limbs placed along the long axis of the couch. A pillow 4-inch-thick pillow was placed behind his buttocks to be used as vantage point instead of using the end edge of the couch, during the test. His head was rotated 45 degrees first to his left in the yaw plane and he was taken to supine position so that his head got extended 30 degrees as he was laid. As no nystagmus was elicited, after some time, he was again made to sit and his head rotated 45 degrees to his right in the yaw plane. Subsequently, he was taken to supine position again so that his head got extended 30 degrees as he was laid. The Dix-Hallpike test failed to elicit positional nystagmus either to the right or left and was interpreted as negative.

**Supplementary Video 2**

Initial supine roll test bilateral negative. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The patient was made to sit on the examination couch with his lower limbs placed along the long axis of the examination couch. He was made to lay supine with his head landing on a 4-inch-thick pillow so that it got anteflexed 30 degrees in this position. After sometime, his head was briskly rotated first to his left, which did not elicit any positional nystagmus. Thereafter, patient's head was brought to neutral supine position and then briskly rotated to his right, which again did not reveal any positional nystagmus. The supine roll test was interpreted as bilaterally negative.

**Supplementary Video 3**

Head shaking in left Dix-Hallpike position. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The head-shaking Dix-Hallpike test was performed by making the patient sit on the couch with his lower limbs placed along the long axis of the couch in such a way that his right side was toward the free long edge of the couch and the distance of his buttocks from the head end of couch would allow his head to hang when he would be made to lay supine. His head was held with both hands and rotated 45 degrees to his left in yaw plane and then he was made to lay supine in such a manner that his 45 degrees left rotated head was extended 30 degrees as he was taken to supine position that corresponded to left Dix-Hallpike position. In the left Dix-Hallpike

position, his head was briskly shaken side-to-side for 10 seconds and thereafter left Dix-Hallpike position was maintained for few seconds to look for positional nystagmus. As no positional nystagmus could be elicited, he was taken back to upright sitting position.

**Supplementary Video 4**

Repeat Dix-Hallpike maneuver immediately after head shaking for 10 seconds in the left Dix-Hallpike position elicited apogeotropic nystagmus. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The Dix-Hallpike test was performed immediately after a previous head-shaking Dix-Hallpike test. The patient was made to sit on the couch with his lower limbs placed along the long axis of the couch in such a way that his right side was toward the free long edge of the couch and the distance of his buttocks from the head end of couch would allow his head to hang when he would be made to lay supine. His head was held with both hands and rotated 45 degrees to his left in yaw plane and then he was made to lay supine in such a manner that his 45 degrees left rotated head was extended 30 degrees as he was taken to supine position. An apogeotropic horizontal positional nystagmus was elicited in the left Dix-Hallpike position with minimal latency.

**Supplementary Video 5**

Supine roll test bilateral geotropic but left stronger. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The patient was made to sit on the examination couch with his lower limbs placed along the long axis of the examination couch. He was made to lay supine with his head landing on a 4-inch-thick pillow so that it got anteflexed 30 degrees in this position. After waiting for few seconds, his head was briskly rotated first to his left, which did not elicit any positional nystagmus. Thereafter, patient's head was brought to neutral supine position and then briskly rotated to his right, which elicited a geotropic horizontal positional nystagmus. Then patient's head was again brought to the neutral supine position and after waiting for few seconds it was again briskly rotated to his left and at this time it elicited a stronger geotropic horizontal positional nystagmus. The supine roll test was interpreted as localizing disease to the left horizontal semicircular canal.

**Supplementary Video 6**

Gufoni maneuver with captured geotropic nystagmus. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The Gufoni maneuver for the left geotropic horizontal semi-circular canal benign paroxysmal positional vertigo was performed by making the patient sit on the edge of the couch with both lower limbs dangling down and briskly moving the patient from sitting to right (contralesional) lateral recumbent position and maintaining the latter position for 1 minute. Thereafter, patient's head was turned ~45 degrees downward in the yaw plane and maintained for 2 minutes, after which he was taken to the upright sitting position.

#### Supplementary Video 7

One-hour post Gufoni maneuver supine roll test bilateral negative. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The supine roll test was performed by making the patient sit on the couch with his lower limbs placed along the long axis of the couch in such a way that his right side was toward the free long edge of the couch. The distance of his buttocks from the head end of couch was adjusted so that on taking him to supine position, the occiput of his head would land on a 4-inch-thick pillow. From the sitting, he was taken to supine neutral position so that his head got flexed 30 degrees and maintained in this position for few seconds. After this, his head was rotated briskly in the yaw plane first to his left and kept in this position for few seconds. Thereafter, the head was brought to supine neutral position and then rotated in yaw plane briskly to his right and maintained for few seconds. There was no elicitable positional nystagmus on either of the sides.

#### Supplementary Video 8

Initial supine roll test negative bilaterally. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The patient was made to sit on the examination couch with his lower limbs placed along the long axis of the examination couch. He was made to lay supine with his head landing on a 4-inch-thick pillow so that it got anteflexed 30 degrees in this position. After sometime, his head was briskly rotated first to his left, which did not elicit any positional nystagmus. Thereafter, patient's head was brought to neutral supine position and then briskly rotated to his right, which again did not reveal any positional nystagmus. The supine roll test was interpreted as bilaterally negative.

#### Supplementary Video 9

Head shaking just prior to supine roll test. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The patient was made to sit with both lower limbs placed along the long axis of the examination couch. His head was anteflexed 30 degrees in the pitch plane and was briskly shaken in excursions of 30 degrees side-to-side in the yaw plane for around 10 seconds. Immediately, thereafter he was taken to supine neutral position so that as his head landed on a 4-inch-thick pillow it got 30 degrees anteflexed. The head was briskly rotated to the left and maintained for 10 seconds and as no positional nystagmus was seen, it was then brought back to the neutral position. Then it was briskly rotated to his right and maintained for 15 seconds and as no positional nystagmus was seen, it was then brought back to the neutral position. Maintaining the patient in supine position, the supine roll test was again repeated first to the left and then to the right and at this time a geotropic positional nystagmus was elicited on both sides, which was visibly stronger on the right compared with the left, localizing the diseased canal as the right horizontal semicircular canal.

#### Supplementary Video 10

Gufoni maneuver for right geotropic horizontal semi-circular canal benign paroxysmal positional vertigo. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The Gufoni maneuver for the right geotropic horizontal semi-circular canal benign paroxysmal positional vertigo was performed by making the patient sit on the edge of the couch with both lower limbs dangling down and briskly moving the patient from sitting to left (contralesional) lateral recumbent position and maintaining the latter position for 1 minute. Thereafter, patient's head was turned ~45 degrees downwards in the yaw plane and maintained for 2 minutes, after which he was taken to the upright sitting position.

#### Supplementary Video 11

One-hour post Gufoni maneuver supine roll test bilateral negative. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The supine roll test was performed by making the patient sit on the couch with his lower limbs placed along the long axis of the couch in such a way that his right side was toward the free long edge of the couch. The distance of his buttocks from the head end of couch was adjusted so that on taking him to supine position, the occiput of his head would land on a 4-inch-thick pillow. From the sitting, he was taken to supine neutral position so that his head got flexed 30 degrees and maintained in this position for few seconds. Thereafter, his head was rotated briskly in the yaw plane first to his right and kept in this position for few seconds. Thereafter, the head was brought to supine neutral position and then rotated in yaw plane briskly to his left and maintained for few seconds. There was no elicitable positional nystagmus on either of the sides.

**Supplementary Video 12**

Twenty-four hours post Gufoni maneuver supine roll test bilateral negative. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0039-1695678>.

The supine roll test was performed by making the patient sit on the couch with his lower limbs placed along the long axis of the couch in such a way that his right side was toward the free long edge of the couch. The distance of his buttocks from

the head end of couch was adjusted so that on taking him to supine position, the occiput of his head would land on a 4-inch-thick pillow. From the sitting, he was taken to supine neutral position so that his head got flexed 30 degrees and maintained in this position for few seconds. After this, his head was rotated briskly in the yaw plane first to his right and kept in this position for few seconds. Thereafter, the head was brought to supine neutral position and then rotated in yaw plane briskly to his left and maintained for few seconds. There was no elicitable positional nystagmus on either of the sides.