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PREVALENCE OF VESTIBULOCOCHLEAR ISSUES IN CHILDREN AND ADOLESCENTS WITH INCREASED SCREEN TIME

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Abstract

Background: During pandemic COVID-19 the screen time was highly increased that causes balance and hearing issues. More than 50% of children in several clinical settings report having headaches, migraines, and dizziness in addition to the most frequent childhood primary headache. In particular, vertigo and dizziness are common in children.

Objective: The objective of the study was to find out the prevalence of vestibulocochlear issues among children and adolescents with increased screen time up to or equal to 6 hours from the cities of Central Punjab, Pakistan.

Methods: The study was cross sectional. Through convenient sampling procedure sample was collected with total sample size 90. The population included children (7 to 12 years) and adolescents (13 to 20 years). Screening of vestibular issues was done by Romberg test, tandem gait test, single leg stance and fukuda step test while screening of cochlear issues was done by gross hearing test, weber test, renin test and whisper test. Consent was taken from each participant in written and verbal form.

Results: Of total 90 participants there were 44(48.9%) male and 46(51.1%) female. The prevalence of vestibular issues assessed by Fukuda test, single leg stance test, Romberg test and tandem gait test is 95.6%, 97.8%, 56.7% 55.6%, respectively. The prevalence of cochlear issues in gross hearing test, weber test, renin test and whisper test is 58.9%, 71.1%, 55.6% 55.6% respectively.

Conclusion: This study demonstrates the prevalence of vestibulocochlear issues in children and adolescents (7-20) is high, that shows symptoms of vestibular dysfunction and hearing loss is frequent. The findings suggest that vestibulocochlear issues are common concern in population because of unlimited screen time.

Keywords: Adolescents, dizziness, screen time, vertigo, vestibulocochlear disorders.

INTRODUCTION

A disruption in the body's balance system that affects how the body is perceived to move and position is known as vestibular dysfunction. The cochlea, a component of the inner ear, is referred to as the cochlear. It is in charge of translating sound waves into electrical signals that the brain can block. The cochlear nerve may malfunction and cause hearing loss. Disorders of the somatosensory, cognitive, vestibular, and balance can be brought on by central nervous system or vestibular abnormalities. Adults with vestibulocochlear dysfunction may have very dependable reasons, particularly if they also have functional, visible, vestibular, or proprioceptive problems. Postural orientation, balance, and gaze stabilization are all influenced by the vestibular system. Vestibular system malfunction might make it difficult to finish regular life activities. The vestibular system primarily affects adults, but because screen usage is growing, it may also have an impact on children and teenagers. Screen addiction can have an impact on balance and vision after five to six hours of constant use. Dizziness, vertigo, and poor balance could result from it. Both the peripheral and central nerve systems are impacted by vestibular dysfunction (1,3).

Currently usage of screen among children and adolescents is increased and many of them have their screen time upto 4-6 hours per day. It is also used for educational purpose as well as for entertainment also. During pandemic COVID-19 the screen time is highly increased that causes balance and hearing issues. Hearing issues usually arise from excessive usage of headphones and Bluetooth devices with loud volume. It usually affects the mental health and person is unable to communicate socially, as all the time was consumed by using screen and devices (headphones or Bluetooth). More than 50% of children in several clinical settings report having headaches, migraines, and dizziness in addition to the most frequent childhood primary headache. In particular, vertigo and dizziness are common in children. Both of these symptoms significantly impede children's and adolescents' physical and intellectual development if they are present. Even so, they may go unnoticed for a while because so many kids struggle with clear communication and propagation. The most frequent identification and basis for a referral for vestibular testing is the co-occurrence of headache and dizziness. Other less frequent causes include fainting spells, unsteady gait, and blurred vision (4,5).

Different visual-vestibular interactions are produced when head motions stimulate visual and vestibular receptors. It has become more challenging for medical professionals to identify the appropriate use of technology in order to monitor the benefits and drawbacks of its use by individuals. The average number of hours a day that participants spend in front of digital screens, such as those on computers, tablets, and smartphones must be taken into account. Young persons in good health who were free of mental or metabolic disorders, hearing impairment, or vestibular problems were able to participate in the tests (6).

These days, it's rather usual for everyone to wear headphones while engaging in various activities. Young people's problems with vision and balance are becoming more common as a result of ignorance. Students who watch videos for more than four to five hours a day without taking a break or a five to ten minute break may be more susceptible to negative effects on their hearing and balance.. It has also been discovered that those who use personal electronics for four hours or longer a day have higher behavioral hearing thresholds and report feeling as though their hearing is impaired. According to Portnuf, Fligor, and Arehart, the safe listening duration when using ear buds is four hours per day at 70% volume or ninety minutes per day at 80% level. Thus, extended high-volume listening sessions and prolonged screen time may cause lifelong damage to a child's hearing, balance, and general (7). One or both ears can be affected by hearing loss. It may rely on a person's listening preferences and way of living. Younger generations, those who are new to screens and headphones, kids, and college students who use their phones and headphones for up to six hours a day, five days a week, are the most likely to experience it**.** People enjoy using headphones to view movies and listen to music. It impairs their sense of hearing, and repeated exposure to loud noises damages hearing in addition to potentially impairing balance and coordination. The screen-to-body ratio when sitting is 13.3–32.9 cm and when lying down, 9.9–21.3 cm. Vertigo and dizziness are both extremely stressful diseases in children. The differential diagnosis for vertigo in children and

adolescents differs from that for adults due to the distinct etiologies that affect this population, as well as the varying prevalence of diseases. People with vestibular disorders are generally less independent in their daily activities. Data from the population was gathered using vestibular tests (such as the Romberg test, tandem gait test, single leg stance test, and fukuda test) and cochlear testing (such as the gross hearing test, weber test, renin test, and whisper test) to ascertain the prevalence of vestibular impairment. The purpose of this study was to evaluate the frequency and prevalence distribution of balance disorders in our facility in order to establish a focused clinical and instrumental diagnostic work-up and guarantee proper treatment of vertigo in children (8,9).

METHODS

The study was cross sectional. This study was conducted to find out the vestibulocochlear issues among children and adolescents with increase screen time up to or equal to 6 hours. Through convenient sampling procedure study sample was collected and total sample size was 90. The data was assembled from children (7 to 12 years) and adolescents (13 to 20 years). The data was collected from educational institutes from the cities of Central Punjab, Pakistan. Consent was taken from each participant in written and verbal form.

Screening was done on the basis of inclusion and exclusion criteria. Participants both males and females with age 7-20 (children and adolescents), screen time up to or equal to 6 hours on mobiles phone along with head phones and Bluetooth devices while distance in sitting (13.3-32.9cm), in lying (9.9-21.3cm) were included (10).

Participants with history of MSK disorder (neck pan, muscle spasm, TOS, rotator cuff tendonitis), degenerative diseases (Werdnig-Hoffman Disease, DM, epilepsy) (11), hearing aids (BTE, ITE,ITC) (12), head injury due to fall and RTA, auditory infection caused by virus and bacteria and childhood dementia (13) were excluded from the study.

The Four vestibular tests were: Romberg test (a positive test is an ability to maintain an erect posture over 60sec with eyes closed while the test is negative when a posture is maintained erect for 60sec), tandem gait test (walk in a straight line with one foot immediately in front of other, arms down by their side. The participant was asked to walk heel to toe on a straight line for 20 steps at his own pace. The last unsuccessful step was not considered in the score. The test was considered positive if the 20 step limit couldn't be reached. Stay close enough to patient to catch them if they fall), single leg stance (Stand up straight and hands placed on the hip. Bend one leg at the knee to lift your foot up. Stand and balance with the other foot. Ask the participant to hold this position for 30 seconds. The test is positive when the participant is unable to maintain this position) and fukuda test (Individuals were asked to take off their shoes, stand up right, extend their arms forward, and take 50 steps on the same spot with their eyes closed). The sensitivity and specificity of fukuda test were 53.3% and 78.6%, respectively (14).

The four cochlear tests were: Gross hearing test (Position approximately 60cm from the participant's ear and then whisper a number or word. Ask the participant to repeat the number or word back to you. If the sound is not heard clearly and participant does not repeat the number back to you or unable to understand then the test is positive. If sound is heard clearly and the participant repeats the word back to you then the test is negative), weber test (Strike the tuning fork softly. Place the vibrating fork on the middle of the head. Ask if the sound is heard better in one ear or the same in both ears), renin test (Place the vibrating tuning fork against the mastoid bone and ask the participant to tell you when the sound is no longer heard. Once the participant signals they can't hear it, the still vibrating tuning fork is placed 1-2cm from the auditory canal. The participant is asked again to indicate when no longer able to hear. If the air conduction is greater than bone conduction the test is normal. If the bone conduction is greater than air conduction than it causes conduction hearing loss. In some cases, there is sensory neural hearing loss that results false positive) and whisper test (Stay behind the participant from 1-2 feet distance. Instruct the participant to place one finger on tragus of left ear to obscure sound. Whisper the word with too distant syllable towards participant right ear. Ask participant to repeat word back. Repeat test for left ear. If the participant correctly repeats two syllable words, the test is negative).

RESULTS

Of total 90 participants there were 44(48.9%) male and 46(51.1%) female. The positive results of vestibular issues in Fukuda test are 95.6%, single leg stance test are 97.8%, Romberg test 56.7% and tandem gait test55.6%, respectively. The positive results of cochlear issues in gross hearing test are 58.9%, weber test 71.1%, renin test 55.6% and whisper test 55.6%, respectively.

Table 1 Shows result of Romberg test, Tandem gait test, Single leg stance, Fukuda test, Gross hearing test, Weber test, Renin test and Whisper test.

Tests for vestibular issues	Result	Frequency	Percent	Valid Percent	Cumulative Percent
Romberg test	**Negative**	39	43.3	43.3	43.3
	Positive	51	56.7	56.7	100.0
Tandem gait test	**Negative**	40	44.4	44.4	44.4
	Positive	50	55.6	55.6	100.0
Single leg stance test	**Negative**	2	2.2	2.2	2.2
	Positive	88	97.8	97.8	100.0
Fukuda test	**Negative**	4	4.4	4.4	4.4
	Positive	86	95.6	95.6	100.0
Tests for cochlear issues					
Gross hearing test	**Negative**	37	41.1	41.1	41.1
	Positive	53	58.9	58.9	100.0
Weber test	**Negative**	26	28.9	28.9	28.9
	Positive	64	71.1	71.1	100.0
Renin test	**Negative**	40	44.4	44.4	44.4
	Positive	50	55.6	55.6	100.0
Whisper test	**Negative**	40	44.4	44.4	44.4
	Positive	50	55.6	55.6	100.0
Total		90	100		

This table shows the percentage of positive results percentage for Romberg test is 56.7%, tandem gait test is 55.6%, single leg stance test is 97.8% and fukuda test is 95.6%. While for the cochlear issues this table shows the positive results percentage of gross hearing test 58.9%, for weber test of 71.1%, for renin test of 55.6% and whisper test of 55.6%.

DISCUSSION

Vestibular disorders can affect the peripheral or central vestibular systems, controlling and maintaining balance. Several studies have confirmed the high prevalence rate of vestibular disorders in other countries. The

study of K.Thirunavukkarasu et al. the prevalence of vestibular disorders is higher in adults with increased screen time (26) and our study concluded the same that there is increased risk of vestibulocochlear issues in persons with increased screen time. The report of RM Rine provides an overview of current literature regarding the incidence of vestibular deficits in children, the related impairments of gaze stability and balance and intervention for vestibular related impairments in children and our study also supports that fact (15).

It has been observed that prolonged screen time may cause balance impairment in children and prolonged use of headphones may affect high-frequency hearing thresholds in the study conducted by Aydogan Z et al. (16) and this supported the results of our study. The narrative review by LeBlanc et al. provides a brief history of research on sedentary behavior in the context of screen time, the evolution of screens and screen time, highlights the risks and benefits of screen-based sedentary behavior, and provides experimental evidence for reductions in habitual screen time (17).

KB Bolat et. al's study investigates the effect of increased screen time during the COVID-19 pandemic on balance in children and adolescents. Hearing issues usually arise from excessive usage of headphones and Bluetooth devices with loud volume. It usually affects the mental health and person is unable to communicate socially, as all the time was consumed by using screen and devices

(headphones or Bluetooth). In our study, usage of screen among children and adolescents is increased and many of them have their screen time upto 4-6 hours per day. It is used for educational purpose as well as for entertainment also. Visual, vestibular and somatosensory are involved in balance while CNS is involved in hearing and any disturbance in these system leads to balance and hearing issues (18).

CONCLUSION

There is marked prevalence of vestibular and chochlear issues in children and adolescents with increased screen time. The concern is based on the negative impacts of excessive usage of screen as well as Bluetooth devices in children and adolescents. Interventions and modifications in the lifestyle can be done to prevent or reduce the harmful factors that affect children and adolescents and can be motivated for healthy lifestyle at home. It includes physical activity such as playing games with other children, increase social contact and do their hobby such as gardening, painting, sketching, reading books etc in their leisure time after educational practices. It is the responsibility of parents and health care professionals to decrease the harmful effects of screen time in children and adolescents.

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