



A CORRELATION STUDY BETWEEN BALANCE IMPAIRMENT AND MOTION SENSITIVITY IN HEALTHY FEMALES OF AGE GROUP 20 TO 30 YEARS.

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Abstract :

OBJECTIVE - TO STUDY THE POSSIBLE CORRELATION BETWEEN OCCURANCE OF MOTION SENSITIVITY & BALANCE IMPAIRMENT IN HEALTHY FEMALES OF AGE GROUP 20 TO 30 YEARS, BY USING MODIFIED CLINICAL TEST OF SENSORY INTEGRATION ON BALANCE FOR BALANCE TESTING AND MOTION SENSITIVITY TEST FOR DETECTING MOTION SENSITIVITY.

METHOD - The study started with synopsis presentation to an ethical committee of P.E.S Modern College Of Physiotherapy. Ethical clearance was obtained from the ethical committee. 80 Subjects were selected from various institutions in Shivajinagar area, Pune city, based on their inclusion and exclusion criteria. Consent was taken from the subjects & they were explained about the procedure. The subjects were assessed for Motion Sensitivity. Then the subjects with MSQ- mild, moderate and severe were assessed for Balance. Then the data was calculated and analyzed.

RESULT - Spearman's rho coefficient was used to find correlation which showed value of -0.42219 which is considered moderately significant negative correlation.

CONCLUSION - This study shows there is increased balance impairment as the motion sensitivity increases in healthy females of age group 20 to 30 years

KEYWORDS - Balance, motion sensitivity, vestibular system, MSQ, MCTSIB

1. Introduction

BALANCE refers to an individual's ability to maintain their line of gravity within their Base of Support. It can also be described as the ability to maintain Equilibrium, where equilibrium can be defined as any condition in which all acting forces are cancelled by each other resulting in a stable balanced system. Systems involved in Balance – SOMATOSENSORY / PROPRIOCEPTIVE System, VESTIBULAR System, VISUAL System. The CNS receives feedback about the body orientation from these three main sensory systems & integrates this sensory feedback & subsequently generates a corrective, stabilizing torque by selectively activating muscles. Motion sickness or Motion Sensitivity, is defined as disorientation of space and is a common symptom related to dizziness and impaired Balance. (2) Possible causes of motion sickness are: Sensory conflict theory, Reflexive eye movement theory & Postural instability theory. (2) Additional symptoms associated with motion sensitivity include nausea, vomiting and cold sweating. (2) Motion sensitivity is affected by factors such as gender, age, psychological status, and environmental factors. (2) Motion sensitivity and impaired postural control can occur in healthy adults while exploring visual surroundings, particularly while standing on unstable surfaces, while travelling, moving up & down in a boat, going over bumps in a car etc. (2). Women are more sensitive to motion than men, by a ratio of about 5:3, although this may be related to reporting differences rather than true physiological differences (Cheung, B. and K. Hofer, 2002). In a large study done in India, the prevalence of motion sickness was about 28%, and females were more susceptible (27%) were more susceptible than males (16.8%). (3)

2. NEED OF THE STUDY

1. As there is a common factor i.e. Vestibular system is responsible for maintaining the Balance and that also is responsible for Motion sensitivity, there is need to study the correlation between Balance Impairment and Motion Sensitivity.
2. There are no studies done emphasising on correlation between balance disturbances and motion sensitivity in people with

motion sensitivity.

3. AIM

TO STUDY THE POSSIBLE CORRELATION BETWEEN OCCURANCE OF MOTION SENSITIVITY & BALANCE IMPAIRMENT IN HEALTHY FEMALES OF AGE GROUP 20 TO 30 YEARS .

4. OBJECTIVE

TO STUDY THE POSSIBLE CORRELATION BETWEEN OCCURANCE OF MOTION SENSITIVITY & BALANCE DISTURBANCE /IMPAIRMENT IN HEALTHY FEMALES OF AGE GROUP 20 TO 30 YEARS , BY USING MODIFIED CLINICAL TEST OF SENSORY INTEGRATION ON BALANCE FOR BALANCE TESTING AND MOTION SENSITIVITY TEST FOR DETECTING MOTION SENSITIVITY

5. HYPOTHESIS

5.1. NULL HYPOTHESIS (H₀)

There will be no correlation between occurrences of Motion Sensitivity & Balance Impairment in healthy females of age group 20 to 30 years.

5.2. ALTERNATE HYPOTHESIS

(H₁) Positive Hypothesis: There will be increased Balance impairment as the Motion sensitivity increases.
(H₂) Negative Hypothesis: There will be decreased Balance impairment as the Motion sensitivity increases.

6. METHODOLOGY

1. STUDY DESIGN : Correlation Study
2. SAMPLE SIZE : 80
3. SAMPLING METHOD: Convenient
4. STUDY POPULATION: Healthy females of age group 20 to 30 years.
5. STUDY SETTING: Physiotherapy OPD in Pune City.
6. STUDY DURATION : 6 Months

7. MATERIAL

1. Pen ,Pencil
2. Paper
3. Foam Mat
4. Marker
5. Consent form
6. Modified Clinical test of sensory integration on balance chart
7. Motion sensitivity test chart

8. CRITERIA

8.1 INCLUSION CRITERIA

1. Individuals age : 20 to 30 years
2. Females
3. Females with MSQ(motion sensitivity quotient) - mild , moderate and severe .
4. Females with normal ROM of lower limb joints.

8.2 EXCLUSION CRITERIA

1. Females of more than 30 years age.
2. Females with disability of lower limb (fractures , prosthetics)
3. Pregnant females

9. OUTCOME MEASURES

9.1 For motion sensitivity assessment- (MST) Motion Sensitivity Test (9)

9.2 For Balance assessment - Modified Clinical test of sensory integration on balance (10)

9.1 Motion Sensitivity Test (9)

The MST was administered according to the clinical protocol described by Smith-Wheelock et al. (9). Each subject performed 16 different head and/or body movements in the following order :

Position Change	Symptoms Intensity	Symptom Duration	Score (I+D)	Nystagmus
Baseline Symptoms		_____	_____	
1. Sitting↔Supine				
2. Supine↔Left side				
3. ↔Right side				
4. Supine↔Sitting				
5. Left Dix-Hallpike				
6. ↔Sitting				
7. Right Dix-Hallpike				
8. ↔Sitting				
9. Sitting↔Nose to left knee				
10. ↔Sitting erect				
11. Sitting↔Nose to right knee				
12. ↔Sitting erect				
13. Sitting↔Neck rotation				
14. Sitting↔Neckflexion & extension				
15. 180 degree turn to the right				
16. 180 degree turn to left				
		Total		
		MSQ		

1. Sitting to supine.
2. Supine to left side.
3. Supine to right side.
4. Supine to sitting.
5. Left Dix-Hallpike (sitting to supine, head hanging to the left).
6. Head up from left Dix-Hallpike.
7. Right Dix-Hallpike (sitting to supine, head hanging to the right).
8. Head up from right Dix-Hallpike.
9. Sitting with head tipped to left knee.
10. Head up from left knee.
11. Sitting with head tipped to right knee.
12. Head up from right knee.
13. Head turns while sitting.

14. Sitting head tilts.
15. 180° turn to right while standing
16. 180° turn to left while standing

9.1.1. INSTRUCTIONS

- Each subject was instructed to indicate the onset and offset of any dizziness that occurred in each position.
- The duration of dizziness, which was recorded with a stopwatch, was assigned the following values:
1 point for 5 s to 10 s of dizziness,
2 points for 11 s to 30 s of dizziness,
and 3 points for >30 s of dizziness.
- Once the duration was recorded for a position, the subject was asked to rate verbally the intensity (severity) of the dizziness just experienced on a scale of 0 to 5 (0 = no symptoms; 5 = severe dizziness).
- By adding the duration score to the intensity score, investigators calculated a raw score for each position.
- The maximum raw score for each of the 16 positions is 8 points (3 points for dizziness lasting >30 s and a score of 5 points for severe dizziness); the total possible MST raw score is 128 (8 points × 16 positions).
- The MST quotient was calculated with the use of the formula .

9.1.2. MOTION SENSITIVITY SCORE

- a. symptom intensity: subjective (patient report) scale from 0 to 5
(0 = no symptoms, 5 = severe symptoms)
- b. symptom duration: scale from 0-3
(5-10 sec = 1 point; 11-30 sec = 2 points; >30 sec = 3 points)
- c. total score = intensity + duration for each position change
- d. MSQ (motion sensitivity quotient) = (#Positions × Total Score) / 20.48
ADAPTED FROM RICHARD A. CLENDANIEL LECTURE '98
Abbott: 0-10% = mild; 11-30% = moderate; 31-100% = severe

9.2 Modified Clinical Test of Sensory Interaction in Balance (CTSIB-M)

*Administer only one trial per condition if participant able to complete first trial without loss of balance.

Condition One: Eyes Open, Firm Surface Trial One Total Time: _____ / 30 sec Trial Two Total Time: _____ / 30 sec
Trial Three Total Time: _____ / 30 sec

Condition Two: Eyes Closed, Firm Surface Trial One Total Time: _____ / 30 sec Trial Two Total Time: _____ / 30 sec
Trial Three Total Time: _____ / 30 sec

Condition Three: Eyes Open, Foam Surface Trial One Total Time: _____ / 30 sec Trial Two Total Time: _____ / 30 sec
Trial Three Total Time: _____ / 30 sec

Condition Four: Eyes Closed, Foam Surface Trial One Total Time: _____ / 30 sec Trial Two Total Time: _____ / 30 sec
Trial Three Total Time: _____ / 30 sec

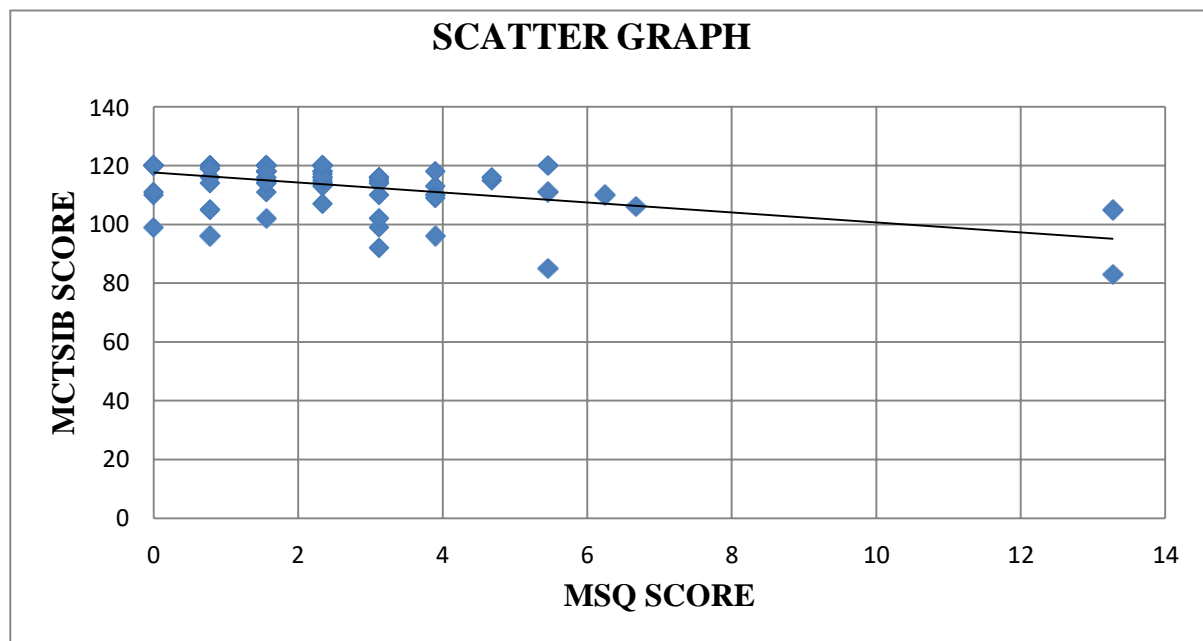
TOTAL: _____ / 120 sec

10. PROCEDURE

The study begun with the presentation of synopsis to ethical committee in PES MCOP . A n approval was granted from the committee . Various institutions were visited in and around the city . The subjects were selected based on the inclusion and exclusion criteria . Before starting the assessment , the subjects were explained about the procedure . Consent was taken from the participants who wished to participate . Baseline data was obtained . Both the outcome measures data calculations were done . This data was then used to find the correlation by using sprearmans rho coefficient . the coefficient value of -0.42219 was obtained . The P value of 0.0001 was obtained .

11. DATA ANALYSIS

Outcome measure	Spearman's rho coefficient value	P value	significance
MSQ MCTSIB	-0.42219	0.0001	Moderately significant

**12. RESULTS**

1. The study evaluated 80 female subjects between the age group of 20 to 30 years , using outcome measures motion sensitivity quotient and modified clinical test for sensory interaction on balance .
2. Spearman's rho coefficient was used to find correlation between the motion sensitivity and balance impairment which showed value of -0.42219 which is considered moderately significant negative correlation .

13. DISCUSSION

The objective of the study was to find correlation between motion sensitivity and balance impairment in healthy females of age group 20 to 30 years. In this study 80 participants were assessed and the results showed that there was increased balance impairment as the motion sensitivity increases . Motion perception is the process of inferring the speed and direction of elements in a scene based on visual, vestibular and proprioceptive inputs. ^[11]There are many theories described for motion sensitivity that are neural mismatch theory , sensory conflict theory .^[11,12]Neural mismatch theory says motion sickness arises from conflicting information processed within a multimodal sensory system whose function is to determine the individual's motion relative to his/her environment.^[12]Sensory conflict theory says ,motion sickness results when the brain receives conflicting information about body movements from the visual and vestibular receptors and the proprioceptive system ('sensory mismatch').^[11] The complex vestibular system which is situated in inner ear has bones and cartilage and fluid filled semi-circular canals, those canals play significant role in perceiving the position of head in space according to the motion of head in space, that is perceived as the head moves the position of fluids in the semi-circular canals changes that gives the brain signals as a part of vestibular system's inputs . The vestibular inputs are one of the 3 responsible inputs that further integrate in CNS and modulated by the other higher centres for maintaining balance control .And the same vestibular inputs are mixed or are in conflict with the other 2 system's input that gives rise to motion sensitivity .So as the conflicts occur during episodes of motion sensitivity , the inputs are mixed and are in conflict which gives rise to balance impairment during that period .Very few studies are found that are related with motion sensitivity and balance . Johnson EG studied that the healthy young adults without chronic sub-clinical motion sensitivity have better postural control than those with chronic sub-clinical motion sensitivity. ^[2]

14. CONCLUSION

1. This study shows there is increased balance impairment as the motion sensitivity increases in healthy females of age group 20 to 30 years .
2. Hence null hypothesis and negative hypothesis are rejected and positive hypothesis is accepted .

15. CLINICAL IMPLICATIONS

1. As the study has shown negative correlation there is a need of preventing balance impairment for the people with balance impairment in motion sensitivity .

16. LIMITATIONS

1. The study included only female participants .
2. The females in age group of 20 to 30 years were only evaluated.

17. FUTURE SCOPE OF STUDY

1. The same study can be conducted for wider range of population that is , for all the genders and age groups .
2. The strategies to improve balance can be taught to these subjects with increased motion sensitivity .
3. Strategies , exercises to reduce motion sensitivity can be discovered for these subjects .
4. The study can be conducted for the people having balance impairment for the presence of motion sensitivity .
5. The study can also be conducted to see the effect of balance training on motion sensitivity .

18. REFERENCE

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19. IMAGES



19.1, 19.2 Some of Motion sensitivity test positions (position no. 9 , 8)



19.3, 19.4 MCTSIB POSITIONS (on foam mat & hard surface)

