ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

SENSITIVITY AND SPECIFICITY OF THE AMER DIZZINESS DIAGNOSTIC SCALE (ADDS) IN PATIENTS WITH VESTIBULAR DISORDERS

AMER AL SAIF [1], MOHAMED FAISAL[2], HISHAM ALEM[3], MUATAZ ALMADDAH[4], SAMIRA ALSENANY[5], MUTASIM ALHARBI[6], EHAB WALY[1], DHUHA ALHAZMI [7], KHOLOUD ALBLOWI [7]

1) Assistant Professor, Department of Physical Therapy, Faculty of Applied Medical Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.
2) Lecturer, Department of Physical Therapy, Faculty of Applied Medical Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.
3) Assistant Professor and Consultant, Department of ENT, Faculty of Medicine, King Abdulaziz University.
4) Teaching Assistant, Department of Physical Therapy, Faculty of Applied Medical Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.
5) Assistant Professor in Gerontology, Public Health Department, Faculty of Nursing, King Abdulaziz University, Jeddah, Saudi Arabia.
6) Teaching Assistant, Department of Physical Therapy, Faculty of Applied Medical Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.
7) PT Intern, FAMS, PT Department, King Abdulaziz University.

Manuscript Info

Manuscript History:

Received: 15 April 2014
Final Accepted: 25 May 2014
Published Online: June 2014

Key words:
Dizziness, Dizziness Diagnostic Scale, VNG, Vertigo, BPPV, Balance, Vestibular Hypofunction

Corresponding Author

AMER AL SAIF

Abstract

[Purpose]: To investigate the sensitivity and specificity of a newly developed diagnostic tool, the Amer Dizziness Diagnostic Scale (ADDS), to evaluate and differentially diagnose vestibular disorders and to identify the strengths and weaknesses of the scale and its usefulness in clinical practice.
[Subjects and Methods]: Two hundred subjects of both genders (Male72, Females 128) aged between 18 to 60 (49.5±7.8) who had a history of vertigo and/or dizziness symptoms for the previous two weeks or less were recruited for the study. All subjects were referred from otolaryngologists, neurologists and family physicians in and around Jeddah, Kingdom of Saudi Arabia. On the first clinic visit, all the patients were evaluated once with the ADDS, following which they underwent the routine testing of clinical signs and symptoms, audiometry, and a neurological examination, coupled with tests of Vestibulo-Ocular Reflex function, which often serve as the "gold standard" for determining the probability of a vestibular deficit.
[Results]: The results showed that the ADDS strongly correlated with "true-positive" and "true-negative" responses for determining the probability of a vestibular disorder (r = .95). A stepwise linear regression was conducted and the results indicated that the ADDS was a significant predictor of "true-positive" and "true-negative" responses in vestibular disorders (R^2 = .90). Approximately 90% of the variability in the vestibular gold standard test was explained by its relationship to the ADDS. Moreover, the ADDS was found to have a sensitivity of 96% and specificity of 96%. **[Conclusion]**: The study showed that the Amer Dizziness Diagnostic Scale has high sensitivity and specificity and that it can be used as a method for differential diagnosis of patients with vestibular disorders.

INTRODUCTION:

Dizziness is one of the most common complaints in medicine and describes various abnormal sensations relating to perceptions of the body's relationship to space. The prevalence of dizziness in the general population ranges from 20% to 30%[1]. Typically, dizziness is divided into four subtypes: vertigo, lightheadedness, disequilibrium and oscillopsia, and this classification is still the basic definition of dizziness[2, 3]. In many patients dizziness causes serious functional impairments[4]. An important problem in clinical decision-making regarding patients with vestibular disorders is the trial-and-error method of diagnostic procedures, which consumes a lot of time and money for both clinicians and patients. Since the causes of vestibular disorders are multi-factorial, reaching a correct diagnosis can be quite challenging for clinicians[5, 6, 7, 8]. Currently, with the evolution of high-tech advances, a wide range of laboratory tests are available for evaluation of the vestibular and balance systems alongside clinical history; these include: video nystagmography (VNG) recording for eye examinations, caloric test and rotary chair testing, Vestibular Evoked Myogenic Potential (VEMP), Subjective Visual Vertical and Computerized Dynamic Posturography and electro nystagmography (ENG)[9,10,11]. Traditionally, electronystagmography which relies on the corneo-retinal potential to record the eye movements, has been considered the 'gold standard' for testing dizzy patients. Video nystagmography is a recent introduction which offers a multitude of advantages over traditional electronystagmography protocols. In contrast to electronystagmography, video nystagmography records the eye movements using digital video image technology, utilizing infrared illumination to determine eye position. The use of video nystagmography enables simultaneous subjective observation of eye movements together with objective collection and analysis of eye movement waveforms via computer algorithms[12]. Since dizziness is a highly subjective matter[13], the single most important element in reaching a correct diagnosis in dizziness patients is obtaining an accurate history. The Vertigo Symptom Scale (VSS) by *Yardley et al* is a disease-specific subjective questionnaire to quantify balance disorders, somatic anxiety, and autonomic severity symptoms[14]. The VSS consists of two subscales: the Vertigo scale (VSS-VER), which assesses symptoms mainly associated with disorders of the

vestibular system, and the Anxiety and Autonomic symptom scale (VSS-AA) for the assessment of a group of generic symptoms which may be associated with autonomic arousal or somatic expressions of anxiety[15,16]. Also, in 1990, *Jacobson and Newman* designed and validated a specific questionnaire for dizziness, the Dizziness Handicap Inventory (DHI), which evaluated the self-perception of the incapacitating effects on quality of life caused by dizziness. The DHI is a useful tool for physiotherapists and professional rehabilitation teams, enabling them to list patients' problems, define intervention goals, and plan and evaluate treatment and/or rehabilitation programs[17]. Even though both these scales are used in dizziness patients, they are primarily used for those who have been already diagnosed, to establish the intensity of dizziness and the functional impact of dizziness in life. But before using any of these tests and scales, it is always preferable to provide direction for the clinician as to how to proceed with further assessment and examination of a patient who presents with a complaint of dizziness so that unnecessary diagnostic procedures can be avoided.

The wide variation in patient symptoms and the lack of knowledge about the natural history of some vestibular impairments complicate the selection of patients who might be good candidates for vestibular rehabilitation. There is thus a need for sensitive and specific methods for identifying patients with vestibular impairment so as to enable the clinician or the rehabilitation member to direct them to the right treatment. For diagnosing peripheral vestibular dysfunction, the first step in the procedure is the patients' report of symptoms, which can infer the presence of a vestibular deficit. If the questions are not described properly, the outcome of the diagnosis may vary. For this reason, there is frequently a lack of association between symptoms and the actual detection of vestibular abnormalities[18]. The vestibular tests, however, do not characterize the vestibular deficit in terms of the patient's functional deficit, and thus have limited value for identifying balance deficits related to vestibular dysfunction[19]. The selection of tests for a dizziness patient will depend on a number of factors. To choose an ideal test, the clinician must consider the tests' measurement properties, the characteristics of the subjects being tested, the expertise needed by the clinician to administer the test, cost and equipment requirements, as well as the space and

time required for the test. Although there are multiple tests in existence for documenting vestibular dysfunction, the cost and the time required to perform these tests often preclude their use in general clinics. Therefore, the need arises for a simple scale to screen dizzy patients so as to differentially diagnose them on their first visit to the clinic itself and direct them to the appropriate mode of investigative procedures and management. As discussed earlier, since the causes of dizziness are multi-factorial, it may be difficult for general physicians to diagnose a patient with dizziness. Thus, the main aim of the current study was to use the ADDS as the first line of evaluation in general clinics so that even those who are not specialized in these areas can effectively screen a patient who complains of dizziness and refer him or her to the appropriate specialty for further diagnosis and management. By considering these factors, the aim of the current study is to evaluate the sensitivity and specificity of the ADDS, a newly developed diagnostic tool to evaluate and differentially diagnose vestibular disorders, which can adequately capture people with vestibular disorders and to identify the strengths and weaknesses of its usefulness in clinical practice.

SUBJECTS AND METHODS:

Subjects: Two hundred subjects aged between 18 and 60 years old (49.5±7.8) including both male and female patients who had history of vertigo and/or dizziness symptoms for the previous two weeks or less were recruited for the study. After explaining the need for the study to subjects, informed consent for this study was obtained. The study was approved by the Institutional Review Board. All subjects were referred from otolaryngologists, neurologists and family physicians in and around Jeddah, KSA and the study was conducted over a period of 11 months.

Procedure: ***Amer Dizziness Diagnostic Scale (ADDS)*****:** The Amer Dizziness Diagnostic Scale (ADDS) is administered as a structured interview where participants are asked seventeen specific questions which cover different aspects of dizziness or vertigo, such as the type of dizziness, symptoms, tempo, circumstances, history etc. The specific questions in the scale are arranged as a hierarchical decision tree and each question is aimed at one behavior and evokes a “yes” or “no” answer. The presence and severity of dizziness symptoms are rated on a scale

based on the category or section. Thus, possible scores vary from 0 to 113, with each category of scores indicating a different diagnosis Figure (1). The ADDS's seventeen questions are divided into five categories. The first seven questions are general information questions. The patients are asked about their gender, age, and their history of hypertension, diabetes mellitus, and balance problems, and also includes whether they have experience partial hearing loss associated with dizziness. These general questions are intended for statistical and future research purposes. The next three questions are specific to Unilateral Vestibular Hypofunction (UVH). First, they ask whether the patient has been diagnosed with a viral or bacterial infection in the last two weeks, such as the common cold or flu, and then whether they have experienced blurred vision with or without vomiting. The third question in this set documents whether they drift to one side when walking. The third set of questions contains two questions and has a critical value for Benign Paroxysmal Positional Vertigo (BPPV). These questions ask about the experience of dizziness while moving the head and also whether they experience dizziness with different body movements, such as bending forward or sleeping on one side. The fourth group of questions is related to Central Mediated Problem (CM), and includes only four questions. These questions ask whether patients have been diagnosed with any neurological disorders, such as stroke or multiple sclerosis. The next question asks the patient whether they had a head concussion before experiencing dizziness, and whether they experience lightheadedness or fainting while moving from sitting to standing, and whether they have ear tinnitus. The last question, which relates to all previous vestibular disorders, in addition to Cervicogenic Dizziness (CGD), is about the dizziness episodes.

Questions 1 to 16 are in YES or NO format, but question 17 is designated only for dizziness episodes. The scoring criteria for the seventeen questions are as follows; NO always equals ZERO. Questions 1 through 7 have no score, whereas Questions 8-10, will be given one point for every YES answer. Questions 11-12 are given five points for every YES answer and questions from 13-16 are given twenty points for every YES answer. For the final question, if the dizziness lasts seconds it is given 1 point, if it lasts minutes it is given 5 points and if it lasts hours it is given 20 points. The interpretation of the ADDS total score is as follows: if the total score is 0, the diagnosis is

probably a Cervicogenic Dizziness problem (CGD). Dizziness can be diagnosed as Unilateral Vestibular Hypofunction (UVH) if the total score lies between 1 and 4. Scores from 5 to 19 are interpreted as Benign Paroxysmal Positional Vertigo (BPPV), while if the score is 20 or higher, it can be interpreted as a Centrally Mediated problem. The scale is designed in such a way that at the end of the interview, the clinician is able to differentially diagnose the exact pathology and the patient can be directed to the specific diagnosis and the treatment required. The scale is of benefit for both clinicians and patients, because it avoids unwanted and expensive diagnostic procedures and saves a lot of time.

On their first visit to the clinic, all the patients who participated in the present study were evaluated with the Amer Dizziness Diagnostic Scale (ADDS) just once, followed by routine testing of clinical signs and symptoms, audiometry, and a neurological examination, coupled with tests of VOR function, which often serve as the "gold standard" for determining the probability of a vestibular deficit([19]). To measure the sensitivity and specificity, by "true-positive" or "true-negative" response, the results of both tests were then compared statistically to establish the correlation, sensitivity and specificity of the scale[(20)].

Masking and Blinding

Data was collected by researchers blinded to “gold-stand diagnosis”. Participants were instructed not to reveal the results of ADDS to the researchers during data collection. The results were analyzed using the statistical package SPSS for Windows version 19.0 (SPSS, Inc., Chicago, IL), to test the scale’s sensitivity and specificity, positive predictive value and negative predictive value of probability of a vestibular disorders. The level of statistical significance was set at $p < 0.05$.

RESULTS: Two hundred subjects (n=200) participated in this study. The demographic and baseline clinical characteristics of patients with Vestibular Disorders who were recruited in this study are presented in Table (1). Results showed that the ADDS strongly correlated with the "true-positive" and "true-negative" results ($r = 0.95$, $p < 0.05$). A stepwise linear regression was conducted and the results indicated that ADDS was a significant predictor of

"true-positive" and "true-negative" results ($R^2 = 0.90$, $p < 0.05$). Approximately ninety percent of the variability in "true-positive" and "true-negative" results was explained by its relationship to the ADDS. Moreover, the Amer Dizziness Diagnostic Scale has been found to have a sensitivity of 96% and specificity of 96% that can adequately capture a possible diagnosis of people with vestibular disorders ,Table (2). In this study, the coefficient (r) range for validity for ADDS was acceptable, at 0.766. Furthermore, content validity has been obtained through examination by a bilingual panel (Arabic and English) of 12 experts, recruited to establish the content validity of the ADDS instruments. The panel consisted of experts in the fields of, otolaryngology, vestibular therapy. However, panel experts summarized the criteria for content validity, as used in this paper for ADDS are: clear and simple wording of questions, easy to understand, relevant to purpose of the expected diagnosis, comprehensive questions, appropriate language, appropriate length for each question, no bias in responses in either direction.

DISCUSSION:

The purpose of the current study was to evaluate the sensitivity and specificity of a newly developed diagnostic scale, the Amer Dizziness Diagnostic Scale (ADDS), to evaluate and differentially diagnose vestibular disorders and adequately capture possible disorders in people with vestibular dysfunctions and to identify the strengths and weaknesses of its usefulness in clinical practice. It also aimed to understand the feasibility of the ADDS as a first-line evaluation tool in general clinics so that even those who are not specialized in these areas can effectively screen a patient who complains of dizziness and can refer him or her to the appropriate specialty for further diagnosis and management, since the cause for the dizziness is multi-factorial. Dizziness is one of the most common complaints in medicine and describes various abnormal sensations relating to perception of the body's relationship to space. Typically, dizziness is divided into four subtypes – vertigo, lightheadedness, disequilibrium and oscillopsia – and this classification is still the basic definition of dizziness[2,3]. Since dizziness is highly subjective[13], the components of the ADDS basically focus on subjective questions with which ultimately we can detect a diagnosis, and ADDS is a clinical tool that classifies the reasons for dizziness. To our knowledge, this is the first study to develop a

comprehensive scale to differentially diagnose patients complaining of dizziness, which is updated and extended to take account of key developments in research and practice in dizziness as a first-line evaluation tool. While there are many scales used in dizziness patients, such as the DHI and the VSS-VER[12-15], these scales are all basically used for patients who have already been diagnosed, to establish the intensity of dizziness and its functional impact. But before using any of these tests and scales, it is always preferable to provide direction for the clinician as to how to proceed with further assessment and examination of a patient who presents with dizziness so that the unnecessary diagnostic procedures can be avoided. We consider this study as fundamental for evaluating and treating dizziness patients appropriately. All healthcare workers will find the ADDS to be a relevant tool as well as a reliable reference guide that promotes best practice care for the differential diagnosis, evaluation and treatment of dizziness. The single most important element in reaching a correct diagnosis in dizziness patients is obtaining an accurate history. However, in the absence of a valid diagnostic scale for dizziness, the clinician is put in a difficult situation where they may not able to differentially diagnose patients. The results of this study indicate that the ADDS has high sensitivity and specificity and can be used as a method for differential diagnosis of patients with vestibular disorders. Therefore, the ADDS provides clinicians with an objective measure to help in clinical decision-making process and can be used as a first-line evaluation tool in general clinics so that even those who are not specialized in these areas can effectively screen patients who complain of dizziness and can refer them to the appropriate specialty for further diagnosis and management.

The next step in the validation of the ADDS will be to demonstrate that it has comparable reliability and validity across a range of languages and cultural settings. Translation and validation in several languages for the final version of the ADDS will include translation instructions and a list of languages that will help a variety of patients from different countries and cultural contexts in order to select additional cross-culturally relevant items to assess more demanding and social activities and to establish the reliability and discriminant validity of the ADDS. A major advantage of establishing a scale suitable for use in a wide range of contexts is that this will permit direct comparison

between studies and populations in different countries and settings. This study suggests that the ADDS is an ideal tool for this role, as it has close continuity with the best existing measure of Vestibular Disorders**.** The ADDS includes seventeen questions which are divided into five categories; the first seven questions are general information questions that are intended for statistical and future research purposes. The next three questions are specific to UVH and totally represent the features of UVH patients, especially drifting towards the same side while walking, which is a classical finding in UVH[(21)]. The third set of questions are focused on the diagnosis of BPPV, where all these patients experiences the features of dizziness while moving the head and with different body movements[(3,4)]. The fourth group of questions are related to Centrally Mediated Problems and the importance of these questions is to understand the role of different clinical specialties, as UVH and BPPV can be treated by a physical therapist, whereas if a centrally mediated problem is diagnosed, a referral and consultation with a neurologist, neuro-physiologist, neuro psychiatrist or neurosurgeon is required. Thereby each team member in the clinical rehabilitation can limit themselves in the diagnosis and management of patients with various neurological symptoms, which will ultimately benefit both the clinician and the patient [(22)]. The last question, which is about dizziness episodes, relates to all previous vestibular disorders, in addition to Cervicogenic Dizziness (CGD), and the diagnosis of CGD comes as a diagnosis of exclusion if all other possible causes are ruled out. The scale is designed in such a way that at the end of the interview, the clinician must be able to differentially diagnose the exact pathology and the patient can be directed to the specific diagnosis and treatment required for the same. This scale is of benefit for both clinicians and patients because it avoids unwanted and expensive diagnostic procedures and saves considerable time. In order to ensure the relevance and reliability of the study and the scale, we have tested the scale's specificity and sensitivity in comparison with the standard routine testing of clinical signs and symptoms, audiometry and neurological examination, coupled with tests of VOR function, which often serve as the "gold standard" for determining the probability of a vestibular deficit[(19)]. One limitation of our study is that we have excluded subjects over the age of 60, because, as stated in a study by *Landel*,[(22)] patients older than 60 years may not be physiologically stable, as many of

them are likely to have cardiovascular disorders, which might alter the scoring of the scale and can affect the results of the study. The next issue was that there were no other Dizziness Diagnostic Scales that we could rely on to serve as a standard scale for comparison or to adjust the questions. Therefore, future studies should involve patients from a wider age group by considering the factors of physiological changes, especially in the elderly, and also need to study variations in the scale outcome between genders.

CONCLUSION: This study has showed that the Amer Dizziness Diagnostic Scale (ADDS) has high sensitivity and specificity and can be used as a method for the differential diagnosis of patients with vestibular disorders.

Figure1: AMER Dizziness Diagnostic Scale (ADDS)

AMER Dizziness Diagnostic Scale (ADDS)

Name: _____

Date: _____

Therapist: _____

	Question	YES	NO
	Section 1 (no score)		
1	Gender?	[M]	[F]
2	Age?	Above 50	Below 50
3	Are you Hypertensive?		
4	Are you Diabetic?		
5	Do you have a balance problem?		
6	Do you experience double vision or blurred vision that cause vomiting?		
7	Have you experienced partial hearing loss associated with dizziness?		
	Section 2 (yes = 1, no = 0)		
8	Have you been diagnosed with a viral or bacterial infection in the last 2 weeks (cold, flu)?		
9	Do you experience double vision or blurred vision?		
10	Do you drift to one side when walking?		
	Section 3 (yes = 5, no = 0)		
11	Do you experience dizziness while moving your head?		
12	Do you experience dizziness with different body movements, like bending forward or sleeping on your side?		
	Section 4 (yes = 20, no = 0)		
13	Have you been diagnosed with any neurological disorder (Stroke, MS)?		
14	Have you had a head Concussion before experiencing dizziness?		
15	Do you experience lightheadedness or fainting when moving from a sitting to a standing position?		
16	Do you have ear Tinnitus?		
	Section 5 (No = 0, S = 1, M = 5 & H = 20)		
17	How long does your dizziness last?	No / S / M / H	
	Total (max 113) =		

Diagnosis:

☐ CGD ☐ UVH

☐ BPPV ☐ CM

Table1. Demographic and baseline clinical characteristics of patients with Vestibular Disorders (N=200)

Age (y), n (%)	Below 50 years	36 (18%)
	Above 50 years	164 (82%)
Gender, n (%)	Male	72 (36%)
	Female	128 (64%)
Diagnosis (Gold Standard)	BPPV	99 (49.5%)
	UVH	44 (22%)
	CGD	26(13%)
	CM	31 (15.5)

Table2: ADDS Indicators of sensitivity, specificity.

ADDS Indicators of sensitivity and specificity.	
Sensitivity	Specificity
0.96	0.96

REFERENCES:

1. Yardley L, Owen N, Nazareth I, et al. Prevalence and presentation of dizziness in a general practice community sample of working age people. Br J Gen Pract, 1998, 48: 1131-5.
2. Sloane PD, Coeytaux RR, Beck RS, et al.: Dizziness: state of the science. Ann Intern Med, 2001,134: 823-32.
3. Al Saif A, Alem, HB, Alsenany A: Efficiency of the Deep Head Hanging Maneuver for Anterior Canal Benign Paroxysmal Positional Vertigo. J Phys Ther Sci, 2012, 24: 1191–1193.
4. Al Saif A, Alsenany S: Physical therapy management of Anterior Canal Benign Paroxysmal Positional Vertigo by the Deep Head Hanging Maneuver. J Health Sci, 2012, 2(4): 29-32.
5. Saif A, Alsenany S: Dizziness among older adult. J Am Sci,2012, 8(8):305-309.
6. Kroenke K, Lucas CA, Rosenberg ML, et al: Psychiatric disorders and functional impairment in patients with persistent dizziness. J Gen Intern Med, 1993, 8:530-535.
7. Michael C S, Ronald J T, Lawrence E G, et al.: Optimizing the Sensitivity of the Head Thrust Test for Identifying Vestibular Hypofunction. Phys Ther, 2004, 84:151-158.
8. Nazareth I, Yardley L, Owen N, et al.: Outcome of symptoms of dizziness in a general practice community sample. Fam Pract, 1999, 16:616-618.
9. Bailey KE, Sloane PD, Mitchell M, et al.: Which primary care patients with dizziness will develop persistent impairment? Arch Fam Med, 1993, 2:847-852.
10. Delinay KA: Bedside diagnosis of vertigo: value of history and neurological examination. Acad Emerg Med, 2003, 10: 1388 – 95.
11. Al-Saif A, Al-Nakhli H, Alsenany S: Physical Therapy Examination for Patients with Cervicogenic Dizziness. J Nov Physiother, 2013, 3: (149): 1-4.
12. McCaslin DL, Jacobson GP: Current role of the videonystagmography examination in the context of the multidimensional balance function test battery. Semin Hear, 2009, 30:242–52.

13. Wrisley DM, Sparto PJ, Whitney SL, et al.: Cervicogenic Dizziness: A review of diagnosis and treatment. J Orth Sports Phys Ther, 2000, 30:755-766.
14. Yardley L, Masson E, Verschuur C, et al.: Symptoms, anxiety and handicap in dizzy patients: Development of the Vertigo Symptom Scale. J Psychosom Res, 1992, 36: 731–741.
15. Guerraz M, Yardley L, Bertholon P, et al.: Visual Vertigo: symptom assessment, spatial orientation and postural control. Brain, 2001, 124: 1646-56.
16. Zainun Z, Zakaria MN, Sidek D, et al.: Development of Malay Version of Vertigo Symptom Scale (MVVSS) for Clinical Use. Malays J Med and Health Sci, 2010, 6: 31-39.
17. Jacobson GP, Newman CW: The development of the Dizziness Handicap Inventory. Arch Otolaryngol Head Neck Surg, 1990, 116:424–427.
18. Stone J, Carson A, Sharpe M: Functional symptoms and signs in Neurology: assessment and diagnosis. J Neurol Neurosurg Psychiatry, 2005, 76: i2-i129.
19. Di Fabio RP: Sensitivity and Specificity of Platform Posturography for Identifying Patients with Vestibular Dysfunction. PhysTher, 1995, 75:290-305.
20. Lalkhen AG, McCluskey A: Clinical tests: sensitivity and specificity. J Cont Edu Anaes, Crit Care & Pain, 2008, 8:221-223.
21. Hornibrook J: A Balance Test for Chronic Perilymph Fistula. Intl J Otolaryng, 2012,1: 8-16.
22. Landel R: Dizziness: A Screening Examination and Differential Diagnostic Decision-Making Process for Physiotherapists. Physioth Sing, 2005, 3:46-50.