

## Correlation between Degree of Forward Head Posture and Rounded Shoulder Posture in Physical Therapy Students

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### Abstract

**Background:** Forward head posture has been shown to be a common postural displacement, with a conservative estimate being 66% of the patient population. Failure of the head to align with the vertical axis of the body can lead to malalignments in the body such as rounded shoulders and hyper-kyphosis to compensate for altered location of the line of gravity leading to further impairments. Although most previous researches were conducted to determine the relation between forward head posture (FHP) and cervical pain or thoracic kyphosis or temporomandibular joint and the relation between FHP and rounded shoulder posture (RSP) is not clearly understood.

**Aim:** The present study aimed to investigate the correlation between different degrees of forward head posture and changes in shoulder angle in asymptomatic subjects with forward head and rounded shoulder posture.

**Subjects and Methods:** 114 physical therapy subjects (58 males and 56 females) aged 18-27 years and body mass index ranged from 16-35 kg/cm<sup>2</sup> were recruited for this cross section study. The craniovertebral and shoulder angle were used to measure the degree of FHP and RSP

respectively from standing position by photogrammetry.

**Results:** Significant negative negligible correlation was detected between mild degree of forward head posture and rounded shoulder ( $p < 0.001$  and  $r = -0.06$ ) and significant positive negligible correlation a between moderate degree of FHP and RSP ( $p < 0.01$  and  $r = 0.1$ ). However, the relation between sever degree of forward head posture and rounded shoulder posture was non-significant positive negligible correlation ( $p > 0.3$  and  $r = 0.08$ ).

**Conclusion:** it was demonstrated that, mild and moderate degrees of forward head posture change the degree of the rounded shoulder. However, the sever degrees of forward head posture don't change the degree of the rounded shoulder.

**Key words:** Correlation, Forward head posture, Rounded shoulder posture.

### Introduction

**POSTURE** is the alignment of the body segments at a particular time and is an important health indicator. It must correspond to a specific body position in space which minimizes anti-gravity stresses on body tissues. Inadequate posture consists of poor interrelations between parts of the body. These will cause muscle tension and shortening, which makes

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appropriate joint movements more difficult to achieve and may cause pain [1].

Forward head posture (FHP) has been shown to be a common postural displacement, with a conservative estimate being 66% of the patient population. It is generally believed that this abnormal posture is associated with the development and persistence of many disorders including cervicogenic and migraine headaches, myofascial pain syndrome, abnormal scapular movement, and even temporomandibular disorders [2].

FHP is a forward inclination of the head with cervical spine hyperextension and is associated with shortening of the upper trapezius, the splenius and semispinalis capitis and cervicis, the cervical erector spinae and the levator scapulae musculature [3].

If cervical spine is held in protraction for long duration it can lead to poor head posture called forward head posture FHP. Failure of the head to align with the vertical axis of the body leads to more malalignments such as rounded shoulder posture (RSP) [4].

RSP is a forward deviation of the shoulders associated with a protracted position of the scapula as caused by a muscular imbalance between a shortened pectoralis minor and a lengthened middle trapezius [3].

Kwan et al., concluded that different head positions have different effects on head/shoulder kinematics and muscle activities. The results corroborate the clinical notion that postural alterations related to an FHPRS can change scapular kinematics and muscle activities in individuals with such a posture [5]

Therefore, FHP that causes rounded shoulder and neck pain due to an imbalance between the curvature of the spine and muscles that are attached to the neck bone, is correlated with problems in the neck bone [6]. While several studies were

conducted to determine the relation between FHP and cervical pain or thoracic kyphosis or temporomandibular joint, research on the correlation between the degree of FHP and rounded shoulder remains incomplete.

Hence, the present study aimed to specifically investigate the correlation between different degrees of forward head posture and changes in shoulder angle in asymptomatic subjects with forward head rounded shoulder posture.

## Subject and Methods

*Subjects:* A total of 114 physical therapy subjects (58 males, 56 females) aged 18–27 years who were currently enrolled from Faculty of Physical Therapy, Cairo University, in the period from May 2018 to October 2018. Before the experiment, the purpose and procedures of the study were fully explained to all subjects, and all subjects subsequently voluntarily agreed to enroll in the present study.

General characteristics of the subjects were measured, including mean age was  $20.29 \pm 1.3$  years, mean height value was  $170.46 \pm 9$  cm, mean weight was  $66.94 \pm 12.4$  kg and BMI mean value was  $22.59 \pm 3.4$ . Subjects who had neck pain, shoulder pain, recent shoulder fracture, vertebrobasilar insufficiency, cervical disc and radiculopathy or is athlete were excluded from the study.

*Instrumentation:* A Nikon d3100 camera (14 megapixels), tripod for supporting the camera were used for photographing, tape measurement was used to measure 1.5m between the center of the tripod and the midpoint of the subject foot, a fixed marker on the floor for the subject to stand at. The height of the camera was adjusted at the center of the subject dominant shoulder, adhesive markers were placed on tragus of the ear, spinous process of cervical spine for measuring craniovertebral angle and anterolateral aspect of the acromion for measuring the shoulder angle. Computer

and CorelDraw graphic suits X7 software program to analyze the pictures.

Subjects were instructed to uncover from the head to the thoracic spine. Then they were stood in a relaxed position at the marker on the floor, making cervical flexion and extension to be relaxed. Three images were taken for each subject and these images were uploaded on the software to be analyzed.

**Measurements:** To measure craniovertebral angle (CVA) of forward head posture a line from C<sub>7</sub> to tragus of the ear was taken and a horizontal line from C<sub>7</sub>. To measure shoulder angle (SA) of rounded shoulder a line from anterolateral aspect of acromion to C<sub>7</sub> was taken and a horizontal line from anterolateral aspect of acromion [1].

**Data analysis:** Measured data were analyzed and their mean values and standard deviation were calculated. Person correlation coefficient was calculated to determine relationship between forward head and rounded shoulder. All statistical significance levels were  $\alpha$  level =0.05.

## Results

Demographic data of the 114 studied subjects were shown in table (1). A 57 subjects were shown to have forward head and rounded shoulder and the correlation was tested on them.

CVA and SA of FHRSP subjects in the standing position was 45.5±4.30 degrees and 42.32±6.54 degrees respectively (Table 2).

Forward head posture in the FHRSP was divided into 3 degrees according to the CVA into: mild (CVA= 47-50 degrees), moderate (CVA= 43-46 degrees) and sever (CVA= 32-42 degrees) to test the effect of different degrees on the rounded shoulder posture.

*Correlation coefficient analysis between CVA and RS in standing position demonstrated:*

The mild forward head  $p < 0.001$  and  $r = -0.06$  indicating significant negative negligible correlation between FH and RS, the moderate forward head  $p < 0.01$  and  $r = 0.1$  indicating significant positive negligible correlation between FH and RS and the severe forward head  $p > 0.3$  and  $r = 0.08$  indicating non-significant positive correlation between FH and RS.

Table (1): Demographic data of the studied subjects

	Number of subjects	Age "Years"	Weight "Kg"	Height "cm"	BMI "Ratio"
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
Normal	11	20.45 ±2.01	69.36 ±12.17	178.90 ±7.62	21.59 ±2.8
Rounded Shoulder	41	20.21 ±0.98	62.80 ±12.72	169.09 ±9.28	21.80 ±2.94
Forward head	5	20 ±0.70	64.2 ±11.96	170.6 ±7.33	21.87 ±2.36
Forward head rounded shoulder	57	20.35 ±1.40	69.70 ±11.84	169.80 ±8.50	24.14 ±3.53

Table (2): The mean and standard deviation of CVA and SA in degrees of the studied subjects

	CVA	SA
	Mean ±SD	Mean ±SD
Normal	54.41±3.44	53.50±6.21
Rounded Shoulder	54.12±2.70	42.84±7.67
Forward head	46.39±1.92	59.05±9.17
Forward head rounded shoulder	45.5±4.30	42.32±6.54

## Discussion

The dependent variables examined in this current study were craniovertebral angle and shoulder angle in asymptomatic subjects with forward head rounded shoulder posture (FHRSP). Our results showed that there was no significant correlation between sever degrees of forward head posture and rounded shoulder posture but the relation between the mild and moderate degrees were significant.

In the study of Kim and Kim, showed that no significant correlation was detected between CVA and RSP in the standing and sitting positions [6]

In this study; standing position only was used as in sitting, forward head inclination involves a combination of lower cervical flexion, upper cervical extension, and

rounded shoulders, which reduce the average lengths of muscle fibers, contributing to extensor torque around the upper cervical joint. In addition, this abnormal state causes musculoskeletal abnormalities such as decreased scapular upward rotation as well as greater internal rotation and anterior tilting, which may lead to difficulties maintaining an upright sitting posture [5].

It is evident that the FHP angle measured in the study is not within the range that could cause the deformity of RSP. The limit of FHP was determined as  $<53^\circ$  of CVA (while the current study set the limit as  $<50^\circ$  [2]).

The lower CVA led to a higher frequency of neck pain, proposing no certain angle range to identify FHP. Therefore, the study exhibited a limitation in finding the specific decrement in CVA that causes RSP [6].

Kim and Kim, assessed the degree of rounded shoulder by the height of the acromion of the dominant shoulder joint that was measured in the supine position. In our study photogrammetry had been used to assess shoulder angle instead of supine position [6]. Ruivo et al., stated that to study the misalignments of body segments, the photographic measurement of sagittal postures of cervical spine and shoulder is becoming more widespread, with several studies confirming the high reliability of photogrammetry [1]

While the supine position is reliable for determining signs of RSP, it is typically used to measure the length of the pectoralis minor muscle. The height of the acromion of the dominant shoulder joint of only one side was measured to gauge RSP and, as it was measured in supine position, there was a limitation in determining deformity of spinal bending and positional change of the scapula due to FHP. Measurement of RSP may vary depending on the position of the anatomical point of the acromion, as could the position of the neck bone  $C_7$  ( $7^{\text{th}}$

cervical spinous process) depending on posture. Therefore, it cannot be concluded that a decrease in CVA certainly leads to an increase in RSP [6].

Another study concluded that Forward head posture, rounded shoulders, and increased thoracic kyphosis can exist alone or in any combination. Alteration in the resting scapular position is thought to occur with abnormal alignment of the cervical and thoracic spine. FSP can be associated with FHP, increased thoracic kyphotic posture or both [4].

Thigpen et al., and Kwan et al., studies provided evidence of an association between FHP and rounded shoulders [4,5,7]. This literature concluded that there appears to be a relationship between FHP, FSP, and thoracic kyphosis. Current evidence limits our understanding of the association between these 3 conditions. It is unclear whether any of these 3 postural deviations is a cause or a consequence of the other 2 deviations. However, it is clear that 2 or all 3 deviations can co-exist [4].

Kwan et al., concluded that different head positions have different effects on head/shoulder kinematics and muscle activities. The results corroborate the clinical notion that postural alterations related to an FHPRS can change scapular kinematics and muscle activities in individuals with such a posture [5]

Thigpen et al., concluded that in individuals free from shoulder pain with FHRSP displayed greater scapular anterior tilting and internal rotation throughout and greater scapular upward rotation at the upper ranges of elevation with concurrent lower levels of serratus anterior muscle activity during the loaded forward flexion task, and greater scapular internal rotation with concurrent lower levels of serratus anterior muscle activity during the loaded forward reaching task. This provides support for the clinical theory that postural alterations associated with FHRSP can alter

scapular kinematics and muscle activity during overhead tasks [7]

FHP is one of the most common cervical abnormalities that predisposes individuals to pathological conditions. A lower CVA indicates greater FHP. In the study of subjects who use smartphone more than 4 hours per day had lower CVAs. Another study showed that many smartphone users had neck pain due to increased cervical angles [8]

Neck musculoskeletal disorder and cervical dysfunction are related to thoracic kyphosis and rounded shoulder posture. Irregular lower trapezius condition and serratus anterior positions by abnormal scapular tilt can lead to rounded shoulder posture in children and adults [9].

### *Conclusion:*

It was concluded that, mild and moderate degrees of forward head posture change the degree of the rounded shoulder. However, the sever degrees of forward head posture don't change the degree of the rounded shoulder.

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## العلاقة بين درجة وضعية الرأس إلى الأمام و وضعية الكتف المدورة في طلاب العلاج الطبيعي

*الخلفية البحثية:* لقد ثبت أن وضع الرأس الأمامي هو نزوح ما بعد الوضع الشائع ، مع تقدير متحفظ يبلغ 66% من عدد المرضى. إن فشل الرأس في محاذاة المحور العمودي للجسم يمكن أن يؤدي إلى سوء التصرف في الجسم مثل الأكتاف المستديرة والفرط المفرط للتعويض عن تغيير موقع خط الجاذبية مما يؤدي إلى مزيد من الإعاقات. على الرغم من إجراء معظم الأبحاث السابقة لتحديد العلاقة بين وضعية الرأس الأمامية وآلام الرقبه أو الحداث الصدري أو المفصل الصدغي الفكي والعلاقة بين وضعية الرأس الأمامية ووضع الكتف المستدير غير مفهومة بشكل واضح.

*الأهداف وطرق البحث:* هدفت الدراسة الحالية إلى دراسة العلاقة بين الدرجات المختلفة لوضعية الرأس الأمامي والتغيرات في زاوية الكتف في اشخاص لديهم وضع الرأس الأمامي مع وضع الكتف المستدير بدون اعراض ظاهره.

*الاشخاص والطريقة:* تم مشاركته 114 شخص من العلاج الطبيعي (58 ذكور و 56 إناث) ممن تتراوح أعمارهم بين 18-27 سنة وتراوح كتلة الجسم من 16-35 كغم / سم<sup>2</sup> في هذه الدراسة الشاملة. تم استخدام زاوية القحف والكتف لقياس درجة وضع الراس الامامي و وضع الكتف المدوره على التوالي من وضعية الوقوف بواسطة التصوير الفوتوغرافي.

*النتائج:* تم الكشف عن ارتباط هام ضئيل لا يذكر بين الدرجة الخفيفه من وضعية الرأس الأمامية والكتف المستدير (  $p < 0.001$  و  $r = -0.06$  ) وارتباط هام لا يذكر مهم بين درجة المعتدله من وضعية الرأس الأمامية والكتف المستدير (  $p < 0.01$  و  $r = 0.1$  ) ومع ذلك ، كانت العلاقة بين درجة وضع الرأس الأمامي الشديده و وضع الكتف المستدير غير ذات دلالة إحصائية لا تذكر (  $p < 0.3$  و  $r = 0.08$  )

*الإستنتاج:* ثبت أنه ، الدرجات الخفيفة والمعتدلة من وضع الراس الامامي تغيير درجة الكتف المستدير. و لكن الدرجات الشديده لوضع الرأس الأمامي لا تغيير درجة الكتف المستدير.