

Direct Resolution of Horizontal Semicircular Cupulolithiasis by Zuma Plus Maneuver Vis-à-Vis Transformation to Canalolithiasis by Zuma Maneuver

Dear Editor,

Apogeotropic horizontal semicircular canal (HSC) benign paroxysmal positional vertigo (*apo*-HSC-BPPV) mostly results from cupulolithiasis (either on the utricular [Cup-U] or on the canal side [Cup-C]) of HSC, presenting as positionally triggered short dizzy spells, and elicits apogeotropic horizontal positional nystagmus while rolling the head laterally to either side during the diagnostic supine roll test (SRT).^[1] Horizontal apogeotropic positional nystagmus elicited during SRT in patients with short anterior arm horizontal semicircular canalolithiasis (HSC-BPPV-*ca*) lasts less than 60 seconds, whereas in horizontal semicircular cupulolithiasis (HSC-BPPV-*cu*) it lasts >60 seconds.^[2] In pursuance to Ewald's second law, the side eliciting weaker nystagmus during lateral head roll lateralizes the affected canal.^[3] During diagnostic positional testing, the otoconial clot often moves from short anterior to long posterior arm of the horizontal canal, transforming apogeotropic to a geotropic variant.^[4] In the absence of adequate recommendations from the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF),^[5] a practical method to address HSC-BPPV-*cu* is to transform it into canalolithiasis. This enables the use of well-established treatment options, although direct resolution would be even better. The inertial forces generated by rapid movements can cause the otoconial clot to detach, converting Cup-C cupulolithiasis to canalolithiasis.^[6-8]

In this study, we discuss three cases of right HSC-BPPV-*cu*, of which two transformed to right long posterior HSC-BPPV-*ca* by Zuma maneuver (ZM)^[9] and thereupon were successfully treated with Gufoni maneuver (GM).^[10] In patient 3, we improvised ZM by adding an extra 2-minute positioning before uprighting the patient.

All three patients (patient 1: 34-year-old male, patient 2: 49-year-old female, and patient 3: 59-year-old female) presented with 1–6 days history of positionally triggered dizzy spells in August–September 2023 and patients 1 and 2 had vomiting as well.

Neurological and general physical examination was normal. Otoneurologic examination showed normal gaze holding, smooth pursuits, and saccades in horizontal and vertical gaze. The positional tests were as follows:

In patients 1 and 2, lean nystagmus was directed to patients' right and bow nystagmus to their left. In patient 3, horizontal nystagmus was directed to the patient's left in lean as well as in bow positions.^[11]

In all three patients elicits lying down nystagmus (LDN) to the right and apogeotropic horizontal positional nystagmus on lateral head roll to the left as well as to the right, this was weaker on the right compared to the left, lateralizing the involvement to right HSC.^[8]

We carried out therapeutic ZM in patients 1 and 2.^[9] Moving the patient quickly from sitting to lying down (Zuma positions 1 to 2) generates inertial force, causing the otoconial clot to detach from the canal side of horizontal cupula and fall to the short arm [Figure 1A and B]. An inhibitory ampullofugal deflection of right horizontal cupula results in left beating nystagmus during position 3 [Figure 1C] of ZM (direction reversed compared to that of LDN observed during the initial diagnostic SRT). Geotropic horizontal nystagmus observed in position 4 [Figure 1D] connotes that the otoconial clot moved further in the long posterior arm of right HSC, transforming it to the geotropic variant. It can be explained by the ongoing inhibitory ampullofugal deflection of right horizontal cupula. Since inhibitory neural circuitry of right HSC projects to the

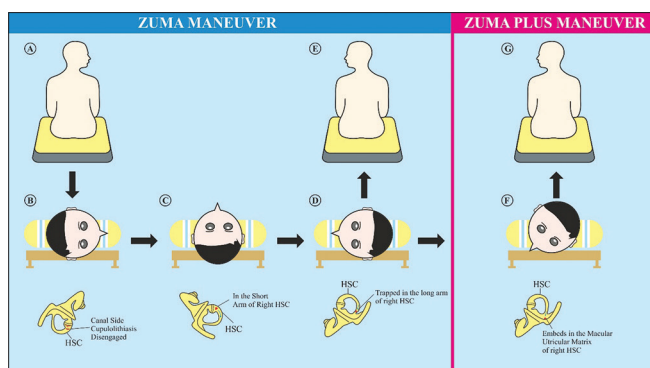


Figure 1: With the patient in long-sitting position on the examination table and the head yawed maximally to the right, the patient is quickly positioned supine for 3 minutes (A and B). Thereupon, the head is quickly yawed to the left, sequentially 90° twice (C and D), maintaining 3 minutes each in the supine neutral and left lateral recumbent positions. Thereafter, the patient's neck is flexed maximally in the *chin-to-cheek* position and is uprighted to short sitting, completing ZM. (E). For *Zuma plus* maneuver, instead of uprighting the patient from position 4 (D), we inclined her head 45° to the left and maintained the nose-down position for 2 minutes (F), after which the patient was uprighted to short sitting (G)

right lateral rectus and the left medial rectus,^[12] a slow-phase apogeotropic vestibulo-ocular reflex (VOR) is generated in Zuma position 4; elicited positional nystagmus (which is a fast-phase VOR or reflexive saccade) is geotropic (signifying transformation to the geotropic variant). After completion of 9 minutes through positions 1–4 of ZM [Figure 1A–D], with the patient's head anteflexed maximally in *chin-to-chest* position, we uprighted the patients (1 and 2) to short-sitting position [Figure 1E]. Both cases successfully transformed from right horizontal cupulolithiasis to right long posterior arm horizontal semicircular canalolithiasis after retesting immediately after ZM. Thereafter, we treated both the patients (1 and 2) with GM.^[5] In patient 3, instead of sitting the patient upright [Figure 1E] from Zuma position 4 [Figure 1D], we yawed her head 45° further to her left, maintaining the nose-down position for 2 minutes [Figure 1F]. Next, we moved the patient to a short-sitting position [Figure 1G], completing the improvised Zuma plus maneuver.

An hour post-GM, the retest SRT was unremarkable in patient 1. In patient 2, we observed a horizontal LDN to the left. The lateral head roll to either side elicited neither any nystagmus nor attendant vertigo. We instructed patient 2 to lie in the left lateral recumbent position for 1 hour initially in the night. At 24 hours, both patients 1 and 2 were asymptomatic with negative positional retests. In patient 3, retest SRT after Zuma plus maneuver was unremarkable and the patient was asymptomatic at 1 hour and after 24 hours.

Rapidly moving the head during ZM causes debris to detach from either side of the horizontal cupula because of inertial forces [Figure 1A and B]. Three minutes in Zuma position 2 facilitates the detached otoconial clot to gravitate through the short anterior arm [Figure 1C] toward the long posterior arm [Figure 1D] (in Zuma positions 3 and 4) of the right horizontal canal, transforming it to a geotropic variant. In

Cup-U HSC-BPPV-*cu*, 3 minutes in Zuma position 4 allows the otoconial debris (detached from the utricular side during position 1–2 transition) to gravitate and embed into the utricular macula. We hypothesize that direct resolution of the vertigo and concurrent positional nystagmus by ZM occur in patients with Cup-U HSC-BPPV-*cu*. All three reported cases had Cup-C HSC-BPPV-*cu*, of which patients 1 and 2 transformed to long posterior HSC-BPPV-*ca*, requiring an additional GM in either and short, forced prolonged left lateral recumbent positioning for 1 hour in case 2. In patients 1 and 2, the angled section of the posterior arm of the right HSC [Figure 1D] possibly blocked the otoconial clot from exiting the utricle. In patient 3, yawing the head 45° after Zuma position 4, the terminal portion of the non-ampullary long posterior arm of the right HSC possibly attained a near-vertical position, allowing a hassle-free gravitation of otoconial clot into the utricular macula.

Video Links

Patient 1	https://youtu.be/NzDU1_f3ZJk?si=MvOJOJ6Yfu5pTAWr
Patient 2	https://youtu.be/Ydrt4Cgsole?si=0o6Pl0S9ZZQ2EC9h
Patient 3	https://youtu.be/DK0Llu7yFbM?si=xU5Xtw8XYMsqzU18

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Conflicts of interest

There are no conflicts of interest.

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REFERENCES

- Vats AK. A case of apogeotropic horizontal canal benign paroxysmal positional vertigo that transformed to the geotropic variant during treatment with Appiani maneuver, followed by successful treatment with Gufoni maneuver. *Physiother Theory Pract* 2022;38:952-60.
- Alvarez de Linera-Alperi M, Garaycochea O, Calavia D, Terrasa D, Pérez-Fernández N, Manrique-Huarte R. Apogeotropic horizontal canal benign paroxysmal positional vertigo: Zuma e Maia Maneuver versus Appiani variant of Gufoni. *Audiol Res* 2022;12:337-46.
- Ewald JR. *Physiologische Untersuchungen Ueber das Endorgan de Nervus Octavus* [Physiological Examination of the Eighth Cranial Nerve]. Wiesbaden, Germany: Bergmann JF Publishers; 1892.
- Ciniglio Appiani G, Catania G, Gagliardi M. A liberatory maneuver for the treatment of horizontal canal paroxysmal positional vertigo. *Otol Neurotol* 2001;22:66-9.
- Bhattacharyya N, Gubbels SP, Schwartz SR, Edlow JA, El-Kashlan H,

- Fife T, *et al.* Clinical practice guideline: Benign paroxysmal positional vertigo (Update). *Otolaryngol Head Neck Surg* 2017;156:S1-47.
6. Nuti D, Agus G, Barbieri MT, Passali D. The management of horizontal-canal paroxysmal positional vertigo. *Acta Otolaryngol* 1998;118:455-60.
 7. Kim JS, Oh SY, Lee SH, Kim DU, Jeong SH, Choi KD, *et al.* Randomized clinical trial for apogeotropic horizontal canal benign paroxysmal positional vertigo. *Neurology* 2012;78:159-66.
 8. Zuma E Maia F, Ramos BF, Cal R, Brock CM, Mangabeira Albernaz PL, Strupp M. Management of lateral semicircular canal benign paroxysmal positional vertigo. *Front Neurol* 2020;11:1040.
 9. Zuma e Maia F. New treatment strategy for apogeotropic horizontal canal benign paroxysmal positional vertigo. *Audiol Res* 2016;6:163.
 10. Mandalà M, Pepponi E, Santoro GP, Cambi J, Casani A, Faralli M, *et al.* Double-blind randomized trial on the efficacy of the Gufoni maneuver for treatment of lateral canal BPPV. *Laryngoscope* 2013;123:1782-6.
 11. Choung YH, Shin YR, Kahng H, Park K, Choi SJ. 'Bow and lean test' to determine the affected ear of horizontal canal benign paroxysmal positional vertigo. *Laryngoscope* 2006;116:1776-81.
 12. Bronstein AM, Patel M, Arshad Q. A brief review of the clinical anatomy of the vestibular-ocular connections-how much do we know. *Eye (Lond)* 2015;29:163-70.

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