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TO CORRELATE THE EFFECT OF FORWARD HEAD POSTURE WITH HAND – EYE COORDINATION IN YOUNG ADULTS HAVING SEDENTARYLIFESTYLE

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Abstract

Purpose:
To correlate & compare the effect of forward head posture on hand – eye coordination in young males and females having sedentary lifestyle.

Methods:
60 subjects (30 females and 30 males) between the age group 20 – 30 years with normal BMI & sedentary lifestyle were included for the results through random sampling technique . Group A had 30 females. Group B had 30 males. Alternate hand wall test was used to monitor the ability of the athlete's vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of catching a ball (hand-eye coordination). After this, posture estimation was done and three angles were marked: Sagittal Head Angle (SHA), Crania- Vertebral Angle (CVA) & Shoulder Angle (PS).
The pictures were evaluated to measure the respective angles using IMAGE TOOL – UTHSCSA.

Results:
The between group comparison shows that all three angles shows significant effect on test score in both Group A and Group B which was 43.39 ± 3.93 and 44.20 ± 4.57 respectively.
The within group A comparison shows SHT shows highest effect on test score as compared to CVA & PS in Group A. CVA shows non – significant effect while PS shows significant effect.
The within group B comparison shows SHT & PS shows near effect on test score as compared to CVA which shows less significant effect in Group B.

Conclusion:

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To conclude, our study suggests that there was significant effect of FHP on hand – eye coordination in young females and males having sedentary lifestyle. Also, there was more significant result in case of females as compared to males. Thus, rejecting null hypothesis and accepting the alternate hypothesis.

Key Words: Sagittal Head Angle (SHA), Crania-Vertebral Angle (CVA), Shoulder Angle (PS), Alternate hand wall test, Posture estimation, Sedentary lifestyle

抽象的

目的：

关联和比较头部前倾姿势对久坐不动的年轻男性和女性手眼协调的影响。

方法：

60 **名受**试者（30 **名女性和** 30 **名男性）年**龄在 20-30 岁之间，BMI **和久坐的生活方式正常**, **通**过随机抽样技术获得结果。 A组有30**名女性。** B组有30**名男性。交替手**墙测试用于监测运动员视觉系统协调通过眼睛接收到的信息以控制、引导和指导双手完成接球（手眼协调）的能力。在此之后，完成姿势**估**计并标记三个角度：矢状头角（SHA）**、**颅骨角（CVA）**和肩角**（PS）。

使用 IMAGE TOOL – UTHSCSA 评估图片以测量各自的角度。

结果：

组间比较显示，所有三个角度对A组和B组的考试成绩均有显着影响，分别为43.39±3.93**和** 44.20±4.57。

A 组内的比较显示，与 A 组中的 CVA **和** PS **相比**, SHT 对测试分数的影响最大。 CVA 显示非显着影响，而 PS 显示显着影响。

B 组内的比较显示，与 CVA **相比**, SHT **和** PS 对测试分数的影响接近，后者在 B 组中显示出较小的影响。

结论：

总而言之，我们的研究表明，FHP 对久坐不动的年轻女性和男性的手眼协调能力有显着影响。此外，与男性相比，女性的结果更显着。因此，拒绝零假设并接受备择假设。

关键词：矢状头角 (SHA)、颅椎角 (CVA)、肩角 (PS)、交替手墙测试、姿势估计、久坐生活方式

I. Introduction

A forward head posture is one in which the head is positioned anteriorly and the normal cervical convexity is increased with the apex of the lordotic cervical curve at a considerable distance from the LoG in comparison with the optimal posture. This forward translation of the head leads to flexion of the lower cervical spine and extension of the upper cervical spine. (47)

This causes abnormal compression on the posterior zygopophyseal joints and posterior portions of the intervertebral disks and narrowing of the intervertebral foramina in the lordotic areas of cervical region. (1)

Forward head posture can also lead to Forward tilting of the head. (1), Chronic pain in the neck, shoulders, upper, lower and middle back. (1), Rounded shoulders. (1), Temporo- mandibular joint (TMJ) dysfunction. (7), Fatigue, Arthritis. (7), Decreased appetite. (1), Muscle spasms, Numbness or tingling in the hands and arms, Tightness, soreness and pain in the neck and chest muscles. (8), Insomnia or poor sleep. (9,10)

Eye–hand coordination is the coordinated control of eye movement with hand movement, and the processing of visual input to guide reaching and grasping along with the use of proprioception of the hands to guide the eyes. It is part of the mechanisms of performing everyday tasks; in its absence, most people would be unable to carry out even the simplest of actions such as picking up a book from a table or playing a video game. (16)

The eyes provide spatial information for the hands. (17) The duration that the eyes appear to be locked onto a goal for a hand movement varies—sometimes the eyes remain fixated until a task is completed. Other times, the eyes seem to scout ahead toward other objects of interest before the hand even grasps and manipulates the object.

When eyes and hands are used for core exercises, the eyes generally direct the movement of the hands to targets.[18] Furthermore, the eyes provide initial information of the object, including its size, shape, and possibly grasping sites that are used to determine the force the fingertips need to exert to engage in a task.

For sequential tasks, eye-gaze movement occurs during important kinematic events like changing the direction of a movement or when passing perceived landmarks.[19] This is related to the task- search-oriented nature of the eyes and their relation to the movement planning of the hands, and the errors between motor signal output and consequences perceived by the eyes and other senses that can be used for corrective movement. The eyes have a tendency to “re-fixate" on a target to refresh the memory of its shape, or to update for changes in its shape or geometry in drawing tasks that involve the relating of visual input and hand movement to produce a copy of what was perceived.

[20] In high accuracy tasks, when acting on greater amounts of visual stimuli, the time it takes to plan and execute movement increases linearly. [21]

Impaired head-eye movement control is an identified problem in patients with chronic neck pain. Symptoms associated with head-eye movement control impairment are dizziness, headache, light- headedness and visual disorders. (23)

Thus, it is providing a correlation that symptoms associated with forward head posture affects coordination between hand and eye while focusing on the tasks.

Hand – eye coordination is an integral part of our life which is used in each and every zone of activities. And the postural deviation like FHP is commonly seen due to lack of exercises and advancement of technology. Thus, the result of the study may be useful in determining the correlation between the two.

II. Methods

Design Of The Study

This study was a correlational study between the angles used to measure FHP and hand – eye coordination. Measurements were taken and readings for the test were taken 3 times to dilute the errors.

Source Sample And Sample Size

60 subjects (30 females and 30 males) between the age group 20 – 30 years were included for the results.

Group A had 30 females. Group B had 30 males.

Instrumentation And Tools Used

• Alternate hand wall test (35): This included throwing of a tennis ball over the triangle made on the wall 2 metres away from the subject. The objective of the test is to monitor the ability of the athlete's vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of catching a ball (hand-eye coordination).

Tools used:

Measuring tape, tennis ball, stopwatch, smooth wall, camera PROCEDURE

1. Signed information consent were obtained from the subjects.

2. The exclusion criteria were ruled out one by one by taking subject’s history.

3. This test requires the subject to throw and catch a tennis ball off a wall.

The subject warms up for 10 minutes

The subject stands two metres away from a smooth wall

The researcher gives the command "GO" and starts the stopwatch

The researcher throws a tennis ball with their right hand against the wall inside the triangle and catches it with the left hand, throws the ball with the left hand and catches it with the right hand. This cycle of throwing and catching is repeated for 30 seconds

The researcher counts the number of catches and stops the test after 30 seconds. The researcher records the number of catches.

4. The test was repeated for another 2 times.

Posture Estimation

1. Each subject was then assessed for the FHP.

2. 2 pictures were taken from the lateral side of the subject.

3. Three angles were marked with the help of markers.

Sagittal head tilt angle - Angle A – It is the angle between lateral canthus of the eye and midpoint of the tragus and the horizontal line through the middle of the tragus.

Craniovertebral angle – Angle B – It is the angle between the midpoint of the tragus and C7 spinous process and the horizontal line through the spinous process of C7.

Shoulder angle – Angle C – It is the angle between the midpoint of the humerus and C7 spinous process and the horizontal line through the midpoint of the humerus.

4. The pictures were evaluated to measure the respective angles using IMAGE TOOL – UTHSCSA. (36)

III. Inclusion Criteria

1. Age group – 20 to 30 years was selected.

2. Both male and female subjects were selected.

3. Normal BMI

4. Sedentary lifestyle

IV. Exclusion Criteria

1. Any sort of visual or motor impairment.

2. Amputees

3. Myopic or hypermetropic individuals.

4. Recent treatment for neck, thoracic and lumbar disorders.

5. Any sort of neurological disorders.

6. Any sort of psychiatric disorders.

V. Results

Demographic Data Of Subjects Of Two Groups

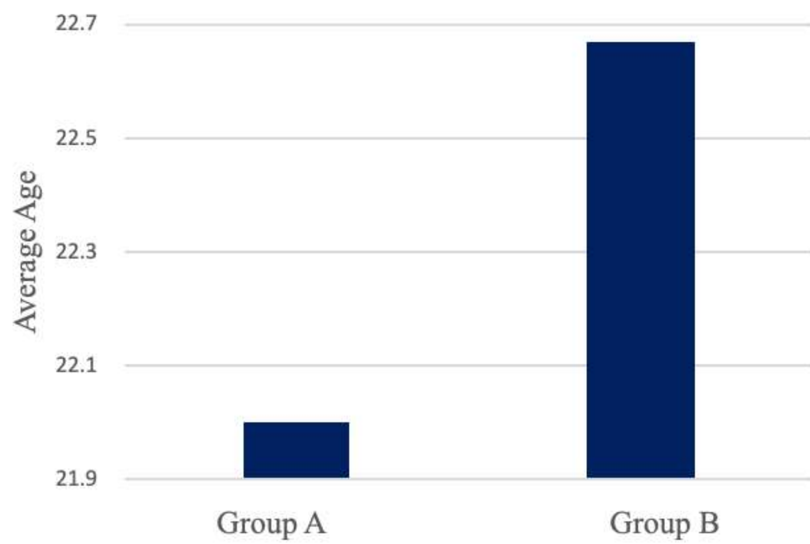
Young adults (n= 60) in the age group of 20 – 30 years were included after they met the inclusion criteria. Female participants were assigned to female group and male participants were assigned to male group.

The Mean ± Standard Deviation of 30 adults in group A were: age = 22.66 ± 2.75 & of 30 adults in group B were: age = 22 ± 2.27. There was no significant difference in demographic characteristics

i.e. age between 2 groups.

AGE	GROUP A (n=30)		GROUP B (n=30)	
	Mean	S.D.	Mean	S.D.
	22.66	2.75	22	2.27

TABLE 6.1 – Table of Demographics



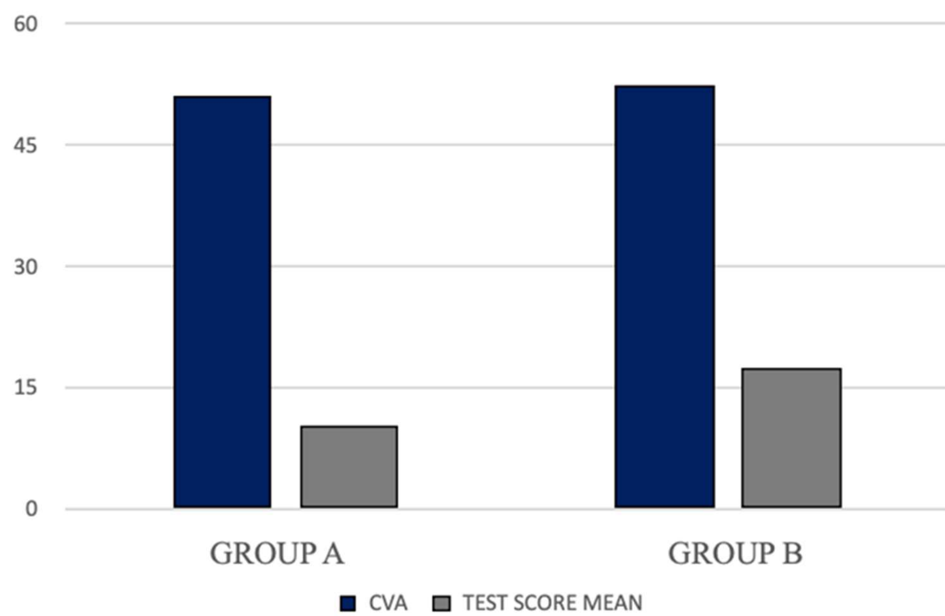
GRAPH 6.1 – Average Age for Group A and Group B.

CVA OF SUBJECTS OF TWO GROUPS

The between group comparison shows that CVA shows non – significant effect on test score in both Group A and Group B which was 51.11 ± 4.75 and 52.40 ± 4.99 respectively.

CVA	GROUP A (n=30)			GROUP B (n=30)		
	Mean	S.D.	PCC	Mean	S.D.	PCC
	51.11	4.75	- 0.04	52.40	4.99	0.17

TABLE 6.2 – Comparison of CVA between Group A and Group B



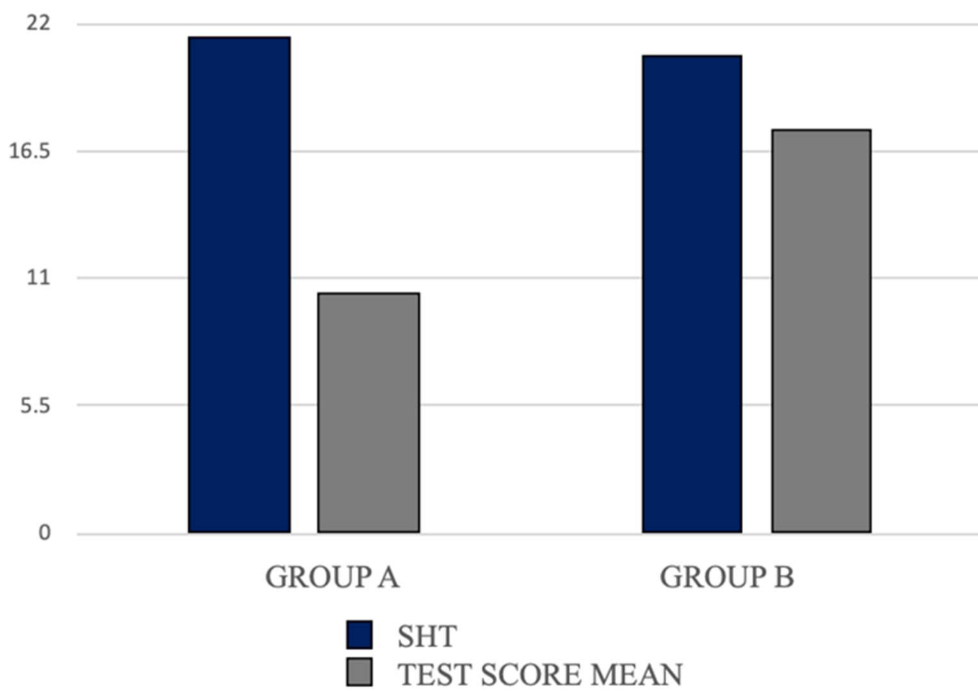
GRAPH 6.2 – Comparison of test score and CVA between the groups.

<u>SHT OF SUBJECTS OF TWO GROUPS</u>

The between group comparison shows that SHT shows significant effect on test score in both GroupA and Group B which was 21.45 ± 12.51 and 20.65 ± 5.99 respectively; more on Group A.

SHT	GROUP A (n=30)			GROUP B (n=30)		
	Mean	S.D.	PCC	Mean	S.D.	PCC
	21.45	12.51	0.84	20.65	5.99	0.71

TABLE 6.3 – Comparison of SHT between Group A and Group B



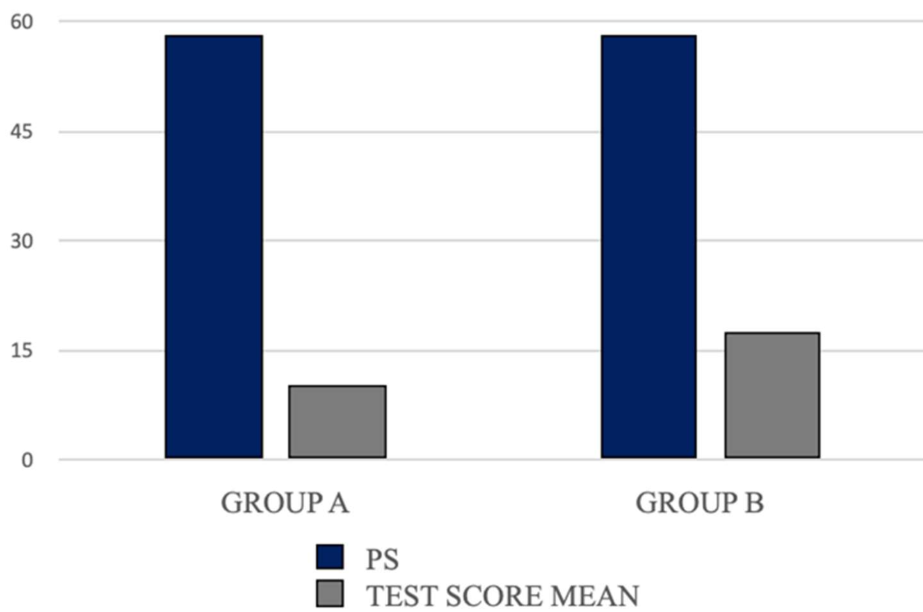
GRAPH 6.3 – Comparison of test score and SHT between the groups.

<u>PS OF SUBJECTS OF TWO GROUPS</u>

The between group comparison shows that PS shows significant effect on test score in both GroupA and Group B which was 58.34 ± 10.55 and 58.28 ± 7.42 respectively.

PS	GROUP A (n=30)			GROUP B (n=30)		
	Mean	S.D.	PCC	Mean	S.D.	PCC
	58.34	10.55	0.75	58.28	7.42	0.70

TABLE 6.4 – Comparison of PS between Group A and Group B



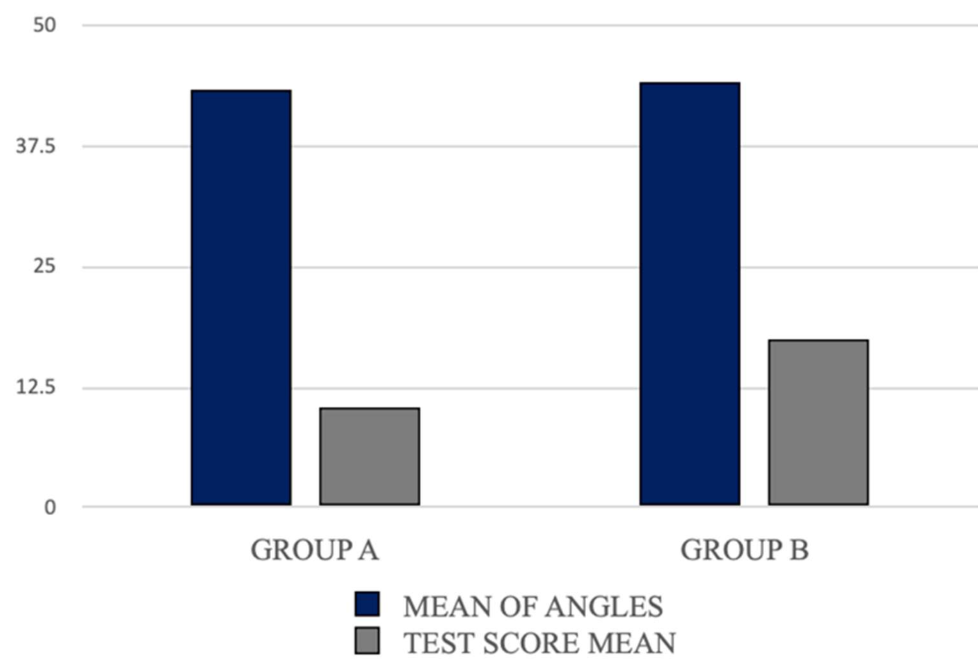
GRAPH 6.4 – Comparison of test score and PS between the groups.

MEAN OF ANGLES OF SUBJECTS OF TWO GROUPS

The between group comparison shows that all three angles shows significant effect on test score inboth Group A and Group B which was 43.39 ± 3.93 and 44.20 ± 4.57 respectively.

CVA + SHT + PS	GROUP A (n=30)			GROUP B (n=30)		
	Mean	S.D.	PCC	Mean	S.D.	PCC
	43.39	3.93	0.89	44.20	4.57	0.85

TABLE 6.5 – Comparison of all three angles between Group A and Group B



GRAPH 6.5 – Comparison of test score and all three angles between the groups.

<u>ANGLE COMPARISON OF SUBJECTS OF GROUP A</u>

The within group comparison shows SHT shows highest effect on test score as compared to CVA & PS in Group A. CVA shows non – significant effect while PS shows significant effect.

ANGLE	MEAN	S.D.	PCC
CVA	51.11	4.75	- 0.04
SHT	21.45	12.51	0.84
PS	58.34	10.55	0.75

TABLE 6.6 – Comparison of the angles within Group A.

ANGLE COMPARISON OF SUBJECTS OF GROUP B

The within group comparison shows SHT & PS shows near effect on test score as compared to CVA which shows less significant effect in Group B.

ANGLE	MEAN	S.D.	PCC
CVA	52.40	4.99	0.17
SHT	20.65	5.99	0.70
PS	58.28	7.42	0.70

TABLE 6.7 – Comparison of the angles within Group B.

VI. Discussion

The objective of the study was to find the correlation between forward head posture and hand eye coordination. The data analysis shows that there is a positive correlation exists between the forward head posture and hand eye coordination.

When the Group A and Group B was compared, Group A showed more positive correlation i.e. Pearson correlation coefficient value 0.89 as compared to Group B with PCC value 0.85.

This study also found that male subjects have faster simple reaction compared to female subjects as their test score was better than females.

In this study, females showed a lower resting CV angle than males, which is in accordance with Hakala et al., who found females had 2-3° more neck flexion than males in a study of standing cervical habitual posture. Also in adults, significant sex differences in CV angle have been observed

previously, with women having a more forward head position than men. This posture of greater flexion in females can be attributable to psychosocial issues, such as stress, or partly associated with the development of secondary sex characteristics in females. Regarding shoulder angle and sagittal head tilt, we found similar mean values in boys and girls. This was further supported by Raine and Twomey in their research. (46)

According to the study, rather than individual angle, it is the mean of all the three angles which is showing a positive correlation with the hand – eye coordination. It is essential to use both cranio- vertebral angle and head tilt angle to evaluate cranio-cervical posture more accurately. (47)

The mechanism behind the above result can be suggested as follows.

Head movements of variable amplitude and velocity accompanied the eye movements in various tasks. In most activities, gaze movements to single targets have indicated that eye and head are strongly coupled, despite flexibility in gaze change in terms of timing and contribution of each (Ron and Berthoz 1991). (43) A synergy is created between head and hand to regulate the cycle of movements.

Coordination of eye and hand movements was preserved by initiating the hand movement at about the same time as the eye movement to guide pickup and placement. This meant that hand movements were delayed when an information gathering fixation was interposed, until the fixation was almost complete.

Maintaining a fixed timing between eye and hand was probably most critical for having the eye available for visual guidance of the final phase of the movement, rather than for initial targeting. The head movements reflected the additional influence of either the hand movement or the final gaze target. (43) The control system for eye-hand-head coordination into two stages. The first is an early representational stage where multiple visual targets are represented and mapped in a retinal frame. Thus, one might speculate that only the target that is selected for action is put through the subsequent transformations of the second visuomotor execution stage. The latter stage would involve the computations required to compute motor commands in multiple head- and body-centric reference frames, i.e., comparisons with eye and head orientations, computation of kinematics and dynamics of the arm and so on. (44)

We observed the coordination of unrestricted eye, head, and hand movements during performance of a task involved acquisition of visual information, alternating with visually guided hand movements for pickup and placement. (43)

Also, the lower and upper cervical spine can change because of the dependency of the head posture to vision and hearing senses on the lower cervical spine position. (47)

The change in the lower cervical spine (increased flexion) is based on the biomechanical principle relating an increased lever arm (from head center of mass to head/neck and neck/ thorax axes of rotation) with increased gross moment. Johnson suggested that prolonged FHP might increase loading to the non-contractile structures and abnormal stress on the posterior cervical structures and cause myofascial pain.

Thus, the head, eye and hand should be well coordinated in a task & also, head movements influence the hand movement. Therefore, FHP affects the biomechanics of the head which in turn affect the hand – eye coordination.

Future Research

More research is required to clarify the role of sex in cervical posture.

More work is required to clarify angle specific effect on hand – eye coordination

VII. Conclusion

To conclude, our study suggests that there was significant effect of FHP on hand – eye coordination in young females and males having sedentary lifestyle. Also, there was more significant result in case of females as compared to males. Thus, rejecting null hypothesis and accepting the alternate hypothesis.

Ethical Approval

Institute of Applied Medicines & Research, CCS University

All participants gave written consent form before data collection begin.

Conflict Of Interest

No conflict of interest

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