

# **Recommended Procedure**

# **Positioning Tests**

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## **General foreword**

This document presents a Recommended Procedure by the British Society of Audiology (BSA). A Recommended Procedure provides a reference standard for the conduct of an audiological intervention that represents, to the best knowledge of the BSA, the evidence-base and consensus on good practice given the stated methodology and scope of the document and at the time of publication.

Although care has been taken in preparing this information, the BSA does not and cannot guarantee the interpretation and application of it. The BSA cannot be held responsible for any errors or omissions, and the BSA accepts no liability whatsoever for any loss or damage howsoever arising. This document supersedes the recommended procedure for Hallpike manoeuvres by the BSA and stands until superseded or withdrawn by the BSA.

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Page



# 1. Contents

2.	Introduction and Scope				
3.	3. Preparation				
	3.1	Indications for testing	6		
	3.2	Contraindications / patient safety issues	6		
	3.3	Patient consent	8		
4. Performing the positioning tests					
	4.1	General considerations applying to all positioning tests	9		
	4.2	Dix-Hallpike test	10		
	4.3	Side-lying test	12		
	4.4	Roll test	13		
	4.5	Rose test	16		
	4.6	Modified test techniques	16		
5	Interpretation		17		
6.	References				

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 $\mathsf{Page}4$ 



# 2. Introduction and Scope

This document replaces the previous recommended procedure for the Dix-Hallpike manoeuvre. It aims to achieve standardisation of the Dix-Hallpike test throughout the UK and provide a more detailed description of testing. It also includes descriptions of other positioning test techniques and provides guidance on the interpretation of test results.

The Dix-Hallpike test was developed and introduced into clinical practice in 1952 (Dix and Hallpike, 1952). It is now used extensively in the differential diagnosis of positioning vertigo<sup>1</sup>, of both peripheral and central type. In relation to peripheral positioning vertigo, it is primarily used for the identification of posterior or anterior canal Benign Paroxysmal Positional Vertigo (BPPV)<sup>2</sup>, although the horizontal nystagmus associated with horizontal canal BPPV may also be elicited.

In recent years alternative test manoeuvres have become more widely utilised, especially where there is physical difficulty in performing the Dix-Hallpike test.

Data show that BPPV has an increased incidence and prevalence with increasing age, with studies noting that approximately 40% of patients over 65 years of age referred to a neurootology clinic for dizziness or imbalance were suffering from BPPV (Herdman and Tusa, 2000; Uneri and Polat, 2008), and that untreated BPPV in the elderly has been associated with increased risk of falls (Oghali, 2000). This underlines the need to be able to adapt test techniques in order to assess and treat the older or less mobile patient.

The side-lying test is an alternative technique for patients where hyperextension of their neck is difficult or contraindicated, or where there is lower back pain. It can also be helpful for obese patients, particularly where there is difficulty bending at the waist (Humphriss et al, 2003; Cohen, 2004; Roberts and Gans, 2008).



<sup>&</sup>lt;sup>1</sup> Note that the Dix-Hallpike test is primarily a dynamic positioning test as the signs and symptoms of BPPV are related to the movement of otoconia within the semicircular canals. Sustained positional nystagmus of peripheral or central origin may also be elicited by the Dix-Hallpike and other positioning tests.

<sup>&</sup>lt;sup>2</sup> Although benign paroxysmal positioning vertigo is the more correct term (in order to differentiate it from static positional vertigo or nystagmus), positional remains the term in common usage and is therefore adhered to in this document when referring to BPPV.



The Roll Test is specifically aimed at the identification of horizontal canal BPPV.

The Rose positioning test (supine with head and neck hyperextension) can be used to help identify anterior BPPV where this is suspected, and the Dix-Hallpike has not been positive for this.

## 3. Preparation

#### 3.1 Indications for testing

An appropriate positioning test should be performed in all patients with any history of vertigo, unsteadiness, light-headedness, disequilibrium or imbalance, unless contraindicated. Positioning tests may identify not only BPPV but also any positioning or positional nystagmus of peripheral or central origin (where the patient may be asymptomatic).

### 3.2 Contraindications / patient safety issues

Absolute contraindications (Humphriss et al, 2003), which will apply to all tests detailed in this document:

- Fractured odontoid peg.<sup>3</sup>
- Recent or unstable cervical spine fracture.
- Atlanto-axial subluxation.<sup>4</sup>
- History of vertebral or carotid artery dissection.
- Cervical Arterial Dysfunction that is known and verified.
- Recent eye surgery (within the past three weeks).<sup>5</sup>

<sup>4</sup> Atlanto-axial subluxation: refers to loss of ligamentous stability in the joint connecting the skull to the spine and is often associated with Down's Syndrome, other syndromes, rheumatoid arthritis, or trauma.

PageO



<sup>&</sup>lt;sup>3</sup> *Fractured odontoid peg:* fractures of the odontoid peg of the axis (C2) may result from extension of the neck in a high velocity accident or a severe fall.

<sup>&</sup>lt;sup>5</sup> Procedures that risk inducing strong nystagmus are best avoided during this period (Personal communication, Opthalmology Department, Portsmouth Hospital NHS Trust, 2014).



Caution is advised in patients with neck or cardiovascular problems (especially carotid sinus syncope and orthopnoea), who have had a recent stroke, or where there is a recent history of severe nausea or vomiting. Patients should be asked if they can adopt the position required for testing without difficulty in order to check their suitability. For a more detailed account of particular conditions that may prevent or modify testing see Humphriss (2003). If in doubt regarding suitability for testing then a medical or physiotherapy opinion should be sought.

It is advisable to perform a neck screen in patients either reporting neck problems or who are elderly before carrying out positioning tests, as shown in Figure 1. More research is required, however, to clarify the predictive value of the screen in accurately identify when testing can or should not take place, and this remains a controversial area. This is carried out by asking the patient to turn their head 45° in each direction with a small amount of lateral flexion. If they are able to do this without pain, tingling or feelings of passing out then a side-lying test should be possible. They should also be asked to extend their neck 20-30° during each 45° head turn. If they are able to do this without pain, tingling or feelings of passing out, then a Dix-Hallpike test should be possible. If movement is restricted then a modified test should still be considered and performed as appropriate (see section 4.6).

It may be advisable to use two testers for some patients, such as those who are immobile, obese or anxious. In some instances a chaperone may be appropriate.

Clinicians with known back problems should exercise appropriate care using a technique designed to minimise the risk of further back injury.

Caution should be taken if the tester is pregnant.



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Figure 1. Neck screen, a) 45° head turn

Page 8



Figure 1. Neck screen, b) 20-30° neck extension during 45° head turn

### 3.3 Patient consent

The procedure should be explained to the patient so that they understand what they will need to do and what to expect, demonstrating as necessary, and verbal consent obtained. It is often helpful to demonstrate techniques to elderly patients or patients where there are cautions to



testing, and ask them whether they think they are able to perform the test safely. Explain to the patient that they may experience some dizziness but that it is likely to be short-lived.

## 4. Performing the Positioning Tests

## 4.1 General considerations applying to all positioning tests

Instruct the patient before the test to keep their eyes open throughout the test even or especially if they feel dizzy, looking straight ahead, and endeavouring to suppress blinks since observation of eye movements is essential. Inform the patient that they will be in the test position for at least 30 seconds and possibly up to 2 minutes. Ask the patient to report any subjective dizziness or vertigo during the test.

If the history is suggestive of BPPV, it is often most appropriate to start by testing the ear on the side that is less likely to induce vertigo to increase the likelihood that both sides can be tested within the same session.

Any baseline nystagmus or any other eye movements that might influence the interpretation of the test result should be taken into account.

During testing observe the patient's eyes, noting the presence of any nystagmus, or any other eye movements. The latency, duration and severity of any reported vertigo should be noted, as well as the presence, direction, magnitude, latency and duration of any nystagmus.

If nystagmus is present, the position should be maintained for the duration of the nystagmus up to a maximum of two minutes (if possible) if the nystagmus is persistent.

If nystagmus is not present, the position should be maintained for a minimum of 30 seconds but longer if a strong history of BPPV or for the duration of any dizzy symptoms, up to one minute.

In the case of persistent nystagmus video goggles can be introduced to abolish optic fixation. It might be difficult to differentiate whether a persistent nystagmus is due to BPPV of cupulolithiasis type or is of a central origin. In BPPV removing fixation will emphasise the vertical component of the nystagmus, whereas the torsional component dominates when fixation is present. Central positioning or positional nystagmus is usually the same whether fixation is present or not or may even be enhanced by the presence of fixation (Roberts, 2016). See Table 2 for further information on differentiating BPPV from central positioning or positional nystagmus. Persistent (static) positional horizontal nystagmus may represent an enhancement of spontaneous nystagmus which can be enhanced by removing fixation.



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Page9



Emphasising the vertical component using the removal of fixation can also help differentiate between posterior and anterior canal BPPV (see section 5 for further information on interpretation). In persistent nystagmus asking the patient to change their direction of gaze can also be used to enhance or diminish the torsional or vertical components of the nystagmus.

There are a few patients who also seem able to suppress their BPPV nystagmus if fixation is possible. Goggles may reveal a BPPV nystagmus in these patients where no nystagmus was present with fixation possible.

On sitting the patient up from any of the tests, ensure this is done slowly, to minimise postural hypotension. Be aware that on sitting up after positioning tests the patient may become acutely vertiginous (with nystagmus reversed in direction to that seen during testing) and may require support.

A cardinal feature of BPPV is that nystagmus habituates on repeating the Dix-Hallpike test. However, it is suggested that checking for habituation is usually not necessary unless the diagnosis is in doubt or the patient fails to respond to treatment. In the case of positive positioning tests, it may be preferable to proceed immediately to the appropriate repositioning manoeuvre so as not to cause the patient undue additional dizziness. If the test is negative, the opposite side should be tested.

Very occasionally, patients may have difficulty tolerating positioning tests without experiencing severe nausea or vomiting. In such cases, medical advice should be sought regarding the administration of anti-emetic medication.

### 4.2 Dix-Hallpike test

The Dix-Hallpike primarily tests for posterior or anterior canal BPPV, as well as central positioning/positional nystagmus. It may trigger the horizontal nystagmus of horizontal canal BPPV.

Ask the patient to sit on an examination couch in a position such that when they lie down, their shoulders will be level with the end of the couch. Ask them to turn their head 45° towards the test ear.<sup>6</sup>

<sup>&</sup>lt;sup>6</sup> An assumption is made that 45° places the posterior canal in the plane of maximal stimulation, and that then if the head is turned either more than 45° or less than 45° the sensitivity of the test may be significantly decreased. There is





There are two possible test positions for the Dix-Hallpike test. In the traditional technique, the clinician stands to the side of the patient facing the patient and may either bend or, alternatively (in order to protect their lower back), move into a seated position to the side as the patient lies down. In the modified version, the tester stands behind the head of the patient and moves into a seated position as they guide the patient backwards.

Take the patient's head with both hands maintaining neck torsion. Ask the patient to lie down so their head is extended approximately 20-30° below the horizontal, beyond the end of the couch. Support the weight of the patient's head and observe the patient's eyes at all times. The optimum duration of the movement from sitting to head-hanging should be about 2 seconds (Baloh et al, 1987). With some patients, it may be necessary to do this more slowly but at the risk of a false negative test (see section 4.6).

Instruct the patient that the head-extended position should be maintained for at least 30 seconds and up to 2 minutes, unless there are reasons for aborting testing such as significant pain, or extreme nausea or anxiety.

Instruct the patient to sit up with their head still turned 45° toward the test ear. After rising to the sitting position, ask the patient to maintain their head position at 45° rotation and observe the patient's eye movements.

If no nystagmus was observed in either sitting, or lying with head hanging then the test is complete for that side, and should be carried out for the other side.

If BPPV is strongly suspected, based on history, but Dix-Hallpike tests are initially negative, then the clinician may want to repeat the Dix-Hallpike test more rapidly on one or both sides to be sure no nystagmus can be elicited, and/or consider other positioning tests. The Dix-Hallpike test position may need to be held for 40-60 seconds as clinicians do occasionally see nystagmus appear beyond the usual 30 seconds latency, with the longest latency reported as 55 seconds (Personal communication, Peter West, 2014). If there is a strong history of BPPV and subjective dizziness on testing which lessens on repeat testing (especially if to one side) but no nystagmus, a treatment manoeuvre for BPPV might still be appropriate. Some patients appear to have an underlying BPPV with no nystagmus on Dix-Hallpike testing, especially if fixation present, which resolves with treatment.

evidence, however, of wide anatomical variations in the orientation of the canals whereby the angle of maximal stimulation may vary between individuals (Bradshaw et al, 2010).



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Figure 2. Traditional Dix-Hallpike test



Figure 3. Modified Dix-Hallpike test

 ${}^{\text{Page}}12$ 

#### 4.3 **Side-lying test**

The side-lying test is an alternative to the Dix-Hallpike test. It primarily tests for posterior or anterior canal BPPV, and central positioning / positional nystagmus. It is useful where the Dix-





Hallpike is not suitable or the side-lying position is more tolerable for the patient, or in anticipation of a Semont or Gans manoeuvre since it constitutes the first position of these treatments.

Ask the patient to sit sideways in the middle of an examination couch in a position such that when they lie sideways their head and torso will be supported on the couch. Ask them to turn their head 45° away from the test ear, and hold both sides of the patient's head. Ask the patient to lie sideways such that they maintain the 45° head turn and will be lying sideways on the couch looking upwards towards the ceiling with slight lateral flexion of the head towards the couch. Instruct the patient that the side-lying position should be maintained for at least 30 seconds and up to 2 minutes. Ask them to bring their feet up onto the couch if possible, as this is likely to be more comfortable (Figure 4).



Figure 4. Side-lying test to the right ear

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#### 4.4 Roll test

The roll test is a test for horizontal canal BPPV. It is useful where BPPV is suspected but initial Dix-Hallpike testing or other positioning testing is negative.

Some patients with neck problems may need a modified technique considering the 90° head turn normally employed. Ideally, the roll test should be performed with fixation removed using video goggles as the horizontal nystagmus associated with a positive roll test may be subject to suppression on fixation.





Ask the patient to lie supine on an examination couch with their head rested on the end of a couch that is raised by 30°. This angle is intended to achieve orientation of the horizontal canals in the vertical plane.

Ask the patient to turn their head 90° towards the test ear. Alternatively, the patient can be asked to roll onto the side of the test ear with their head straight. Place a guiding hand on the patient's head on the side opposite to the test ear. Instruct the patient that the side-lying position should be maintained for at least 30 seconds and up to 2 minutes.



Figure 5. Roll test a) starting position prior to each roll







#### Figure 5. Roll test b) to the right

It should be noted that a roll test on both sides is needed to complete a full assessment for horizontal canal BPPV since diagnosis usually requires nystagmus to be induced to both sides, with the relative strength of the nystagmus and subjective response on each side being used to help determine the affected ear.

In some cases, the relative strength of the nystagmus or subjective symptoms on each test side does not differentiate the side of involvement and further tests have been suggested. It is outside the scope of this document to describe these tests or their interpretation in detail but clinicians are directed to the review article by Galgon (2012). For further information on how to carry out and use the spontaneous (pseudo) nystagmus test, bow and lean (or pitch) test, and the sit to supine test see De Stefano et al, 2011.





#### 4.5 Rose test

There is some suggestion that the Rose positioning test (also known as the straight headhanging test) may lead to better identification of anterior canal BPPV, whereby the patient is asked to lie supine with their head hyper-extended straight back (Helminski, 2012).<sup>7</sup>

### 4.6 Modified test techniques

Possible modifications to testing where there is neck or back pathology or for other patients who are relatively immobile, including obese patients, include the following:

- Dix-Hallpike test with extended couch where the head is tilted back but supported on the couch or tilted couch where the whole of the couch is tilted.<sup>8</sup>
- Use of a pillow positioned at the top of the back to achieve neck extension over the top of the pillow.
- Dix-Hallpike test with limited or no neck extension (lying supine with neck torsion only). If it is known before testing that neck extension is not possible then the patient can be positioned to have their head fully supported on a flat couch (neck extension is not fundamental to provoking BPPV and lying flat may be sufficient in many cases).<sup>9</sup>
- Testing on a wide couch.

Modifications might be especially relevant for the elderly to ensure this group of patients, who are particularly susceptible to BPPV, may still be assessed.

If required, Dix-Hallpike testing at slower speeds than usual is permissible (for example, for those with back problems or for the elderly) but this may result in false negative results.

<sup>&</sup>lt;sup>9</sup> It is outside the scope of this document to go into any detail regarding treatment techniques but for information if the Dix-Hallpike has needed to be done without neck extension then the clinician may consider the Semont or Gans manoeuvres as treatment options as these also do not require neck extension.



<sup>&</sup>lt;sup>7</sup> This test is derived from the Rose Position which is a position used in tonsillectomy surgery where both the head and neck are extended. It was named after the Staff Nurse who first suggested it (De Souza et al, 1995; Balasubramanian, 2014).

<sup>&</sup>lt;sup>8</sup> If a fully tilted couch is used a second tester is needed at the foot end to ensure that the patient does not slide head-first down the couch.



# 5. Interpretation

The features of any nystagmus observed and the patient's subjective response are used to guide the interpretation of positioning tests and determine a diagnosis. The latency to onset, duration and nature of any nystagmus are used to differentiate between BPPV and central positioning nystagmus, and in the case of BPPV determine the particular form of BPPV present.

It is beyond the scope of this document to present all the possible interpretations of the underlying mechanisms of eye movements observed, and only the most common interpretations have been presented.

Table 1 summarises in a simplified form the nature of the eye movements most usually expected with the different forms of BPPV, that is BPPV affecting the different semi-circular canals (posterior, anterior and horizontal) and BPPV of presumed different underlying mechanism (canalithiasis versus cupulolithiasis), using the Dix-Hallpike test, side-lying test and roll test. Details of these interpretations can be found in the second edition (2016) of Balance Function Assessment and Management (edited by Jacobson and Shepard) in Chapter 11 by Richard Roberts (specifically pp. 266-267) and Chapter 26 by Richard Clendaniel (specifically pp. 655-656 and 660).





Canal	Underlying mechanism	Ear affected	Direction of nystagmus	Latency	Duration
Posterior	Canalithiasis	Lower ear	<ul> <li>Torsion to affected ear</li> <li>Up-beating</li> </ul>	2-40 s <sup>10</sup>	< 60 s
Posterior	Cupulolithiasis	Lower ear	<ul> <li>Torsion to affected ear</li> <li>Up-beating</li> </ul>	No latency	> 60 s
Anterior	Canalithiasis <sup>11</sup>	Direction of the torsion	<ul> <li>Torsion to affected ear</li> <li>Down-beating</li> </ul>	2-40 s	< 60 s
Anterior	Cupulolithiasis <sup>12</sup>	Direction of the torsion	<ul> <li>Torsion to affected ear</li> <li>Down-beating</li> </ul>	No latency	> 60 s
Horizontal	Canalithiasis (of posterior arm of the canal)	Side with stronger nystagmus	- Horizontal geotropic	2-40 s	< 60 s
Horizontal	Cupulolithiasis	Side with milder nystagmus	- Horizontal apogeotropic	No latency	> 60 s
Horizontal	Canalithiasis of the short or anterior arm of the canal, near to the cupula	Side with milder nystagmus	- Horizontal apogeotropic	2-40 s	Shorter than in horizontal canal cupulolithiasis

 Table 1. Eye movements associated with the different forms of BPPV: canalithiasis versus cupulolithiasis

 of the posterior, anterior and horizontal canals

<sup>&</sup>lt;sup>12</sup> The possible existence of anterior canal cupulolithiasis is not being questioned.



Page 18

<sup>&</sup>lt;sup>10</sup> The latent period can seem shorter (or absent) if positioning is carried out slowly.

<sup>&</sup>lt;sup>11</sup> There is current discussion, as yet unpublished and so beyond the scope of this document to explain in full, questioning the existence of anterior canal canalithiasis type BPPV. Instead a common crus BPPV is proposed that results in a latent period, then a down-beating nystagmus with torsion to the contralateral ear of less than 30 seconds.



When the BPPV is unilateral, test results as follows are expected:

- Posterior canal BPPV: positive test on side of affected ear.
- Anterior canal BPPV: positive test may be elicited unilaterally or on both test sides, with direction of torsional component determining affected ear. A stronger response may often be elicited from what some might call the 'false positive' side i.e. in a right anterior canal BPPV, for example, a stronger response may be elicited from a Dix-Hallpike test with the head turned 45° to the left. This is because what might normally be termed a 'Left Dix-Hallpike' (especially in reference to posterior canal BPPV) will stimulate the anterior canal of the right ear more than the anterior canal of the left ear. Similarly what is often termed a 'Right Dix-Hallpike' is likely to stimulate the anterior canal of the left ear.
- Horizontal canal BPPV: positive tests on both sides, with strength of nystagmus determining affected ear.

Where there is a strong unilateral posterior canal BPPV, a subtle sustained down-beat nystagmus may be seen, with few or no symptoms, on testing the unaffected ear.

The majority of patients will present with unilateral BPPV but somewhere between 4% and 15% will present with bilateral BPPV (Gans and Harrington-Gans, 2002; Longridge and Barber, 1978), particularly in cases caused by trauma (Liu, 2012). This will most commonly present as bilateral posterior canal BPPV with positive tests to both sides with an up-beating and geotropic torsional nystagmus that beats to the test / under-most ear. Bilateral anterior canal and horizontal canal BPPV are extremely rare.

In BPPV the patient can be asked to deviate their eyes in different directions to enhance different aspects of their nystagmus in order to aid interpretation. In BPPV of a vertical canal having the patient look away from the involved ear will enhance any vertical component and having the patient look toward the involved ear will enhance any torsional component (Roberts, 2016).

In BPPV there may be multiple canal involvement, which will present with a more complicated picture of nystagmus.

Whilst down-beating nystagmus is a feature of anterior canal BPPV pure down-beat nystagmus, without a torsional component, is more commonly of central (usually cerebellar) origin. Central positioning nystagmus can also very closely mimic the nystagmus of BPPV, with or without other central signs. Central positioning / positional nystagmus should always be considered if a patient does not respond to treatment with repositioning manoeuvres for BPPV. Purely vertical or



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purely torsional nystagmus on primary gaze in sitting is of central origin. Table 2 outlines ways in which to differentiate BPPV from central positioning / positional nystagmus.

	BPPV	Central positioning nystagmus		
Latency2 - 40 s (can be absent in cupulolithiasis)		Little or no latency		
Direction	Both vertical and torsional elements present in primary gaze	Pure vertical or torsional on primary gaze; may sometimes closely mimic BPPV		
Duration	< 60 s (canalithiasis) but can persist longer i.e. > 60 s (cupulolithiasis)	Usually sustained i.e. > 60 s		
Return to sitting	If present, will reverse in direction	Unlikely to reverse		
Habituation	Habituates on repeat testing	Does not habituate		
Fixation	Torsional element dominates with fixation; vertical component dominates if fixation removed	Unaffected or may be reduced by removal of fixation		
Symptoms	Time course of vertigo coincides with nystagmus observed	May be asymptomatic; inconsistent with degree of nystagmus observed		

Table 2. Differentiating BPPV from central positioning / positional nystagmus

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