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Prevalence of Forward Head Posture in Patients Diagnosed Clinically with Frozen Shoulder

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ABSTRACT

Aim: To find the prevalence of Forward Head Posture in patients diagnosed clinically with Frozen Shoulder.
Objectives: To measure the Craniovertebral Angle of patients diagnosed with Frozen Shoulder using MB Ruler software and diagnose the presence of Forward Head Posture in them.
Methodology: A study was conducted with 67 subjects clinically diagnosed with Frozen Shoulder. Their Craniovertebral angle was measured in lateral view with photometric assessment using MB Ruler software and accordingly, the presence of Forward Head Posture (FHP) was observed. A CVA measurement less than 50° indicates FHP.
Results: A total of 67% out of the selected population has FHP deviation. This shows that almost 2/3rd of our selected Frozen Shoulder population has Forward Head Posture deviation. This underscores a substantial association between FHP and frozen shoulder, indicating that individuals with Frozen Shoulder may be more susceptible to developing or experiencing severe symptoms of Postural Malalignment in their cervical and upper back area due to changes in the overall normal biomechanics of the shoulder complex.
Conclusion: This study provides compelling evidence supporting the prevalence of FHP in individuals with Frozen Shoulder, highlighting the necessity for interdisciplinary approaches that integrate postural correction techniques with Frozen Shoulder management.
Clinical Implications: Addressing forward head posture in frozen shoulder management requires a comprehensive approach that targets both shoulder dysfunction and postural deviations. This may include manual therapy to restore scapular mechanics, corrective exercises to rebalance muscular imbalances, and postural education to promote awareness and self-management.

Keywords: Frozen shoulder, Forward head posture, Craniovertebral angle, Postural correction, Biomechanical changes

INTRODUCTION

Frozen Shoulder is a condition characterized by inflammation and fibrosis of the shoulder joint capsule, resulting in progressive and painful loss of shoulder motion. It affects slightly over 2% of the general population, with a higher prevalence (about 20%) among individuals with diabetes. The etiology remains unknown, but it is associated with fibroproliferative tissue

changes involving collagen production, inflammation, neoangiogenesis, and neoinnervation.[18]

The condition typically progresses through three stages [1, 10]:

Freezing Stage: Persistent and intense pain, limited motion in all directions.

Frozen Stage: Pain mainly with movement, significant adhesions, and limited shoulder motions.

Thawing Stage: Minimal pain, but significant capsular restrictions persist. The motion may gradually improve.

Frozen shoulder primarily affects people aged 40-60 and commonly presents bilaterally. It involves the tightening and contracture of shoulder ligaments and surrounding muscles, leading to a restricted range of motion, particularly in flexion, abduction, and external rotation.

Scapulohumeral elevation, aided by various muscles including the Trapezius and Rhomboids, is affected in the frozen shoulder. Reverse scapulohumeral rhythm, where the scapula moves more than the humerus, is observed in patients with frozen shoulders, leading to compensatory movements like the "shrug sign."[4] This might cause muscle imbalances due to a lack of awareness. [14]

Muscular imbalances cause changes in the biomechanics of the shoulder complex for instance patients tend to shrug the shoulder while elevating the arm to accomplish the tasks and ADLs and over time, and it further leads to overactivity and tension in muscles like the upper trapezius and levator scapulae increases, while others like the rhomboids may become weak or lengthened.

These imbalances affect the alignment of the cervical vertebrae, which causes anterior translation of the head due to its weight reducing the Craniovertebral Angle, often to less than 50°, which is considered indicative of Forward Head Posture. As the patient feels comfort in achieving his activities in the wrong posture, it further tends to affect the upper back and give rise to other complications like nerve impingements, scoliosis, and hump back and might get more severe with time if gone ignored.

MATERIALS & METHODS

The study is conducted on the prevalence of forward head posture in patients diagnosed clinically with frozen shoulder. The study design is an Observational Study. The sample size comprises 67 individuals. Convenient Sampling was utilized as the sampling technique. The study duration spans 6 months, and the research took place in the Pune Region. Outcome measures include assessing the Cranio-Vertebral Angle using MB Ruler Software. To conduct the study, materials required include a Mobile Phone Camera and a Computer. The study population consists of patients diagnosed with Frozen Shoulder. Inclusion criteria encompass both male and female patients clinically diagnosed with Frozen shoulder by an Orthopedician, aged 40-60 years, and without any cognitive impairment. Exclusion criteria comprise patients with fractures of the upper limb or vertebrae affecting mobility and posture, those who underwent shoulder replacement surgery or any other shoulder surgeries [10, 12], individuals who underwent thoracic or upper back surgeries, those who had shoulder dislocations, and patients with Bilateral Affection.

Clearance was obtained from the ethical committee before commencing the study. Participants were recruited according to the inclusion and exclusion criteria. Upon recruitment, informed consent was obtained from each participant, and the procedure was thoroughly explained to them.

The assessment of Craniovertebral Angle (CVA) [6, 7] was conducted utilizing a photometric process and “MB Ruler 5.3” software, providing accurate measurements. [2, 9, 11] It helps in assessing the angle between a horizontal line passing through the C7 vertebra and a line connecting the tragus of the ear to the seventh cervical vertebra. The recorded measurement serves as a quantitative indicator of head and neck

alignment, helping us in identifying any deviations in the normal posture.[8] The spinous processes of the C6 and C7 vertebrae are evident. A body surface sticker was used to mark the C7 spinous process and tragus of the ear, those are the anatomical markers essential for the photometric assessment. The camera was placed such that all anatomical markers were visible in the image properly. One standard lateral view image was taken. The photographs were transferred to the computer and used for the CVA assessment by using MB-Ruler Software. A CVA less than 50° is considered a Forward Head Posture.[8] Additionally, the assessment of the Frozen Shoulder was carried out by the stages of the disease, namely Freezing, Frozen, and Thawing. Subsequently, participants were classified into three groups based on their condition's stage. Among the 67 patients diagnosed with Frozen Shoulder, distinct stages of the condition were identified through classification. Specifically, 20 patients were categorized as having Stage 1 Frozen Shoulder, denoting an initial phase characterized by mild discomfort and limited range of motion in the shoulder joint. A larger cohort of 22 patients fell into the classification of Stage 2 Frozen Shoulder, indicating a progression of symptoms with increased pain and stiffness. Notably, 25 patients were classified as having Stage 3 Frozen Shoulder, representing the most advanced stage characterized by decreased pain possible restriction of movement, and functional impairment.[1]

Following the assessments, data collection commenced. Relevant information about Craniovertebral Angle and Frozen Shoulder staging was gathered from each participant. Subsequently, the collected data underwent thorough analysis to derive meaningful insights and conclusions. The analysis process involved employing appropriate statistical methods through Microsoft Excel to interpret the gathered information effectively. Graphical analysis and interpretation were ruled out to establish the presence of forward head posture among the selected patients using craniovertebral angle measurements. Thereafter, going deep into the study, all three 3 stages were separately assessed to examine which specific stage is most affected by FHP. Hence patients of every stage were further assessed for the presence of FHP.

RESULT

In a study comprising 67 patients diagnosed with Frozen Shoulder, a condition characterized by limited mobility and pain in the shoulder joint, a gender distribution of 37 males and 30 females was observed. Furthermore, the analysis revealed that 31 patients experienced the condition on their left side, while 36 patients had it on their right side.

We assessed the CVA of all the patients included in the study and classified them into 4 groups accordingly.

Based on our observation, the Craniovertebral Angles of all 67 subjects varied from 32° to 66°. Hence 4 groups of varying angles were made as follows –

30° - 40°
40° - 50°
50° - 60°
60° - 70°

Table No. 1 - Measurements of Craniovertebral Angle in total population

Angles	No. of Patients
30° - 40°	15
40° - 50°	30
50° - 60°	19
60° - 70°	3

Hence, as a Craniovertebral Angle < 50° is considered as Forward Head Posture, 45 out of 67 subjects i.e., 67.2% of Frozen Shoulder patients have Forward Head Posture, with deviation varying from 30° - 50° and only 32.7% have normal posture.[8]

Table No. 2 – Incidence of FHP in total population

Forward Head Posture	Number of Subjects
Present	45
Absent	22

This shows that almost 2/3rd of our selected Frozen Shoulder population has Forward Head Posture deviation.
Moving forward, across 3 stages, out of 67 patients diagnosed with Frozen Shoulder –
20 are classified under Stage 1 Frozen Shoulder,
22 are classified under Stage 2 Frozen Shoulder and
25 are classified under Stage 3 Frozen Shoulder.

Table No. 3 – Craniovertebral Angle Measurements in Subjects with Stage 1 Frozen Shoulder

CVA	No. of Patients
30° - 40°	4
40° - 50°	10
50° - 60°	4
60° - 70°	2
Total	20

Given that a CVA less than 50° is indicative of Forward Head Posture (FHP), it was found that **70% of Stage 1 Frozen Shoulder patients exhibited FHP.**[8]
Moving on to Stage 2 Frozen Shoulder,

Table No. 4 – Craniovertebral Angle Measurements in Subjects with Stage 2 Frozen Shoulder

CVA	No. of Patients
30° - 40°	3
40° - 50°	12
50° - 60°	6
60° - 70°	1
Total	22

It was observed that **68.1% of Stage 2 Frozen Shoulder patients had FHP**. [8]

Finally, in stage 3 Frozen Shoulder,

Table No. 5 – Craniovertebral Angle Measurements in Subjects with Stage 3 Frozen Shoulder

Angles	No. of Patients
30° - 40°	8
40° - 50°	8
50° - 60°	9
60° - 70°	0
Total	25

This stage revealed that 64% of patients exhibited FHP.[8]

Overall, the study highlights a significant association between Forward Head Posture and the progression of a frozen shoulder, with varying degrees of deviation observed across different stages.

DISCUSSION

Frozen shoulder, clinically known as adhesive capsulitis, poses a significant challenge due to its combination of pain and restricted range of motion in the shoulder joint. This condition is not only debilitating but also intricately connected with biomechanical alterations that extend beyond the shoulder complex. In our study, we delved into the prevalence of forward head posture (FHP) among frozen shoulder patients and its potential relationship with disease progression.
Pathomechanically, there exists a cascade of change in mechanics in the complete structure and function of the Shoulder complex in Frozen Shoulder. The glenohumeral capsule is thin.[19] The integrity of the capsule and the maintenance of the normal glenohumeral function depend on the reinforcement of the capsule by ligaments and the attachment of the muscle tendons of the rotator cuff mechanism. The superior part of the capsule, together with the coracohumeral ligament, is called the rotator interval capsule and is important in strengthening the superior aspect of the joint.[20] The interval capsule acts against gravity acting on the humerus and is responsible for the abduction and stabilization of the joint. Anteriorly, the capsule is strengthened by the glenohumeral ligaments and the attachment of the subscapularis tendon. Posteriorly, the capsule is strengthened by the attachment of the teres minor and infraspinatus tendons which are the main external rotators of the shoulder. In a Frozen Shoulder structures are affected as adhesions and contractures are formed in the muscle tissue caused due to fibrosis and it leads to the loss of basic biomechanical function of superior rolling and inferior gliding of the humeral head in

the glenoid fossa.[19] Another major affection is the coracohumeral ligament. Its contracture prevents external rotation at 0° abduction. A study states that the most restricted shoulder motions are external rotation and abduction, implying that teres minor and infraspinatus attachments are affected and get pulled due to the tightness and increased tension.[17]

The contracture of the superior glenohumeral ligament causes decreased motion in external rotation at 30–60°abduction. The contracture of the anterior- inferior capsule leads to the decrease in external rotation at 90°abduction. The decrease in internal rotation is caused by to contracture of the posterior capsule. [17, 19]

Then Deltoid, which is the static as well as the dynamic stabilizer of the shoulder joint gets contracted when any motion has to be initiated.[19] To be precise, superior translation of the humeral head occurs within the glenoid fossa. The Rotator Cuff muscles, the Supraspinatus, Infraspinatus, Teres Minor, and the Subscapularis offset the superior translatory force of the deltoid and are responsible for almost all the actions of the shoulder joint including abduction and lateral rotation that are the most crucial motions for arm elevation and mobility. Subscapularis, Teres Minor, and the Infraspinatus along with the deltoid make up a force couple that purely creates rotation in the joint. The Supraspinatus muscle is a special consideration as it combines with gravity to stabilize the joint and prevent any displacement of the articulation.[19]

In addition to all these adhesions, the inflammatory processes involved in a Frozen Shoulder cause scapular stiffness and scapulohumeral muscular imbalance and cause the scapular mechanics. [3, 17]

Change in scapular muscle function causes a total imbalance in the normal positioning of the head and neck. In normal situations, the scapula demonstrates a pattern of progressive upward rotation, decreased internal rotation, and movement from anteriorly to posteriorly tipped position as the humeral elevation angle increases. Additionally, there is evidences of electromyographic activity of periscapular muscles including upper and lower trapezius, levator scapulae, and serratus anterior and posterior increases with increasing humeral elevation angle. [16, 17]

The trapezius is the superficial muscle that primarily causes shoulder elevation involving the scapulohumeral mechanism and also flexion of the head and neck.[13] Levator Scapulae is a deep muscle that elevates the scapula. It creates a posterior counteracting force against the shear forces of gravity and the cervical lordosis curve. It also facilitates the same motions of the head and neck as the trapezius. So, in a frozen Shoulder, as the normal biomechanics of the shoulder are altered as a result of adhesions, these 2 muscles are overactive to compensate for the lack of forces needed in shoulder functioning. Usually, the scapula is seen tipping from anterior to posterior position in normal humeral elevation.[19] But, in a Frozen Shoulder, as the adhesions are formed and restrictions develop, the scapula remains in the anterior tipped position due to the contractures in the coracohumeral ligaments. Hence, the scapulohumeral rhythm is altered. As a result, the trapezius' function to maintain the ideal position of the scapula gets affected.[5, 14] Additionally, there is an increased demand to support the cervical spine against further tension and tightness.[14] Biomechanically, the Centre of Gravity of the head tends to direct anteriorly due to the cervical lordotic curve, and thus the trapezius has to maintain the position of the head along with stabilizing the scapula in the best possible position.[16] Eventually, overtime, the posture gets adapted leading to increased flexion at C3 – C6 vertebrae, and hence there is a decrease in the Craniovertebral Angle causing forward head posture. The patient, already in pain due to a frozen shoulder stays unaware of the

change of his posture and eventually gets comfortable in it as all functions of the trapezius and levator scapulae are being compromised for compensating the loss of shoulder function. [3, 13, 14, 15]

Moreover, our findings revealed a striking prevalence of forward head posture across different stages of frozen shoulder. Notably, over 60% of patients across all stages exhibited forward head posture, with the highest prevalence (70%) observed in stage 3 patients. This highlights the progressive nature of forward head posture with advancing frozen shoulder stages, suggesting a potential correlation between disease severity and postural deviation.

Importantly, our study underscores the long-term consequences of forward head posture in frozen shoulder patients. Despite symptom improvement with restored range of motion and pain relief, postural deformities may persist, particularly in the advanced stages of the disease. Notably, a significant proportion of patients exhibited severe forward head posture, with a subset belonging to stage 3, indicating a potential link between disease progression and worsening postural deviation.

CONCLUSION

The study sheds light on the relationship between forward head posture and frozen shoulder. Among the 67 subjects suffering from frozen shoulder, a significant portion exhibited a forward head posture, with 45 out of 67 showing a forward head posture. It indicates that the patients lack postural awareness due to restrictions in frozen shoulder due to compensatory movements.

Declaration by Authors

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