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Original Research Article

Effect of playing basketball on the posture of cervical spine in healthy collegiate students

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Abstract

Objective: To assess and compare the cervical posture of collegiate students and collegiate basketball players.
Procedure: Craniovertebral angle and Sagittal head tilt were measured using photogrammetric method in 15 collegiate students and 15 collegiate basketball players.

Results: Significant differences were not found between two groups for any of the two angles at $p<0.05$.
Conclusions: Playing basketball does not place any significant impact on the posture of cervical spine of collegiate students.
Keywords: posture, basketball, craniovertebral angle, sagittal head tilt

1.Introduction

The cervical spine has a natural lordosis. From this extended position the neck flexes and extends further in the sagittal plane. Apart from flexion and extension movements, protraction and retraction occur in this plane. With protraction, the upper cervical spine gets extended and lower cervical spine gets flexed. While reverse happens during retraction. Prolonged periods of protraction lead to biomechanical alteration in the posture of the head and neck which is known as forward head posture[1] and such a posture has been considered to be poor[2].

Majority of the general population is either right handed or left handed and only very few people use both the hands equally for all activities of daily living. According to Kendall this one handed dominance leads to postural asymmetries such as unequal level of shoulders, pelvis etc. It is believed that playing sports leads to better body posture and sports persons thus would not possess postural asymmetries. However, this belief has been supported and refuted by many researchers in the past who had conducted studies on various sports persons (volleyball players, gymnasts, table tennis players, basketball players, football players, tennis players and swimmers). It is only recreational sports which are thought to bring about a better alignment of the body. The reason for postural asymmetries in sports persons who play at the professional level is thought to be repetitive one-sided overloading of the body which leads to postural changes. This is quite typical of overhead sports such as volleyball, javelin throw, basketball, pitching, tennis etc. where either left or right hand is used for throwing, thus, leading to accumulation of load on that side of body. It has been thus suggested that double-sided training should be incorporated into the training regimes of sports persons. This would help not only in prevention of postural asymmetries but would also help the players in quicker correction of technical mistakes since cerebral hemispheres would get stimulated in a better manner when double-sided techniques are used[3]-[10].

Students who would be at a greater risk of various injuries and musculoskeletal pain in future can be identified. If better posture is found out in basketball players as compared to the students, this will strengthen the concept of doing daily exercises and that engaging in physical activity is a good idea for maintenance of better posture. If poor posture is found out in basketball players this will suggest that sporting activities place additional demands over the musculoskeletal structures of the body, leading to postural imbalances and apart from doing sport specific exercises which utilize only some muscle groups excessively, some symmetric exercises should be done on regular basis. If similar kind of posture will be found in both the groups, this will imply that, this kind of posture is common at the age of 18 to 25yrs and should be considered as normal for this age group and can be used as a reference for the future studies.

2. Materials and Methods

A total of 30 subjects were recruited such that group1 had 15 collegiate students and group2 had 15 collegiate basketball players. Only full- time male students aged 18 to 25 years having BMI ranging from 18.5 to 24.9 were recruited for both groups. Additionally group 2 subjects were engaged in at least six months of regular basketball training. Subjects were excluded if they had any history of back, neck or shoulder pain or trauma in last 6 months, any history of spinal or shoulder surgery, scoliosis, Rheumatoid arthritis, Ankylosing Spondylitis, osteoporosis or any other systemic disorder or infection. The study was approved by the Ethical Committee of Jamia Millia Islamia, New Delhi, India and an informed consent form was taken from the subjects prior to the collection of data.

The spinous process of C7 vertebra of the subject was marked. Subject looked straight forwards after marching on the spot for 10 seconds. A head-to-toe photograph of the right lateral side of the subject's body was clicked with a Kodak Easy Share z612, 6.1 Mpi, 12X digital camera being placed 3 meters ahead of the subject on a tripod such that the height of camera lens' centre was equal to approximately half the subject's height[11].

Analysis of photographs was done using the UTHSCSA Image tool program (developed at the University of Texas Health Science Center at San Antonio, Texas)[12]-[15] on a HP vs 15 computer. The angles that were measured are[16]-[20] [Figure1(a-b)]:

1) **<u>Craniovertebral angle</u> (CVA):** angle between C7, tragus and horizontal. It is a measure of forward head posture. A greater value indicates a more forward position of head.
2) **<u>Sagittal head tilt</u> (SHT):** angle between tragus, eye canthus and the horizontal. It is a measure of head extension and is used to determine posture of upper cervical spine. A lesser value indicates a more forward position of head i.e. more of upper cervical spine extension.

Figure 1a: Craniovertebral angle

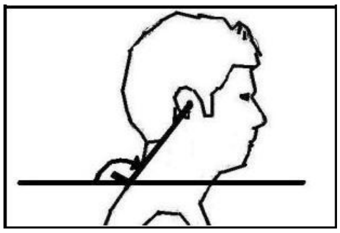
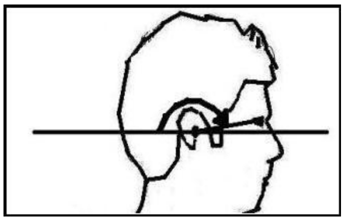


Figure 1b: Sagittal head tilt



2.1Statistical methods

SPSS version 16.0 was used to find out t-value using unpaired t-tests (two-tailed) with alpha being set at 0.05 level.

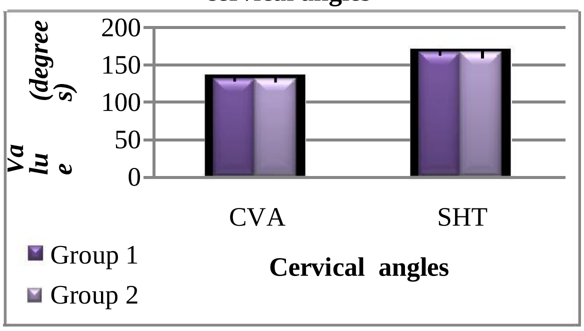
3. Result and Discussion

Absolute values of t for CVA and SHT came out to be 0.222 (p=0.826) and 0.505(p=.618), respectively (Table 1, Figure 2). Significant differences were not found between the two groups for any of the above two variables at $p<0.05$.

Table 1: Mean and Standard Deviation values of cervical angles

Postural angle (degrees)	Group 1		Group 2	
	mean	*SD	Mean	*SD
CVA	129.65	3.56	130	4.83
SHT	165.15	4.49	164.21	5.61
	*Standard Deviation			

Figure 2: Mean and Standard Deviation values of cervical angles



3.1 Craniovertebral angle

A statistically significant difference was not found for craniovertebral angle between the two groups. Harrison et al[21] reported neck inclination angle of 49.3º which means a craniovertebral angle of

130.7º which is in close proximity with our findings. In another study by Raine and Twomey[16], mean sagittal C7 tragus angle i.e. craniovertebral angle was reported to be 127.8±5.2º (n=21, aged 17 to 29 years) which is only slightly lesser than the value that we are reporting for the students group and the difference between their and our mean values does not seem to be significant.

The reason for a non-significant difference between the mean values of two groups is that head and neck do not contribute to the coordinated sequence of actions required for shooting during the game of basketball. During shooting (which is an overhead throwing task) all the body segments are required to function in a coordinated manner for generation of forces required for the propulsion of the ball towards the basket. This coordinated sequencing of the segments in a distal to proximal manner is termed as the "kinetic chain". Normally, during the act of throwing, the force is generated by the legs and trunk which is delivered to the arm via. the shoulder so as to release the ball. The legs and trunk provide a stable base so that the motion of the arm can take place and the scapula acts as a link between distal and proximal segments of the kinetic chain. The forces are generated by the ground reaction forces, knee extension, hip extension and extension of trunk from flexion to neutral which would be guided, directed and increased by doing shoulder flexion. The shoulder is thought to act as a funnel through which the generated forces are passed on to the forearm and hand, where after the ball is released with concentric actions of elbow extensors and wrist flexors[22]-[25].

It is evident from the above facts that during this sequence of events, head and neck are not required for either the generation of forces or for the transmission of forces to the arm and hand. Thus, much of muscular activity does not take place at this region of the body during throwing and shooting activities apart from maintaining a normal upright position of the head that is required for focusing on the target. Thus, it can be said that basketball players do not differ from the students regarding the head posture with respect to C7 vertebra in the sagittal plane and that the former possess craniovertebral angle values very close to the values reported in previous studies for non-sporting population of similar age group.

3.2 Sagittal head tilt

It is a measure of upper cervical spine extension. With forward head posture, the sub-occipital muscles get shortened and the anterior neck flexors in turn get lengthened, thus, producing hyperextension at the upper cervical spine (C0-C1-C2). However, since a significant difference could not be found between the two groups pertaining to forward head posture, thus, it accounted for a non-significant difference even in the case of upper cervical spine extension i.e. sagittal head tilt.

Our values (165.2±4.5 º for group 1 and 164.2±5.6 º for group 2) seem to be in close proximity to the findings of Chansirinukor et al [17] and Harrison *et al* [21] who had reported the craniohorizontal angle (in the standing position without carrying a backpack, n=13, age=13-16 years) and cranial rotation angle as the equivalent of 163.7º sagittal head tilt (180º – 16.3º) and 161.2º sagittal head tilt (180º – 18.8º), respectively, unlike a mean sagittal angle equivalent to 159.95º of the current sagittal head tilt (180º – 20.05º) reported by Neikerk et al [26]. However, the latter had measured the postural angles in the normal sitting position rather than standing and thus, might have led to the differences in the results. It is noteworthy that not even a single subject (either belonging to group 1 or group 2) demonstrated a sagittal head tilt value of greater than 180º (a sagittal head tilt value of greater than 180º represents a relative upper cervical spine flexion) which is considered essential for the maintenance of ideal cervical lordosis (at mid and lower cervical spine). This indicates that it is almost impossible to find ideal cervical spine posture now-a-days in a population aged 18 to 25 years. In fact only one out of fifteen collegiate students and three out of fifteen collegiate basketball players possessed sagittal head tilt values of greater than 170º. In consideration of all the above facts, we can deduce that playing basketball does not impose any significant impact on the posture of the upper cervical spine in the sagittal plane.

4. Conclusion

Playing basketball does not place any significant impact on the posture of the cervical spine of the collegiate students.

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