



An Exercise Therapy for the Cupulolithiasis of BPPV

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ABSTRACT

This study was performed to determine if a new treatment was effective for cases with benign paroxysmal positional vertigo (BPPV) suggesting cupulolithiasis of the horizontal semicircular canal as characterized by apogeotropic direction-changing nystagmus. We describe herein our head tilt-hopping (HtH) exercise designed to release and move otoconia adhesive to the cupula. Subjects were trained to hop with their heads tilted laterally. They completed 3-5 training sessions a day over a 4-week period. Each session ended with a 20-hop trial. HtH exercises were performed in 14 cases with intractable horizontal canal BPPV exhibiting persistent nystagmus beating toward the uppermost ear. The spine roll test was tested on all subjects before and immediately after the first trial, as well as after 1 and 4 weeks of the training to evaluate the effect of this treatment on the apogeotropic nystagmus.

The nystagmus disappeared or decreased immediately after the first trial with the exercise in 3 or 2 of 14 cases, respectively. The number of subjects showing improvement as assessed by the disappearance or a decrease of the nystagmus were in 9 (64.3%) and 11 (78.6%) of all cases tested at 1 and 4 weeks' time, respectively. However the remaining 3 subjects were not affected by this treatment program after 4 week of the training.

These results suggest that HtH exercises based on the concepts of release of otoconia from the cupula would appear to be feasible as a new therapy for cupulolithiasis associated with intractable horizontal canal BPPV



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INTRODUCTION

Benign Paroxysmal positional vertigo (BPPV) which is defined as a disorder of the inner ear characterized by repeated episodes of positional vertigo is thought to relate endolymph debris (maybe fragmented otoconia detached from utricle) in semicircular canals. BPPV is classified as several variants according to the dependent semicircular canals; posterior, lateral (horizontal) or anterior canal although it occurs more frequently in posterior canal. Since debris in the lateral canal provokes direction-changing horizontal nystagmus toward upper- or under-most ear with lateral movements of the head in the spine position, apogeotropic nystagmus encountered in fewer cases is thought to occur when debris is attached to the cupula of the lateral canal. This pathological condition is suggested to be cupulolithiasis of the lateral canal BPPV, unlike canalithiasis. There are few reports on the treatment in the cupulolithiasis of the lateral canal. Although currently clinical practice guidelines for BPPV were published by the AAO-HNS/F in 2008 and JSER (in Japanese) in 2009, these guidelines don't refer to a treatment in the cupulolithiasis of the lateral canal.

Therefore we propose herein a new treatment method named head-tilt hopping (HtH) exercise designed to detach and release the debris adherent to the cupula (Fig.1).

This study was performed to determine if HtH exercise is effective for cases with the lateral canal BPPV cupulolithiasis characterized by apogeotropic direction-changing nystagmus.

METHODS AND MATERIALS

The subjects were 14 patients (4 males and 10 females; age range, 38-73 years; mean age, 60.3 years) who had episodes of positional vertigo longer than 2 weeks. All of the 14 patients showed the apogeotropic nystagmus provoked by the lateral movements of the head in the spine position suggesting cupulolithiasis of the lateral canal BPPV. The nystagmus has characteristics of minimal latency, persistency (not paroxysmal) and no fatigability. The spine roll test was performed to see the nystagmus of which number was measured for 10 seconds after 30 seconds of the onset in the lateral head position showing more intense nystagmus using an infrared CCD device. A neurological examination such as MRI did not reveal CNS pathology in all subjects.

Diagnostic criteria for the lateral canal BPPV cupulolithiasis in this study were as follows:

Spine roll test shows

(1) horizontal nystagmus beating toward the uppermost ear (apogeotropic nystagmus)

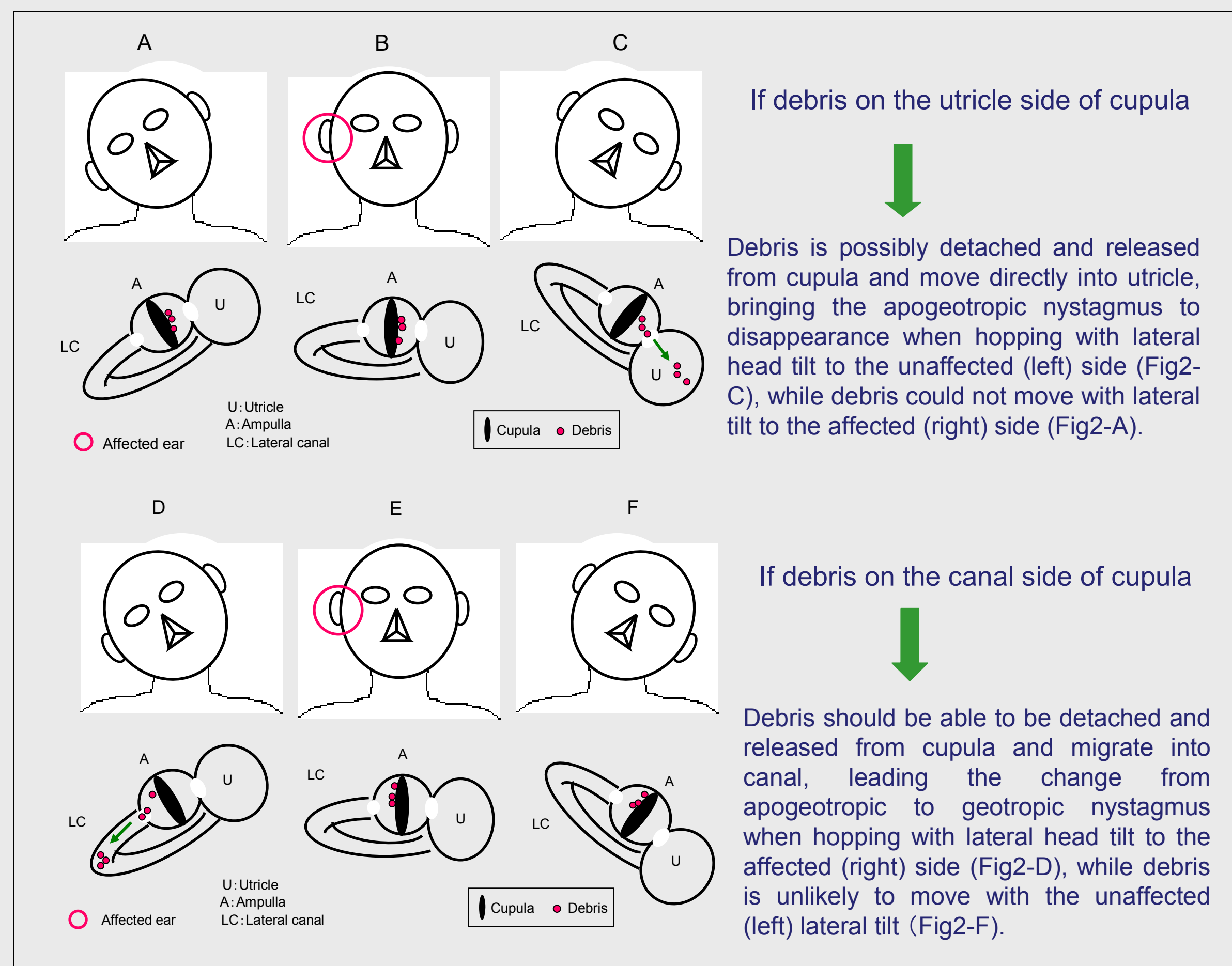
(2) nystagmus in duration more than 60 seconds.

(3) null positions where the nystagmus subsides (usually round about 20 degrees from the straight face up spine position to either side)

We describe herein our head tilt-hopping (HtH) exercise as a new treatment designed to release and move debris adhesive to the cupula (Fig.1). Subjects were trained to hop with their heads tilted laterally, as if draining out water from the external auditory canal after swimming (Fig.2). Each session of HtH exercise ended with a 20-hop trial. They completed one training session in the clinic at the beginning and consecutive 3-5 training sessions a day over a 4-week period at home. They terminated the training session when disappearance in nystagmus was confirmed in each patient.

HtH exercises were performed in 14 cases with the lateral canal BPPV cupulolithiasis confirmed by the criteria as described earlier. The spine roll test was tested on all the subjects before and immediately after the first trial, as well as after 1 and 4 weeks of the training to assess the effect of this treatment by measuring the apogeotropic nystagmus. A successful improvement of the treatment was assessed by a decrease more than 50% in frequency or a disappearance of the nystagmus.

<Conceptual diagram for Head-tilt Hopping exercise> (Fig.1)

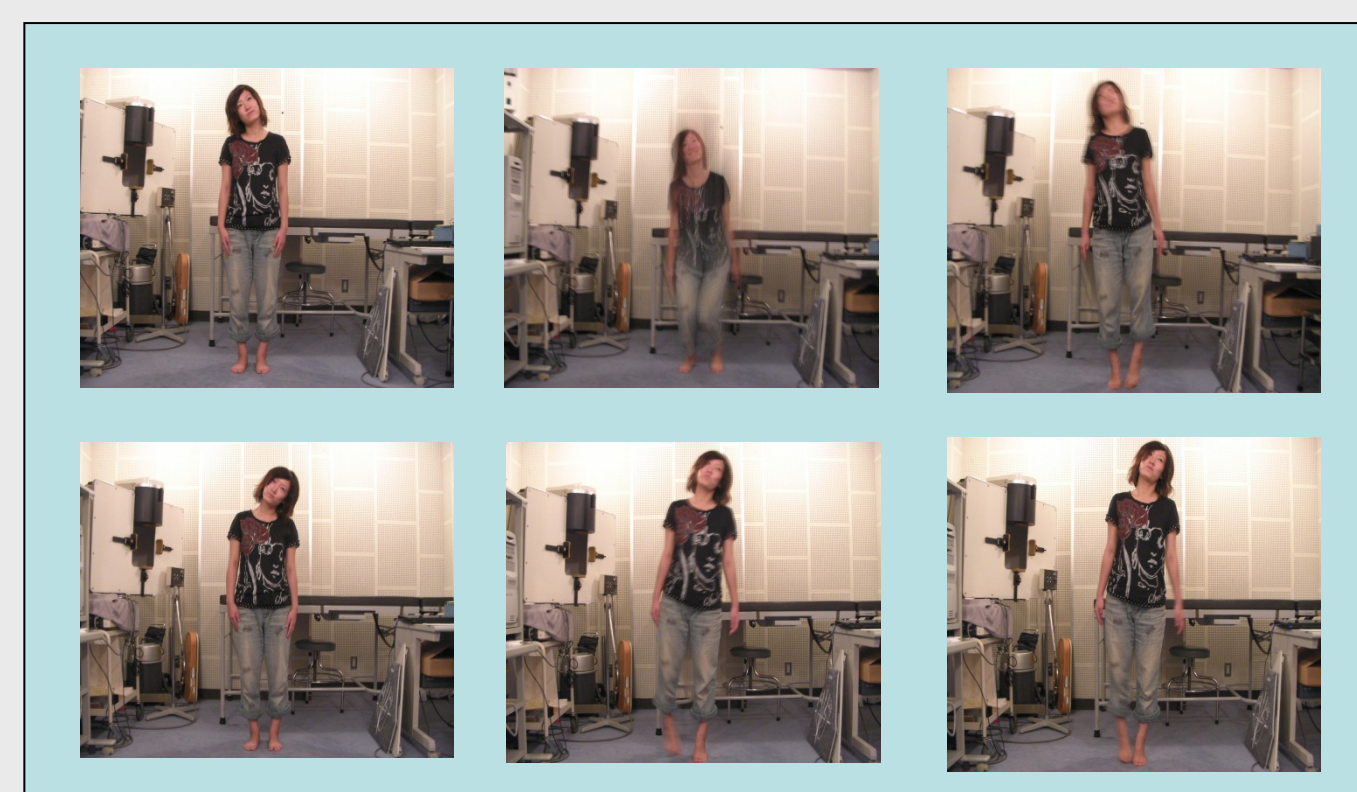


<Clinical features of subjects with lateral canal BPPV cupulolithiasis>

(Table 1)

case	age	gender	affected ear	disease duration (week)	frequency in nystagmus (/10 sec)
# 1	73	M	(R)	4	19
# 2	72	M	(R)	6	9
# 3	68	F	(L)	8	23
# 4	67	F	(R)	3	15
# 5	53	F	(L)	4	22
# 6	72	F	(L)	7	11
# 7	56	F	(R)	3	20
# 8	63	F	(L)	10	7
# 9	66	F	(L)	4	12
# 10	45	F	(R)	2	11
# 11	38	M	(L)	6	18
# 12	64	M	(R)	8	13
# 13	54	F	(R)	5	12
# 14	60	F	(L)	4	15
Average	60.3	M/F:4/10	R/L:7/7	5.3 (2-10)	14.8 (7-23)

<Training methods for Head-tilt Hopping Exercise> (Fig.2)



RESULTS

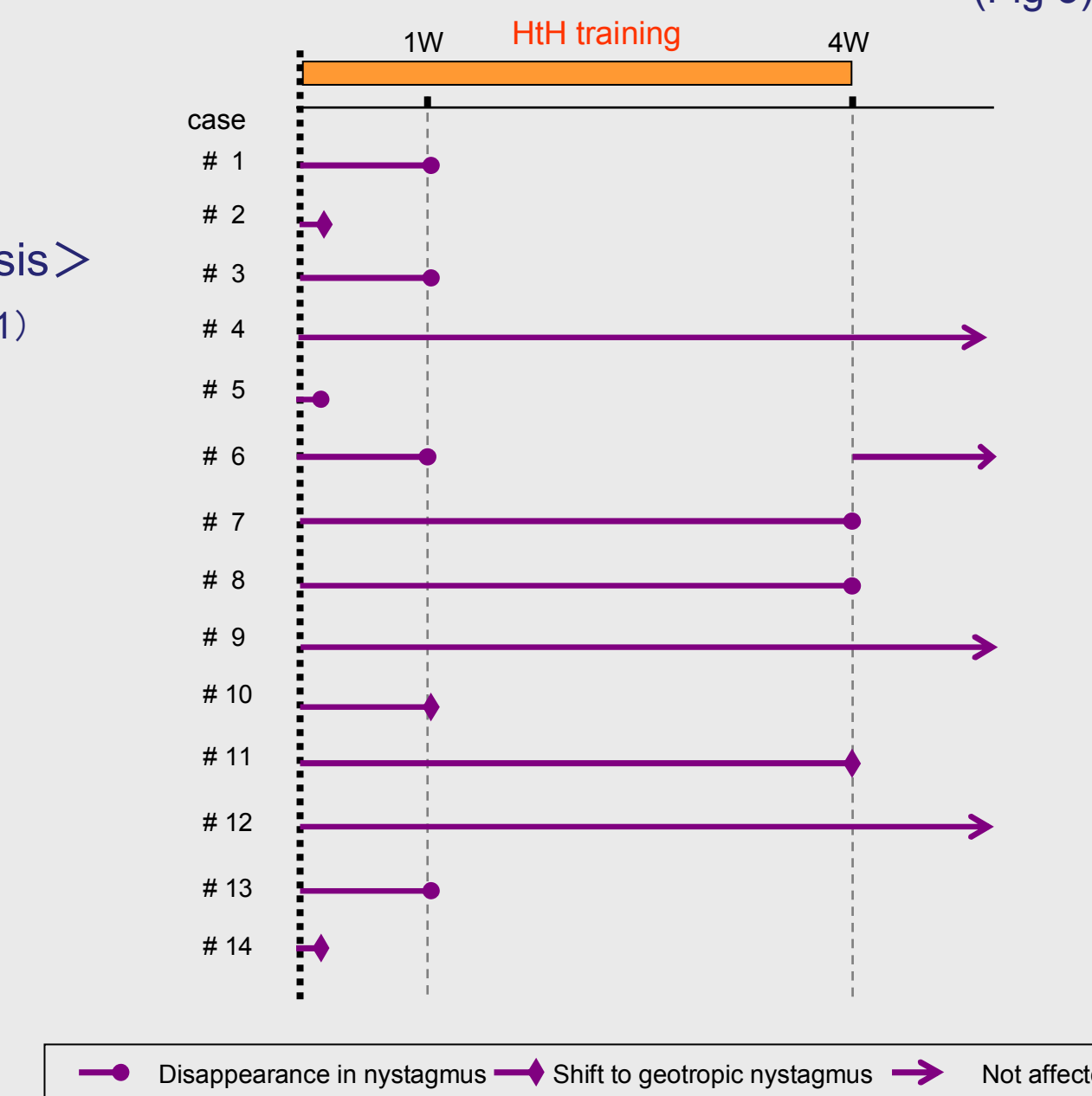
Table 1 and Fig.3 show a summary of patients who underwent the HtH training. All patients met our criteria for the BPPV cupulolithiasis of the lateral canal. Successful improvement as assessed by a decrease or disappearance of the nystagmus was seen in 5 of 14 cases (35.7%) in one training session with the HtH exercise. The number of subjects showing the improvement was 9 (64.3%) in 1 week, and became finally up to 10 (71.4%) at the termination of all the training program for 4 weeks. However 3 subjects were not affected by this treatment after the training.

The remaining one subject had a recurrence at follow-up 4 weeks although showing a disappearance of nystagmus in 1 week (Fig3,4). Disappearance of the nystagmus was seen in 3 cases immediately after the first training session, and further in 5 and 3 cases, after 1 and 4 weeks of the HtH training, respectively (Fig.5).

There were two ways that the HtH training leads to disappearance of the apogeotropic nystagmus. One is the direct disappearance (found in 7 subjects), the other is disappearance via the geotropic nystagmus (found in 4 subjects). In the latter case, the HtH training causes the transformation into the geotropic nystagmus, which was successfully cured by the log roll maneuver (Fig.5).

<Post-treatment course of Nystagmus>

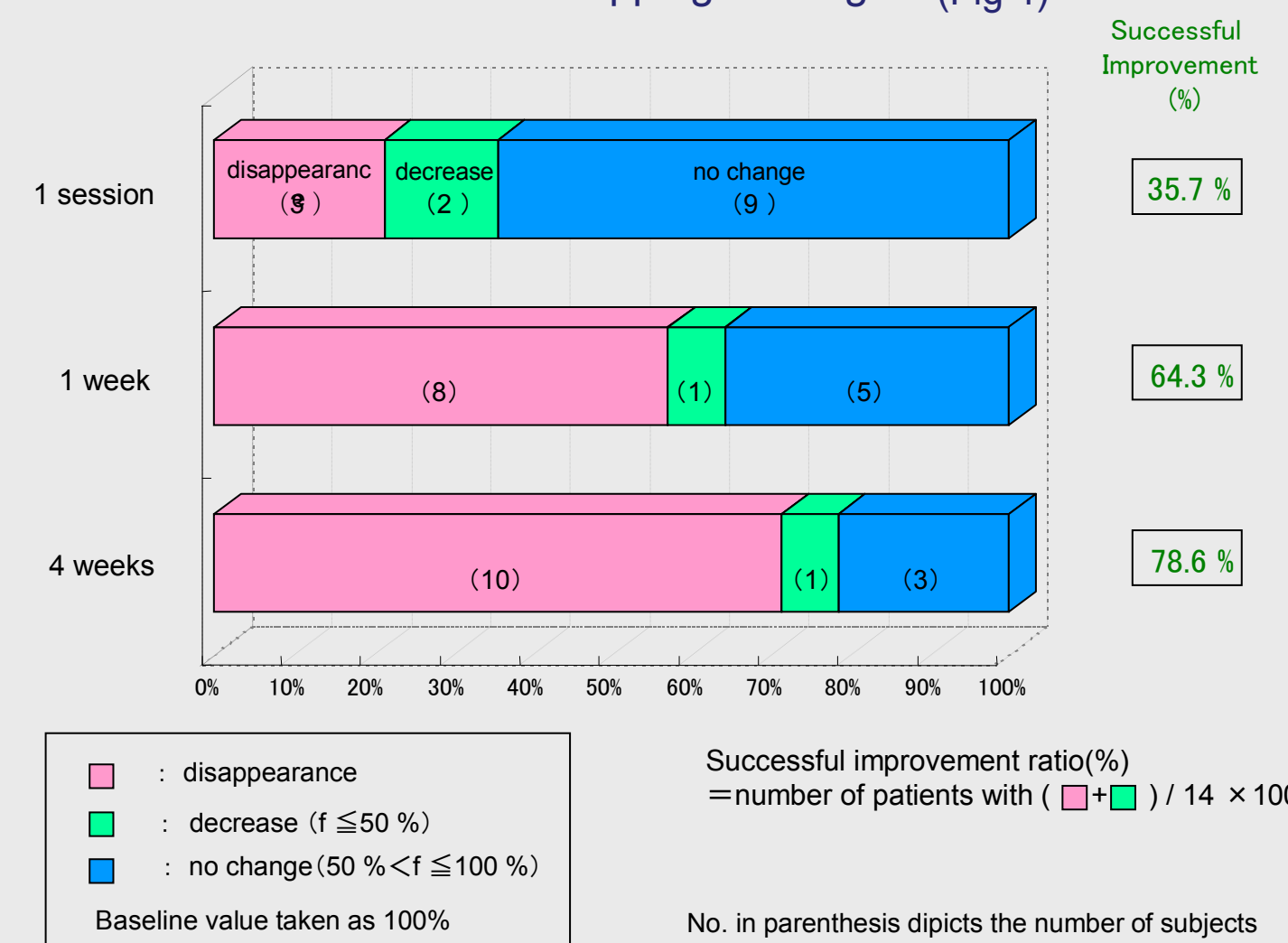
(Fig 3)



CONCLUSIONS

These results suggest that HtH exercises based on the concepts of release of otoconia from the cupula would appear to be feasible as a new therapy for cupulolithiasis associated with intractable horizontal canal BPPV.

<Effects of the Head tilt Hopping training> (Fig 4)



<The way to disappearance in nystagmus after HtH training>

(Fig. 5)

