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Benign Paroxysmal Positional Vertigo (BPPV) Following Dental Surgical Procedures : Short Clinical Study

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ABSTRACT

BPPV is one of the most common type of vertigo observed by the clinicians. The exact etiology is still controversial , although idiopathic, traumatic and viral are the most acceptable theories. Traumatic causes includes traffic , occupational injuries and surgical trauma. Benign paroxysmal positional vertigo due to surgical "traumas" has been previously described in literature. These iatrogenic cases represent a rare possibility and may be the consequence of surgical interventions differing according to the anatomical area involved and surgical technique performed. Author here by wishes to quote benign paroxysmal positional vertigo, due to be of iatrogenic origin, mainly focusing on dental surgery as risk factors for BPPV along with short discussion on pathophysiology, classification and treatment modalities.

KEYWORDS: Benign paroxysmal positional vertigo(BPPV) ; Canalith; Cranio-Sacral Therapy (CST) ; Nystagmus; PRM(particle repositioning maneuvers)

Introduction:

Benign paroxysmal positional vertigo is one of the most common cause of vertigo with a false sensation of spinning. Definition wise it is a Benign –Not life threatening , Paroxysmal – Occurs in sudden brief spells/ short bursts, Positional –Stimulated by certain head positions and movements , Vertigo – A sensation of spinning / rotational movement. BPPV is caused by a problem in the internal ear. Tiny calcium "stones" inside inner ear canals help you keep your balance. Normally, during certains movements like stand up or turning head, these stones move around. But conditions like infection or inflammation can stop the stones from moving as they should. This produces a false stimulous to the brain and result in the vertigo.

Benign paroxysmal positional vertigo (BPPV) is a disorder in which patients feels sudden revolving vertigo due to the presence of free otoconial debris migrating into one or more semicircular canals during head movements and resulting in abnormal stimulation of the ampullary crest. The traumatic origin of benign paroxysmal positional vertigo (BPPV), representing the most frequent cause of labyrinthine vertigo [1,2] caused by dislodged otoconia making its way from the utricle mainly into the posterior semicircular canal [Figure 1]. The posterior semicircular canal (PSC) is affected in the majority of cases of BPPV (80-90%) , with 80-85% unilateral and 5-15% bilaterally . In 5% to 22% of cases, the otoconia will be displaced into the horizontal canal, or more rarely, the anterior canal [3,4]. The movements of the head on the neck, produces an endo-lymphatic stream which stimulates the ampullar receptors resulting in typical BPPV symptomatology [5,6]. Various descriptions of post-trauma BPPV associated with "surgical trauma" have been reported in the literature [7,8,9,10]. Moreover, dental and maxillo-facial surgery seems to be one of the most frequent causes of iatrogenic BPPV due to the anatomical features of the districts involved and traumatic potential of the surgical technique.

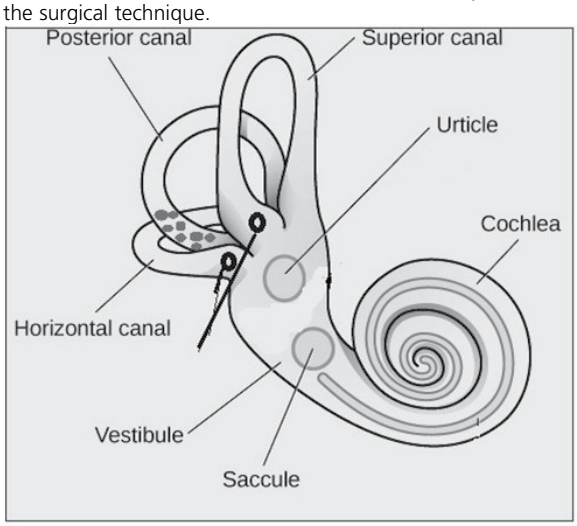


Figure 1. The vestsibular system – semicircular canals and and otolith organs showing displaced otoconia in posteri-

or semicircular canals.

Material and method:

We selected BPPV cases from OMFS OPD observed between Janurary 2014 and December 2015, in which the onset of symptoms occurred immediately after dental or maxillo-facial surgery. Exclusion criteria were patients with BPPV risk indicators like, high cholesterol levels, vascular problems, endocrinological disorders, peri-menopausal age, dyslipidaemia , cranial trauma, neurotologic disorders, migraine , males >42 years and > 38 years.

The diagnosis of BPPV has been based on :

- Recurrent Spontaneous rotational vertigo with nausea and either oscillopsia or imbalance
- Duration of an attack always <1 min
- Symptoms invariably provoked by the following changes of head position: Lying down or Turning up in the supine level, or at least 2 of the following manoeuvres: Reclining the head, Rising up from supine position, Bending forward with nystagmus.
- Not attributable to another disorder .

All of the following criteria, further were confirmed by the Dix-Hallpike test The features of the nystagmus, in the various positions.[2,11]

Age (yrs)	Sex	surgical procedure	Occurence (days after dental treatent)	No. of PRMs	Affected side	Follow-ups	month
29	F	Extraction	1	1	Ipsilateral	3	12
35	F	Implant	3	1	Ipsilateral	2	6
40	M	Curratage	5	1	Ipsilateral	3	12
32	F	Apicectomy	2	1	Ipsilateral	3	6
39	M	Implant	2	1	Ipsilateral	3	12
35	F	Extraction	3	1	Ipsilateral	2	6
34	F	Extraction	3	1	Ipsilateral	1	3
32	F	Extraction	1	1	Ipsilateral	3	12
40	M	Extraction	1	1	Ipsilateral	3	12
33	F	Implant	2	1	Ipsilateral	3	12
28	F	Restoration	2	1	Ipsilateral	2	6
35	M	Restoration	1	1	Ipsilateral	3	12
38	M	Extraction	3	1	Ipsilateral	3	12
30	F	Crown prepration	1	1	Ipsilateral	2	6
28	M	Restoration	2	1	Ipsilateral	3	12
30	F	Restoration	2	1	Ipsilateral	2	6
25	F	Extraction	1	1	Ipsilateral	3	12
35	M	Crown prepration	4	1	Ipsilateral	3	12
35	F	Restoration	2	1	Ipsilateral	2	6
32	M	Extraction	3	1	Ipsilateral	3	12

Eight patient for Extraction of maxillary 3rd molar and impacted maxillary canine with rotary tools and chisel &mallet .Three patient for implant placement over maxillary molars region. One patient of curratage of cystic lesion over ramus with rotary tools . Five patients for restoration of class II cavity using micromotor and two patients for crown preparation for capping of tooth in maxillary molars.One patient for apicectomy of maxillary canine.

BPPV was treated with Epley's canalith repositioning manoeuvre[12]. Vestibular functionality of all patients, at the end of the treatment, was evaluated using Fitzgerald Hallpike's [13] caloric tests to exclude any concomitant posterior labyrinth disorder.

Result:

Twenty patient with BPPV fulfilled the diagnostics criteria .Mostly third-fourth decade of life with female predominance The mean onset time of this pathology was 2-3days. The most rapid onset was reported 1 day after surgical treatment and the most remote after 5 days. Involvment was ipsilateral towards surgical treatment. BPPV was treated with Epley's canalith repositioning manoeuvre with negative recurrence rate. Follow-up of patients was scheduled for 3, 6 and 12 months after treatment. A negative clinical pattern was confirmed in all cases.

Discussion:

Balance is the combined effect of multiple body systems working together i.e the,vestibular system, visual system and proprioception. Disturbance in these systems may lead to vertigo which is a feelings of giddiness, or wooziness, or having a sensation of movement, spinning, or floating. Benign Paroxysmal positional vertigo (BPPV) is the most common cause of vertigo which is an illusion of motion or misperception of a real stimulus and represents a disorder of the vestibular proprioceptive system. BPPV was first described by Adler in 1897 and then by Barany in 1921. BPPV is defined as an abnormal sensation of motion that is stimulated by some provocative positions.

It is the most common cause of spinning dizziness account for 20% of all dizziness. Its incidence of 107 per 100,000 per year [14] and prevalence of 2.4 % [15]. BPPV can affect at any age, but commonly presents at 40-50 decade of life . Younger people may develop BPPV as a result of head trauma. Women are affected two times more than men. BPPV is a condition that can re-occur periodically with long-term recurrence rates as high as 50% within 5 years[16]. The symptoms are, vertigo, which is a sensation of spinning , blurred vision , lightheadedness nausea , vomiting, dizziness ,loss of balance.

Classification of BPPV

According to Site of affected canal –

Posterior canal More common	Lateral (horizontal) canal: Comparative Less common	Anterior (superior) canal: Rarest of all

According to Pathophysiology –

Canalithiasis	Cupulolithiasis.

According to aetiology --

Primary (idiopathic)	Secondary.

According to Course -

Self-limiting	Recurrent	Chronic.

According to Physical examination-

Objective: vertigo presents with signs of nystagmus	**Subjective**: vertigo presents without signs of nystagmus

According to Side involved-

Unilateral: one side involved; majority of cases	Bilateral: both sides involved simultaneously; generally occurs due to closed-head injury.

Pathophysiology:

There are 2 main pathophysiologic mechanisms. canalithiasis and cupulolithiasis,

Canalithiasis (canal rocks) is defined as the condition of particles residing in the canal portion of the SCCs . These particles are free floating and mobile, causing vertigo by putting a force. cupulolithiasis (cupula rocks) refers to particles adhered to the cupula of the crista ampullaris of SCCs and are not free floating. [1]

Within the labyrinth of the inner ear ,there are collections of calcium crystals known as otoconia or otoliths. In BPPV, the otoconia are dislodged from their usual place within the utricle, and moved over time into one of the semicircular canals (posterior canal is mostly affected by virtue its anatomical position). When the head is reoriented relative to

gravity, the gravity-dependent movement of the heavy otoconia within the affected semicircular canal causes abnormal endolymph fluid movement and result in sense of vertigo. This condition is known as canalithiasis.

Etiology of BPPV-

- Idiopathic (50-60%)
- Mild to moderate head trauma specialy in young patients.
- Keeping Head in the same position for a long period of time, such as at the beauty shop or on strict bed rest.
- Bike riding on rough trails.
- High intensity aerobics.
- Labyrinthine conditions – viral / vascular.
- Ménières disease.
- Vestibular migraines.
- viral infections,
- Neuritis, Degeneration of the peripheral end organ.
- Complication of ear surgery (in older people and women),
- Medication side effects like gentamycin .
- Rapid head movements.
- Occasionally BPPV follows surgery, including DENTAL TREATMENT / SURGICAL PROEDURE , where there is prolonged period of supine positioning.
- Diagnosis of BPPV includes general physical examination, complete medical history, and performing a neurological examination.
- Signs and symptoms of dizziness that are prompted by eye or head movements and then subsiding in less than 60 sec.
- Dizziness associated with specific eye motion that occur when you lie on your back with your head turned to one side and tipped slightly table.
- Nystagmus - Involuntary side to side movements of eyes. Inspection for spontaneous nystagmus and assessment.

Romberg testing

1. Segmentary tests
2. Babinski's test
3. Inspection for spontaneous and positional nystagmus using Frenzel lenses
4. Inability to control your eye movements.

Dix-Hallpike test. Subject is moved from sitting to a supine position, with the head turned 45 degrees to one side and moving about 20 degrees backward [Figure 2]. A positive Dix-Hallpike tests consists of a burst of nystagmus (jumping of the eyes).[17]

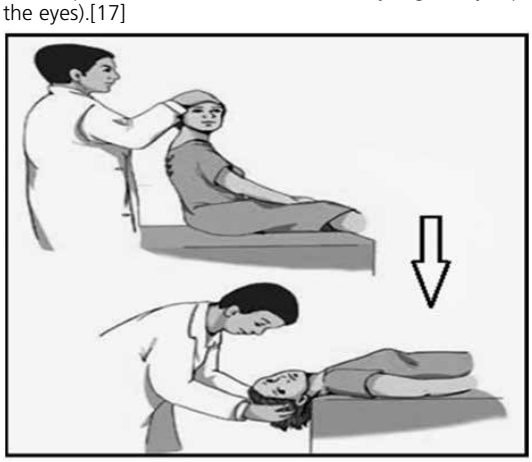


Figure 2. Dix-Hallpike tests.

Others tests :

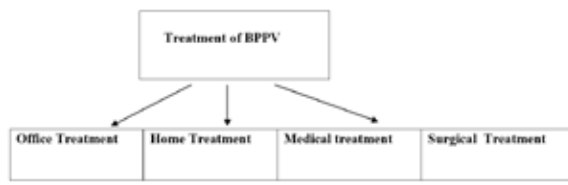
- Caloric stimulation, which is a warming and cooling the inner ear with water or air to observe eye movements
- Hearing evaluation
- MRI of the head
- CT scan of the head
- Electronystagmography (ENG) to record abnormal eye movement. ENG uses electrodes or VNG uses small cameras. It can help determine if dizziness is due to inner ear disease by measuring involuntary eye movements while head is placed in different positions .
- Electroencephalogram (EEG) is useful to measure brain function and may be done to rule out other possible causes of vertigo.

Differential diagnosis

labyrinthitis Ossificans, Ménière's disease, migraine headache , Inner ear concussion , Alcohol intoxication , vascular loop syndrome , Vertebral artery insufficiency , Cervical vertigo, or head extension vertigo , orthostatic hypotension, SLE , multiple sclerosis, poor systemic arterial tone etc.

Treatment: BPPV is described as "self-limiting" because symptoms often reduces within 2 months of onset.

1. Wait and watch: BPPV is not life-threatening , so patient can be reassured to just wait it out. BPPV may go away on its own within a few weeks or months.



Office treatments:

1. Epley maneuver : It is also known as the particle repositioning or canalith repositioning procedure. There is sequential movement of the head into four different positions, resting in each position for 30 seconds. Turn the head 45 degrees toward the affected ear. Deliberately move the patient into the supine position, maintaining the head turn. Then Extending the neck till the downward ear is beneth the shoulder. Keeping the neck extended, rotate the head 90 degrees so that the uninvolved ear point 45 degrees downward. The patient rolls into the right lateral decubitus position, and the head is rotated so the nose points downward. Observe for nystagmus. Nystagmus with a downbeat component indicates an ineffective procedure. The patient brings the knees to the chest and drops the legs over the table, while the head is still kept in the nose down posture. The patient is brought up to the sitting position, while keeping the head rotated close enough to 90 degrees on the body. In the upright position, keeping the chin tucked down, the head is rotated straight ahead, and the patient may assume a normal head position. The recurrence rate for BPPV after these maneuvers is about 30% per year, hence second treatment may be necessary.[18] [Figure 3]

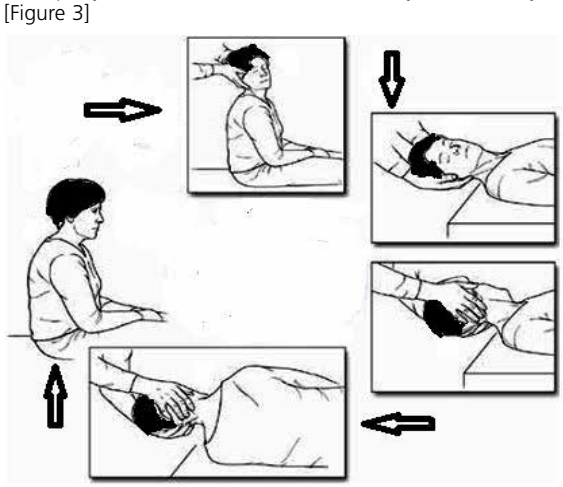


Figure 3. Epley maneuver.

Contraindication for Epley maneuver are Severe neck disease, high-grade carotid stenosis, and unstable heart disease. Complications includes relocation of canaliths from posterior to horizontal semicircular canal and nausea and vomiting after the procedure.

2. Semont maneuver : Also known as liberatory" maneuver. It comprised of a procedure whereby the patient is rapidly moved from lying on one side to lying on the other [Figure 4]. It is a brisk maneuver and is 90% effective after 4 treatment sessions.

These purpose of this maneuver is to moving ear debris out of the part of the ear's sensitive part (posterior canal) to a less sensitive location. Both the maneuvers takes about 15 minutes duration each for completion.[19]

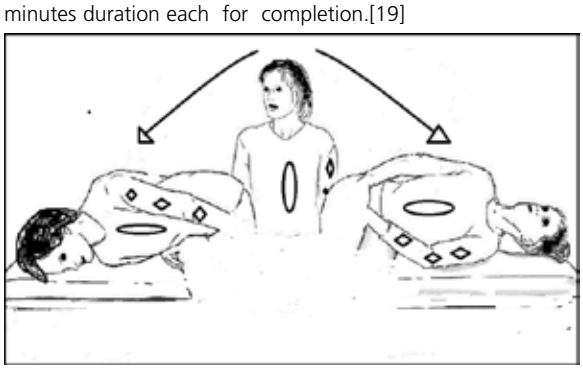


Figure 4. Semont maneuver**.**

3. The"Foster" or half somersault maneuver- Dr. Carol Foster populared this self-treatment maneuver for posterior canal BPPV. In this maneuver, one begins with head up, then flips to upside down, comes back up into a push-up position with the head turned to lateral side at 45 degree, and then back to sitting upright. Biomechanically, it is a series of positions similar to the Epley maneuver. The key of this maneuver is that instead of putting the head far backward like in the Epley maneuver , one should puts the head very far forward.

4. Log Roll maneuver : Done for the lateral (horizontal) canal. lateral canal is difficult to respond the canalith repositioning procedure used for the posterior canal BPPV. So treatment is aimed towards moving the canalith from the lateral canal into the vestibule. The roll maneuver involves rolling the patient 360 degrees in a series of steps to reposition the particles. clinician should be seated at the head of the table with the patient supine. It consists of four stages, each of them is one minute apart, and at the third stage , the horizontal canal is oriented in a vertical position with the patient's neck flexed and on forearm and elbows. When all four stages are completed, the head roll test is repeated, and if negative, treatment ceases.

5. Gufoni maneuver (the lateral /horizontal canal**)**
It involves side laid down for 2 minutes, then a turn the head to 45 degrees either up or down, with remaining in same position for 2 minutes, and then a return to the upright position.

6. Vannucchi maneuver and **Barbeque roll over maneuver or Lempert's maneuver** lateral /horizontal canal BPPV.

7. Yacovino maneuver (for anterior canal BPPV)
It consists of Sequential head positioning starting supine with head hanging 30 degrees with respect to the body, then supine with head inclined 30 degrees forward, and ending sitting with head 30 degrees forward.

8. Kim maneuver and Head down maneuver for anterior canal BPPV Treatment
Brandt-Doroff exercises - It is treatment modality done at home, generally in conjunction with other particle-repositioning maneuvers . The is a form of habituation exercise, designed for the patient to become accustomed to the position which stimulates the symptoms of vertigo. The Brandt-Daroff exercises are done in a same fashion to the Semont maneuver; however, as the patient rolls onto the uninvolved ear side, the head is rotated toward the affected side.

Patient should Sit on the edge of the bed and Turn head at 45 degrees (looking towards left). Then Lie down quickly on the right side. Also ensure that back of the head rests on the bed. Wait for 20–30 seconds or until the dizziness stops. After that Sit upstraight. Wait for 20–30 seconds for dizziness to subside .

Repeat the same procedure on the other side. Turn the head slightly to the right just before moving down quickly on the left side. The exercise is typically performed 3 times a day with 5-10 repetitions each time, till symptoms of vertigo have resolved for at least 2-3 days.[20] [Figure 5]

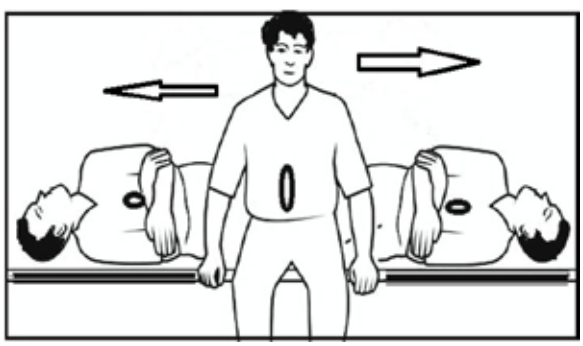


Figure 5. Brandt-Daroff exercises

Oscillators & Rotator devices:
Use of oscillation over the mastoid bone during the particle-repositioning maneuvers, employing with a hand-held massager and other mechanical devices to perform particle repositioning, including a rotating chair which moves patients upside down have been successfully used.

Home Treatment -
- Use two or more pillows at night.
- Do not sleep facing down with the ear which is causing the problem.
- Used to get up slowly in the morning and try to sit on the edge of the bed for afew seconds before standing.
- Avoid leaning over to pick up objects and bending your head far back to look up.
- Be careful about reclining, like in the dentist's chair or having your at a hair salon.
- Be careful or avoid the playing sports which involves you to turn your head, lean over, or lie flat on your back.
- Do Balancing exercises for vertigo, like standing with your feet together, arms down, and slowly moving your head from side to side, may help you keep your balance and improve symptoms of vertigo.
- Brandt-Daroff exercises done at home to help your brain get used to the abnormal balance signals triggered by the particles in the inner ear.

Medical treatment :
- Anti-vertigo medications can be used in acute, severe exacerbation of BPPV, but in most cases are not indicated. It includes
- Anti-histamine- Diphenhydramine (Benadryl) 25-50mg IM/IV/PO q4hr
- Meclizine (Antivert,) 25mg PO QID
- Promethazine (Phenergan,) 12.5-25mg PO/IM/IV q4-6hr
- Anti-cholinergic like meclizine and scopolamine 0.5mg (post auricular transdermal patch) QID
- Benzodiazepines- Lorazepam (Ativan), diazepam (Valium)

The medical management of vestibular syndromes:

Drugs	Underlying disorder
Betahistine, dexamethasone/ gentamicin	Ménière's disease
carbamazepine/oxcarbazepine	paroxysmal dysarthria and ataxia in multiple sclerosis
metoprolol/topiramate or valproic acid/tricyclic antidepressant	vestibular migraine
4-aminopyridine	episodic ataxia type 2 and downbeat and upbeat nystagmus

These drug therapies provides symptomatic treatment, and do not affect the BPPV disease progress and resolution rate. Medications may be used to suppress the severe and intolerable symptoms during the maneuvers.

Surgical Treatment of BPPV
Posterior Canal Plugging
Canal plugging blocks most of the posterior canal's function without affecting the functions of the other's. It is effective in about 90% of individuals who have had no response to any other treatment. Surgery should be done as reserved option and is done when all maneuvers and exercises have been attempted and failed. Singular nerve section / Vestibular nerve sectioning are some other surgical procedures advised.

Cranio-Sacral Therapy (CST)
Craniosacral therapy works directly with the most basic energy in our bodies, our very life force. It connects our cells to the intelligence that directs all living things. It reaches underneath our patterns of psychological and biological system and join them to the source of health that is much larger than our initial blueprints and our collective traumas. CST offers safe and painless treatment for Labyrinthitis by assessing and slowly moulding the bones of head and neck in cranio sacral direction to bring about great balance .this often relieves inflammation in innear ear .

Pathophysiologic mechanism for BPPV in Dentoalveolar surgery represented by an indirect injury of the posterior labyrinth due to the use of rotating tools or chiesel- mallet on the maxilla and on structures near to the temporal bone. High Turbine handpieces having ball bearings, running at 30 lb air pressure, can produce noise level of 70 to 95 db at high frequencies. Noise level greater than 70-80 db in frequency ranges of 1000- 8000 cps can cause damage to inner ear due to vibrations which may propagate through the hard structures themselves, up to the posterior labyrinth. At this structure level, vibrational mechanical energy would be transferred to the endolymphatic liquids resulting in macular trauma able to determine the otoconial separation. Membranous structures of the inner ear, enclosed in hollow bones , are particularly subject to traumatic processes due to the simple propagation of a mechanical wave involving the temporal bone , by traumas, which are not intense but repeated, especially if determined by vibrating /rotating instruments.

Conclusion -
Use of rotary tools in dentoalveolar surgery may be the iatrogenic cause for BPPV.

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