EFFECT OF FORWARD HEAD POSTURE ON STATIC AND DYNAMIC BALANCE

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ABSTRACT

Introduction: Forward head posture is one of the commonest postural malalignment. Very few studies have been done in Indian population to check the effect of forward head posture on static and dynamic balance. In forward head posture, center of gravity (COG) of head shifts in antero-superior direction, increasing the load on the neck causing dysfunction of musculoskeletal system and neuronal system.

Objectives: 1: To assess forward head posture using universal goniometer 2: To assess static and dynamic balance using modified CTSIB 3: To assess effect of Forward head posture on static balance and dynamic balance. Materials and method: This study included 50 participants of age group 18-45 years. Individuals with symptomatic and asymptomatic forward head posture and individuals who are able to carry out their ADL independently were included in study. Individuals with any auditory, visual problem, structural deformity and surgery at any joint of lower limb, history of epilepsy, any disease affecting the balance and neuromuscular control were excluded. From the selected subjects their forward head assessment was performed by using a universal goniometer. Static and Dynamic balance assessment was done using firm and foam surface using Modified CT-SIB. Result: 6% subjects had impairment in static balance (eyes closed), 48% subjects had impairment in dynamic balance(eyes open), 86% subjects had impairment in dynamic balance(eyes closed). The impairment in dynamic balance was found to be greater than static balance. Conclusion: Forward head posture has effect on static and dynamic balance.

KEYWORDS: Forward head posture, Static balance, Dynamic balance, Modified CTSIB.
INTRODUCTION
Posture is defined as positioning of all body segments at a given point. In static posture, the body and its segments are aligned and maintained in certain positions. Dynamic posture refers to postures in which the body and its segments are moving. Proper posture is achieved by maintaining the musculoskeletal balance associated with minimal stress on the body and is considered an important factor in assessment of health condition.\(^1\)

Forward head posture is considered the most common postural deformity. Forward head posture is the abnormal posture, where the head protrudes forward from the sagittal plane and appears to be positioned in front of the body. In forward head posture there is anterior tilting of cervical spine.\(^2\)

Forward head posture increases extension of atlanto-occipital joint and upper cervical vertebrae as well as flexion of lower cervical and upper thoracic vertebrae, this posture causes persistent and abnormal contraction of the suboccipital, neck, and shoulder muscles.\(^2\)

In forward head posture, center of gravity (COG) of the head shifts in antero-superior direction, increasing the load on the neck which causes dysfunction of musculoskeletal system and neuronal system.\(^2\)

The muscles around the head and shoulder, including the trapezius, sternocleidomastoid, suboccipital, and temporal are affected by forward head posture, which further worsen postural deformity. These changes cause persistent and abnormal pressure in the muscles, fascia, and nerves of the neck and shoulders and rounding of shoulder occurs to compensate for this deficit, which in turn, causes high load on the superior trapezius and levator scapula muscles.\(^2\)

Forward Head Posture is commonly evident in people repeatedly using computers, watching television, playing video games, using smartphones, using heavy backpacks and lying on improperly placed pillows can also force your head and neck to adapt to a forward head posture.\(^4\)

Somatosensory information from the cervical region is the only region that directly access to the sense of balance. Postural control system includes all the sensory, motor and musculoskeletal components involved in the control of two important behavioral goals: Postural orientation and postural equilibrium.\(^3\)
Postural orientation is the relative positioning of the body segments with respect to each other and to the environment, whereas postural equilibrium is the state in which all the forces acting on the body tend to keep the body in desired position and orientation (static equilibrium) or to move in controlled way (dynamic equilibrium).[3]

Balance is considered to be an important aspect of an individual while undertaking various daily activities which is achieved by a complex process involving the function of musculoskeletal and neurological systems.[9]

Balance plays an important part in daily life activities as imbalance results into an increased risk of falls and injury which hampers the quality of living as falls sets in fear and anxiety implying dependency on family members and in their absence can lead to abstinence from participating into social activities ultimately resulting into social isolation.

Balance is defined as the ability to maintain a posture for performing activities and counteract with conflicts (External or internal) and in terms of biomechanics maintaining body mass centre in the domain of base of support.[10]

Postural stability is the ability to sustain the body in equilibrium by maintaining the projected centre of mass within the limits of the Base of support (Shumway-Cook & Woollacott, 2001a). [11]

It is a dynamic process that requires sensory detection of body motions, integration of sensorimotor information within the central nervous system, and execution of appropriate musculoskeletal responses in order to establish equilibrium between destabilizing and stabilizing forces (Riemann & Guskiewicz, 2000).[11]

Forward Head posture alters the center of gravity(COG) of body that leads to mechanical modification related to postural control in every joint.[2] The body attempts to adopt to these changes by altering its balance control mechanism, these adaptation decrease balance ability while performing different activities and increase the risk of falling and musculoskeletal injury and ultimately result in limited body function and high incidence of various diseases.[2]
MATERIALS AND METHODS
The synopsis of the study was submitted to institutional ethical committee of Dr. D. Y. Patil College of Physiotherapy for approval. Study was conducted after the clearance from the institutional ethical committee.

Aim of this study was to find balance impairment in subject with forward head posture. Study was carried out and included 50 subjects. Objective of the study was to assess effect of forward head posture on static and dynamic balance.

Individuals with symptomatic and asymptomatic forward head posture and Individuals who are able to carry out their ADL independently were included in study. Individuals with any auditory, visual problem, structural deformity at any joint of lower limb, surgical operation in lower limb, history of epilepsy, any disease affecting the balance and neuromuscular control were excluded in study.

From the selected subject their forward head assessment was performed by using a universal goniometer. Static and Dynamic balance assessment was done using firm and foam surface using Modified CT-SIB test. Study was carried out and included 50 subjects.

Forward head assessment\(^\text{[12]}\)
Visualise a line across upper neck (A) which follows the line of the jaw towards C2. Bisect this line.
(i) Visualise a second line across the lower neck. (B) Which follows the line of the clavicle towards the cervico-thoracic junction. Bisect this line.
(ii) A line (C) that joints the bisectors (i) and (ii) ideally should be vertical or within 10°of the forward inclination.

Visualise the line in the plane of face (D). This line ideally should be parallel to or within 10° of the low cervical neutral line (C).
Modified CTSIB\textsuperscript{[13]}

Equipment/set-up: Foam pad and stopwatch required.

Starting position: Patient stands with feet shoulder width apart and arm crossed over chest.

**Protocol:** A 30 second trial is timed using stopwatch. Time is stopped during trial and recorded if a) Patient deviates from initial crossed arm position, b) patients opens eyes during an “eyes closed” trial condition, or c) patient moves feet (takes a step) or requires manual assistance to prevent loss of balance. A trial is successful if the patient is capable of maintaining the starting position independently for a period of 30 seconds.

A maximum of three (3) trails are performed for all conditions. Trails are performed until the patient either:

a) Successfully maintains the starting position for an entire 30 seconds, or

b) Completes three, 30-second trails to the best of their ability.

**Scoring**

Conditions 1 thru 4: Record the time (in seconds) the patient was able to maintain the starting position (maximum of 30 seconds). Remember to record the times for all trials.

Total scores =

Average time cond 1 + Average time cond 2 + Average time cond 3 + Average time cond 4
(If>1 trial required) (If>1 trial required) (If>1 trial required) (If>1 trial required)
Balance Assessment

- Static balance using modified CTSIB component (on firm surface)

Condition one: Eyes open, Firm surface
Trail One Total Time: /30
Trail Two Total Time: /30
Trail Three Total Time: /30

Condition Two: Eyes closed, Firm surface
Trail One Total Time: /30
Trail Two Total Time: /30
Trail Three Total Time: /30

- Dynamic balance using modified CTSIB component (on Foam surface)

Condition Three: Eyes open, Foam surface
Trail One Total Time: /30
Trail Two Total Time: /30
Trail Three Total Time: /30

Condition Four: Eyes closed, Foam surface
Trail One Total Time: /30
Trail Two Total Time: /30
Trail Three Total Time: /30

TOTAL: /120 sec

Fig. 3: Static balance (eyes open).  
Fig. 4: Static balance (eyes closed).
RESULTS

Table I(a): Demographic data.

a) Gender

<table>
<thead>
<tr>
<th>Gender</th>
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<tbody>
<tr>
<td>Males</td>
<td>10</td>
</tr>
<tr>
<td>Females</td>
<td>40</td>
</tr>
</tbody>
</table>

Graph 1(a): Demographic data (Gender).

Result: Graph 1 (a) shows that 20% Males and 80% Females were having Forward head posture i.e. number of females were more than the males in the study.
b) Table I(b): Age Group.

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-27</td>
<td>45</td>
</tr>
<tr>
<td>27-36</td>
<td>4</td>
</tr>
<tr>
<td>36-45</td>
<td>1</td>
</tr>
</tbody>
</table>

Graph I(b): Demographic data (Age).

**Result:** Graph I(b) shows that 90% subject having age between 18-27 years, 8% are having age between 27-36 years, and 2% are between age of 36-45 years.

Table II: Presence of Forward Head Posture, with and without chin poke.

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>FHP</td>
<td>23</td>
</tr>
<tr>
<td>FHP+CP</td>
<td>27</td>
</tr>
</tbody>
</table>

FHP: Forward Head Posture
FHP+CP: Forward head posture with chin poke
Graph II: Presence of Forward Head Posture, with and without chin poke.

**Result:** Graph II shows that, out of 50 subjects 46% were having forward head posture and 56% were having forward head posture with chin poke.

**Table III: Impairment in Static and dynamic balance.**

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
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<tbody>
<tr>
<td>Static(eyes open)</td>
<td>0</td>
</tr>
<tr>
<td>static(eyes closed)</td>
<td>3</td>
</tr>
<tr>
<td>dynamic(eyes open)</td>
<td>24</td>
</tr>
<tr>
<td>dynamic(eyes closed)</td>
<td>43</td>
</tr>
</tbody>
</table>

**Graph III: Impairment in Static and dynamic balance.**

**Result:** Graph III shows that out of 50 subjects 3 have impairment with eyes closed on firm surface. 24 subjects have impairment with eyes open on foam surface and 43 subjects were having impairment with eyes closed on foam surface.

**DISCUSSION**

Graph I (a) shows that there were 80% of females and 20% males who participated in the study i.e. number of females were more than the males in the study.

Graph I (b) shows that 90% subject having age between 18-27 years, 8% are having age between 27-36 years, and 2% are between age of 36-45 years.

Graph II shows that out of 50, 23 candidates i.e. 46% subjects had forward head posture and out of 50, 27 candidates i.e. 56% subjects were having forward head posture with chin poke.
Every inch head moves forward it gains 10 pounds in weight, as far as the the muscles in upper back and neck are concerned, because they have to work that much harder to keep the Head (chin) from dropping onto chest. This also forces the suboccipital muscles to remain in constant contraction which causes chin poke.\textsuperscript{[12]}

Research shows that many of us sit with poor low back posture, with our lumbar spines slumped into flexion, this rounds the thoracic spine and brings the head forward so we are looking down. Due to the fact that we want our head to be looking forward mostly and not down, we tip our faces up and put our neck in extension. This results in poking chin.

Graph III shows that 6\% subjects had impairment in static balance with eyes closed, 48\% subjects had impairment in dynamic balance with eyes open, 86\% subjects had impairment in dynamic balance with eyes closed. The impairment in dynamic balance was found to be greater than static balance.

Sensory feedback from the neck muscle stretch receptors and vestibular system is necessary to maintain normal posture.

People maintain their body balance with their hip and ankle joints, by obtaining information about balance through somatic sensory, visual, vestibular system, then organizing information with composition process in the central nervous system.\textsuperscript{[3]}

In forward head posture the impairment in the muscle sends an abnormal sensory feedback which could be one of the reason leading to balance impairment. Another reason may be the postural relationship of head to the trunk, a major finding determining integration of sensory feedback to maintain balance.\textsuperscript{[3]}

In FHP there is excessive extension of upper cervical vertebrae and flexion of lower cervical vertebrae, causing disturbance in postural relationship of head to trunk leading to disruption of sensory integration and thereby affecting balance.\textsuperscript{[3]}

If the COG of the body shifts from its normal position, high muscle activity is needed to recover from this unstable position. Therefore, in conditions of structural imbalance, such FHP, it is difficulty to properly adjust changes in the external environment because the autonomic nervous system has decreased ability to respond to external stimulation.\textsuperscript{[3]}
Cervical afferents influence eye, head and postural stability. Any artificial disturbance to this may lead to impairment; impairment in the gaze may cause an increase in postural sway when eyes are open.[3]

In subjects with FHP there is anterior displacement of COG, causing difficulty to maintain balance on static surface.

In present study, the difference in static balance control was higher than in those with their eyes closed than in those with their eyes open, indicating that vision plays an important role in balance control.

When the same candidate were subjected to experiment on dynamic surface with eyes open and eyes closed, balance impairment was more because of unstable surface. In dynamic balance i.e. on unstable surface somatosensory system is compromised therefore dynamic balance impairment was more than static balance.[3]

In our study prevalence of balance impairment was found 88%.

CONCLUSION
The current study shows that forward head posture has effect on static and dynamic balance.

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REFERENCES


