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A Study to Assess Scapular Dyskinesia in Healthy Individuals Aged 25-35 Years

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ABSTRACT

Background: Scapular dyskinesia is the most common prevailing disorder in which there is alteration of the glenohumeral rhythm, thus paving the pathway to various musculoskeletal pathologies associated with the upper extremity. It is caused by the muscular imbalance thereby causing a change in the torque and ultimately the kinematic chain of the upper limb.
A study of the prevalence of the same will help to work on the rehabilitative strategies by identifying the early symptoms and hence enable an early intervention.
Objective: To assess scapula dyskinesia in healthy individuals between the age of 25-35 years
Method: An observational(non-experimental) study was conducted on 100 healthy individuals between the age of 25 to 35 years. Ethical clearance from the committee of the institution and consent from participants was taken. Participants were screened, after which the lateral scapular slide test was performed following which they were asked to fill in the DPA scale.
Results: From the study it was revealed that there was prevalence of scapular dyskinesia in healthy individuals between the age of 25-35 years, with women showing a greater prevalence of the same.
Conclusions: There was prevalence of scapular dyskinesia in healthy individuals between the age of 25-35 years, thus can be used as a baseline strategy for rehabilitation programmes.

Keywords: scapular dyskinesia, glenohumeral rhythm, healthy individuals, lateral scapular slide test

INTRODUCTION

The glenohumeral joint (GHJ) is a true synovial ball-and-socket style joint and therefore serves as the gateway between the axial skeleton and the upper limb. The glenoid fossa and the humeral head function in a complicated synergistic style to allow the multiplanar moves of the joint. The balance between joint stability and freedom of movement is regulated by static (bony shapes, ligaments) and dynamic (muscles) factors. The scapula is a key part of the kinematic chain involving the upper limb and is a crucial component of the glenohumeral rhythm which is defined as the coordinated motion of the scapula and humerus experienced during shoulder movement and motion, occurring at a ratio of 2:1 (2 degrees of humeral flexion/abduction to 1 degree of scapular upward rotation). Hence it is a major determinant of the efficiency and efficacy of the upper limb.
The abnormal scapular biomechanics that occurs as a result of this dysfunction creates an imbalance between the agonist and antagonist muscles and thus predispose the shoulders to injuries.
The scapulothoracic pathology takes place in continual painful situations wherein the glenohumeral motion has been step by step decreased or wherein the glenohumeral joint has been immobilized for a protracted period or when there is recruitment of fibres in an abnormal direction, thus leading to the

abnormal scapular biomechanics that occurs as a result of this dysfunction and creates an imbalance between the agonist and antagonist muscles and thus predispose the shoulders to injuries. In most circumstances, the scapulothoracic joint becomes a secondary problem[2]. Increased shoulder pain may result in muscle spasm in the supraspinatus, trapezius, rhomboids, large dorsal and subscapularis[3.] In the event that a scapulothoracic joint does not function properly, the individual will be able to achieve only 100 to 120° of passive abduction and active abduction may be even more limited.

Scapular dyskinesia-observable alterations in the position of the scapula and the patterns of scapular motion in relation to the thoracic cage, as a result of alteration of muscle activation or coordination.

Types of scapular dyskinesia[5-]

Type 1 - Infero-medial scapula border prominence- It is often associated with tightness at the anterior side of the shoulder (in flexibility of the pectoralis major/ minor muscles) and weakness of the lower trapezius and serratus anterior muscles. Posterior tipping of the scapula is responsible for functional narrowing of the subacromial space during the overhead motion, leading to pain in the abduction/ externally rotated position as often noticed in the early stages of shoulder disorders ultimately caused due to imbalance of muscles

Type 2 - Medial border prominence- This pattern is winging of the entire medial border of the scapula at rest. It turns into greater outstanding withinside the cocking role and after repetitive elevation of the corresponding extremity. It is because of fatigue of the scapula stabilizing muscles (trapezius and rhomboids).

Type 3 - Supero-medial border prominence- This type of dyskinesis is displayed as a prominence of the superior medial border of the scapula and often associated with impingement and and injury of the teres minor, supraspinatus, infraspinatus, subscapularis (rotator cuff muscles).

PREDISPOSING FACTORS-Prolonged sitting tasks(e.g.: desk jobs),increased cervical and thoracic curves ,stiffness of soft tissue surrounding the scapula such as tightness of the muscle pectoralis minor and posterior glenohumeral capsular stiffness ,chronic neck/shoulder pain, caused due to activities like typing and in overhead athletes, altered muscular activity or strength such as weakness of the stabilizing muscles of the muscles of the scapula, altered scapular recruitment patterns (eg, altered serratus anterior muscle activity) and muscle performance (eg, force imbalance in the upper and lower trapezius muscle).[5]

These may lead to flexibility deficits in the soft tissue surrounding the scapula may restrict normal scapular movement during daily activity and sports specific movements.

NEED OF STUDY

Due to the Covid pandemic and various lockdowns imposed during the same, healthy individuals performing desk jobs or working from home post the Covid pandemic assumed a sedentary lifestyle[15] and hence led to increasing cases of spasm in the rhomboid, large dorsal, upper and lower trapezius, subscapular, infra-spinal and supraspinal muscles, due to faulty resting postures like excessive thoracic kyphosis and increased cervical lordosis[3], hence leading to improper movement of the scapula during the shoulder movement. There have been many studies on recognizing the dysfunction and rehabilitation of the same along with its correlation to the biomechanics, pathology, etiology, thus disrupting the normal function. Scapular dyskinesis is often the forgotten cause of pain and dysfunction, this leads to increase dependency for basic activities of daily living, hence study of epidemiology of the same will help reduce the number of occurrences of shoulder injuries.

SELECTION CRITERIA

INCLUSION CRITERIA

Healthy individuals that include population that comes under the age group of 25 to 35 years:

- Both male and female
- People working from home-such as desk jobs, office jobs, recreational players.

EXCLUSION CRITERIA

Individuals with:

- cognitive impairments
- neurological conditions
- upper limb fractures
- non-cooperative
- not willing to participate
- concomitant therapy-an individual who is a diagnostic case of scapula dyskinesia and is undergoing rehab for the same
- concurrent illnesses
- hereditary disorders pertaining to MSK pathology
- systemic diseases like diabetes mellitus.

MATERIALS & METHODS

METHODOLOGY

STUDY DESIGN: Observational(non-experimental)
STUDY TYPE: One-time cross-sectional study
SAMPLE SIZE:100
SAMPLING METHOD: Random/ Convenient
SAMPLE POPULATION: Healthy individuals aged 25-35 years
STUDY SETTING: Suburban
STUDY DURATION:18 months

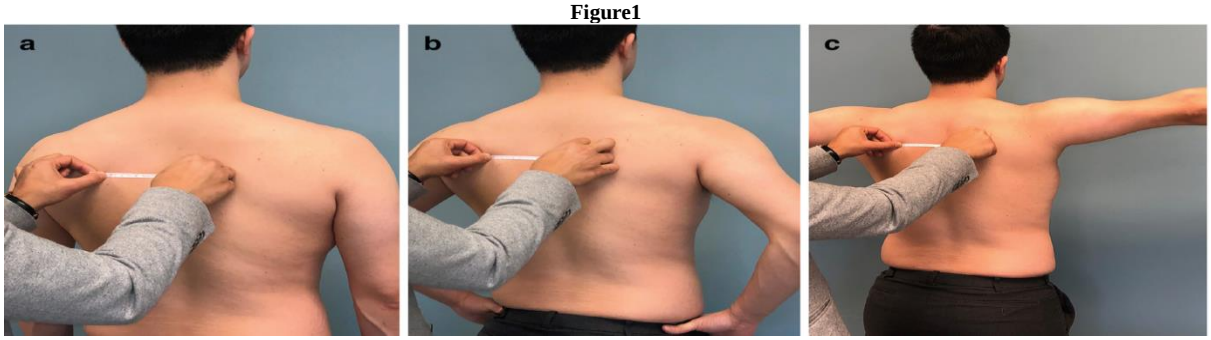
MATERIALS

- Universal Goniometer
- Measuring Tape
- Disablement in the physically active scale
- Consent form
- Demographic data form
- Pen and paper

OUTCOME MEASURE

LATERAL SCAPULA SLIDE TEST- A test to clinically measure static scapular positions called the lateral scapular slide test (LSST). This test involves measuring the distance from the inferior angle of the scapula to the nearest vertebral spinous process using a tape measure or goniometer in three positions: shoulder in neutral, shoulder at 40-45 degrees of coronal plane abduction with hands resting on hips, and the shoulder at 90 degrees abduction with the arms in full internal rotation. The injured or deficient side would exhibit a greater scapular distance than the uninjured or normal side and asserted that a bilateral difference of 1.5 cm (15 mm) should be the threshold for deciding whether scapular asymmetry is present.

Figure1



SCALE-The DPA Scale. The DPA is a multidimensional, patient-report scale that is rooted in both current disablement and HRQOL paradigms. The scale includes questions designed to assess disablement across 3 interrelated domains: IMP, FL, and DIS. Additionally, an HRQOL domain, quality of life, was added to the scale to measure the psychosocial effects of injury on the patient. The terminology used to describe the disablement domains has also been used by a number of models in the field of physical medicine. The HRQOL models generally include symptom status, functional status, health perceptions, and overall quality of life. The latter is influenced by values preferences and social and psychological supports. To avoid redundancy with disablement components that measure symptoms and function, the last element in the conceptual framework, overall quality of life, was the focus of the last domain of the DPA. components that measure symptoms and function, the last element in the conceptual framework, overall quality of life, was the focus of the last domain of the DPA[8]

The concurrent validity of the DPA was done by comparing all DPA scores with GF scores in participants with acute and persistent injuries using a 2-tailed Pearson correlation[8]

Test-retest reliability was established by calculating intraclass correlation coefficient (2,1) values for 2 separate test administrations as per a study done by Luzita I. Vela, PhD,et al(2010).

PROCEDURE

Institutional ethical clearance was taken, and a written consent form was taken from all the subjects. Subjects in the age group of 25 to 35 years were included in the study. The subjects were then screened according to the inclusion and exclusion criteria. After that the purpose of the study and the procedure was explained to the subjects, following which brief history was taken and examination of scapula dyskinesia was done.

The patient was examined with their shirt off or in a sports bra to thoroughly assess the posture, quality of motion, with the Lateral scapular slide test as it utilizes the measurement of the amount of lateral scapular slide from a fixed vertebral landmark in 3 positions of increasing muscular demand.

Figure 2

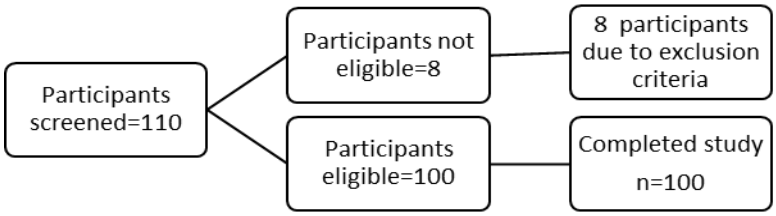
Position 1 **Position 2** **Position 3**

Statistical Analysis

		Participants
Demographic data	Number of males	61
	Number of females	39
	Age Mean(±SD) Male Female	28.49(±2.873) 28.67(±2.850) 28.38 (±2.905)
	Height Mean(±SD) Male Female	161.09(±88.301) 162.64(±8.333) 160(±8.195)
	Weight Mean(±SD) Male Female	65.04 (±11.822) 65.44(±12.663) 64.79(±11.352)
Table 1		

All data was analyzed using SPSS version 28.0.1.1 (14).

Figure3.



RESULT

A total of 100 participants were taken in the study, out of which 61 were females and 39 were males. Age range was 25-35 years with an average of 28.49±2.87, years, with males showing an average of 28.67±2.850 years and females showing an average of 28.38±2.905 years.

The average height of the 100 participants was 161.09±88.301, with males showing an average of 162.64 ±8.333, and females showing an average of 160±8.195, the mean weight of all the participants was 65.04 ±11.822, with males showing an average of 65.44±12.663, and females showing an average of64.79±11.352.

The study was conducted over a period of six months and there were no dropouts.

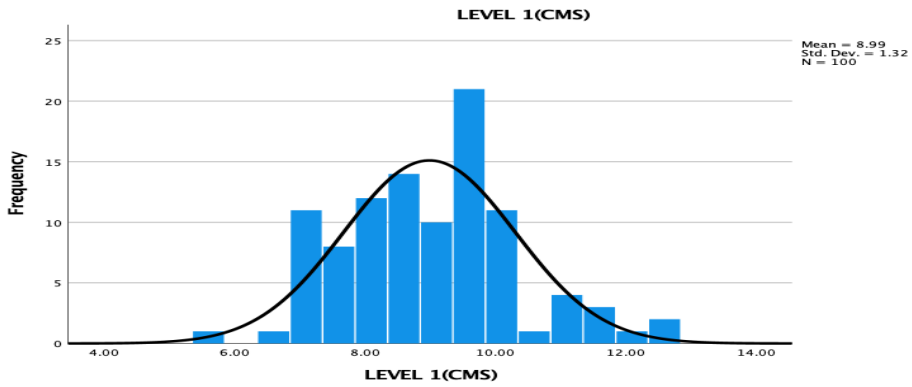
A basic demographic data of the participants was recorded and shown in the following table,

Table 2.

Statistics		
INFERENCE		
N	Valid	100
	Missing	0
Mean		.60
Mode		1
Std. Deviation		.492

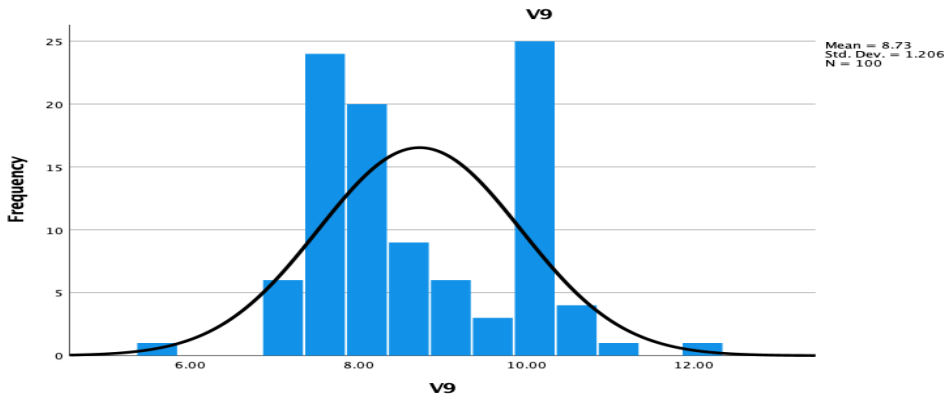
It was concluded that a total of 60% of the participants taken into the study had scapular dyskinesia.

Graph 1



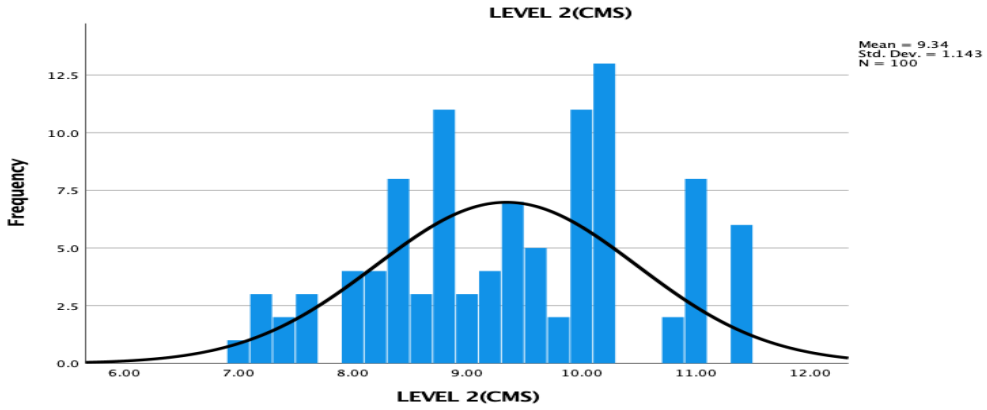
Level 1was the measure of the distance between the inferior angle of the scapula and the corresponding spinous process in centimetres with arms in neutral position.
Graph 1 shows that the mean and standard deviation for level 1(right side) measurement was 8.89 and 1.32 respectively. Hence inference for graph 1 is that more than 20 candidates had a difference of more than 10 centimetres.

Graph 2



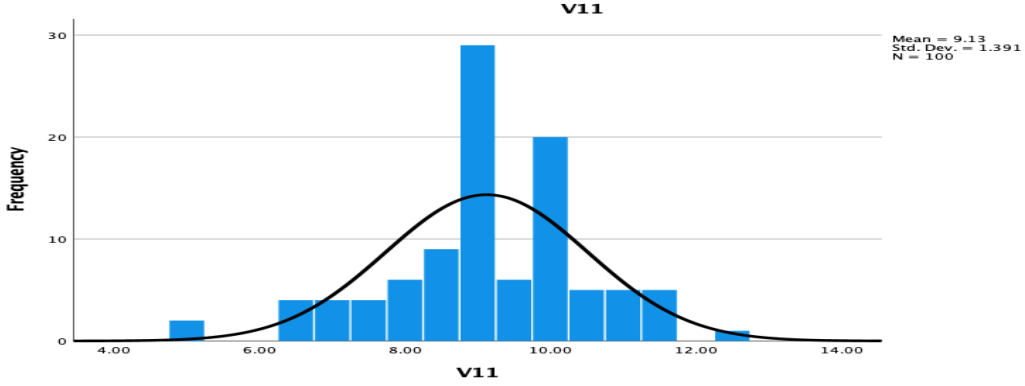
Graph 2 shows that the mean and standard deviation for level 1(left side) measurement was 8.73 and 1.206 respectively. Hence inference for graph 2 is that 25 candidates had a difference of more than 10 centimetres.

Graph 3



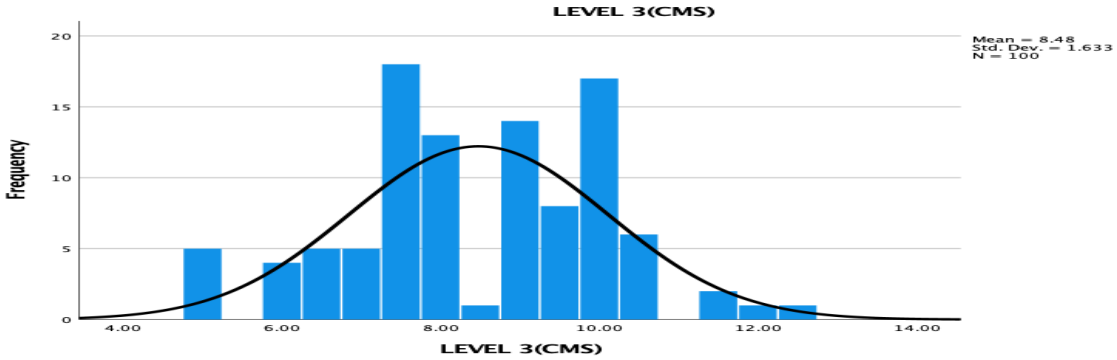
Level 2 was the measure of the distance between the inferior angle of the scapula and the corresponding spinous process in centimetres with hands on the waist.
Graph 3 shows that the mean and standard deviation for level 2(right side) measurement was 9.34 and 1.143 respectively. Hence inference for graph 3 is that more than 12 candidates had a difference of more than 10 centimetres.

Graph 4



Graph 4 shows that the mean and standard deviation for level 2(left side) measurement was 9.13 and 1.391 respectively. Hence inference for graph 4 is that more than 20 candidates had a difference of more than 9 centimetres.

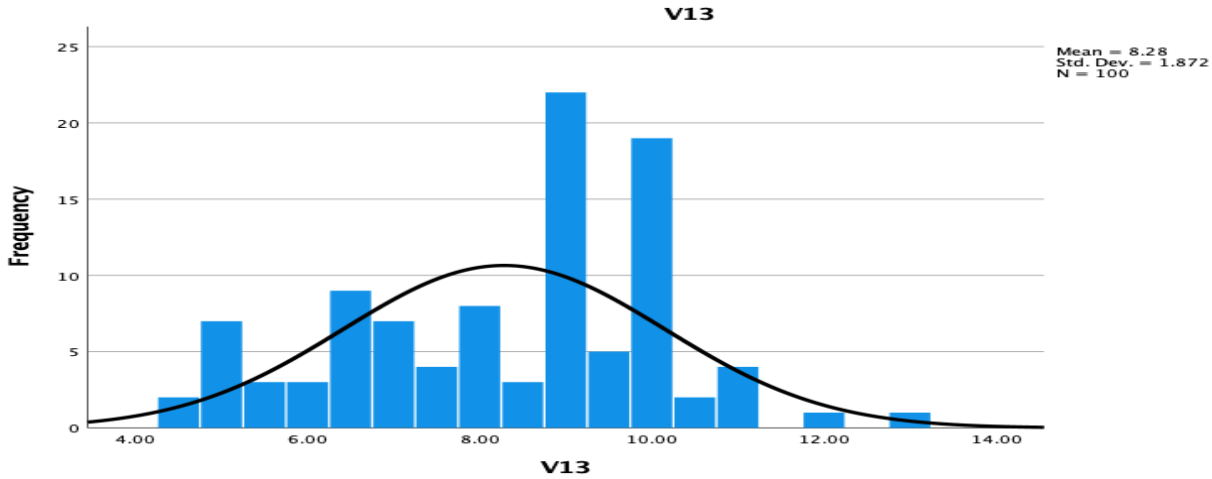
Graph 5



Level 3 was the measure of the distance between the inferior angle of the scapula and the corresponding spinous process in centimetres with arms abducted and internally rotated.

Graph 5 shows that the mean and standard deviation for level 3(right side) measurement was 8.48 and 1.633 respectively. Hence inference for graph 4 is that more than 15 candidates had a difference of more than 8 centimetres.

Graph 6



Graph 6 shows that the mean and standard deviation for level 3(left side) measurement was 8.28 and 1.872 respectively. Hence inference for graph 6 is that more than 20 candidates had a difference of more than 9 centimetres.

Statistics							
		LEVEL 1(CMS)	**V9**	**LEVEL 2(CMS)**	**V11**	**LEVEL 3(CMS)**	**V13**
N	Valid	100	100	100	100	100	100
	Missing	0	0	0	0	0	0
Mean		8.9910	8.7270	9.3440	9.1250	8.4780	8.2830
Std. Deviation		1.31979	1.20587	1.14286	1.39062	1.63278	1.87245

Table 3

Table 3 shows that the mean and standard deviation for- level 1(right side) was 8.9910 and 1.31979 respectively, level 1(left side) was 8.7270 and 1.20587, level 2(right side) was 9.3440 and 1.14286, level 2(left side) was 9.1250 and 1.39062, level 3 (right side) was 8.4780 and 1.63278, level 3(left side) was 8.2830 and 1.87245.

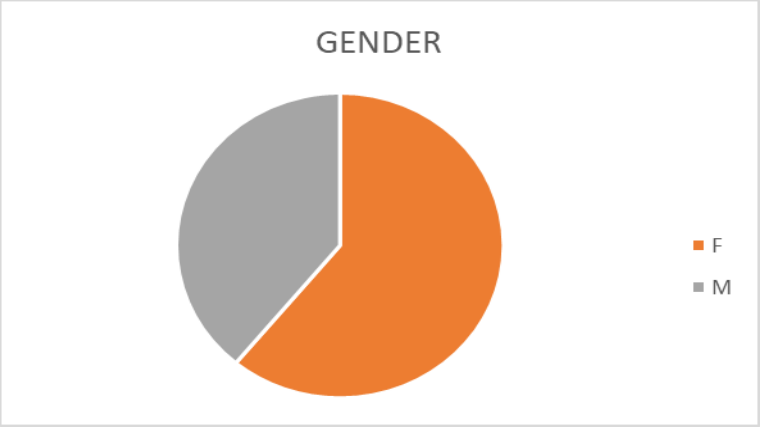


Figure 7

DISCUSSION

The glenohumeral joint is a diarthrodial joint and one of the four joints of the shoulder complex. It is a combination of the humoral head and glenoid fossa and connects the upper extremity to the trunk. The scapulohumeral rhythm can be defined the coordinated motion of the scapula and humerus experienced during shoulder movement and motion that has been traditionally viewed as occurring at a ratio of 2:1 (2 degrees of humeral flexion/abduction to 1 degree of scapular upward rotation). To maintain this configuration the scapula must move in coordination with the movement of the humerus. The best thing position of the scapular it's 5 cm from the midline between the second through the seventh rib, internally rotated 35 to 45° from the coronal plane, anteriorly 10 to 15° from the vertical plane and 5 to 10° vertically.

As a consequence of lockdown during the COVID-19 pandemic, the education system has changed majorly. The only way to conduct classes, meetings, examinations was to do so online which led to an increase in the use of electronic devices. The main issue that came out of this was the use of the same required an individual to sit in one place for prolonged hours at a stretch. Hence this distance learning caused an increase in the number of musculoskeletal problems associated with muscle spasms or imbalances subsequently. Due to the various restrictions imposed it also made it difficult for individuals to continue with their other usual physical activities such as walking. There was decrease in physical activity post the pandemic as per a study done by Puccinelli PJ et all (2021). Syndromes such as Text neck syndrome, text finger syndrome, carpal tunnel syndrome, computer vision syndrome, and cubital tunnel syndrome (Kulin & Reaston, 2011) became more prevalent.

Scapular dyskinesia is defined as the observable alteration in the position of the scapular and the patterns of the scapular motion in relation to the thoracic cage, as a result of muscle activation or coordination. Scapular stabilisation requires coupling of the upper and lower trapezius, rhomboids and serratus anterior. Scapular elevation is performed with the coordination of serratus anterior, lower trapezius coupled with the upper trapezius and rhomboids. The deltoid performs abduction and helps in stabilisation of the glenohumeral joint in elevation activities. The activation of the lower trapezius is necessary for the maintenance of normal path because of its attachment at the medial aspect of the spine and towards straight line of pull when the arm elevates(hence causing scapular rotation). The muscle activation test results in force couples and aids in smooth scapular control.[14]

The resting posture of excessive thoracic kyphosis and cervical lordosis result in excessive scapular protraction along with acromial depression which increases the

potential for impingement.[1] Proprioception is the ability to detect static or dynamic position of a limb in space, changes in posture may cause director indirect alteration in sensory information provided by the mechanoreceptors. These mechanoreceptors, convert the deformity into a frequency modulated signal and is transmitted via afferent and efferent pathways. Any type of muscular imbalance may rupture the innervation of the nerve fibres and thus cause proprioceptive loss. Indirect disruption can lead to the sensory receptors being intact but providing incorrect positional information due to imbalance does deactivating the neuromuscular pathways and causing insufficient or in coordination of muscular group activation, hence causing dyskinesia.[4]

A study by Matthew B. Burn, et al(2016) concluded that there was a greater prevalence of scapular dyskinesia in overhead athletes as compared to non-overhead athletes, similarly our study also concludes with similar results except that the population taken was that of healthy individuals.

A study by Hugo Machado Sanchez et al (2018) stated that muscular imbalance can also be caused due to fatigue of scapular muscles thus leading to alter the glenohumeral proprioception. Sherry's law of reciprocal inhibition and muscle spindle says that activation of muscles uses stretch reflex and the connections to stimulate and agonist and inhibits the antagonist using the inhibitory interneuron, hence our study concludes the prevalence of scapular dyskinesia as a result of the outcome of these underlying mechanisms.

Therefore if a muscle or group of muscles are continually recruited in an abnormal manner, example -forward head posture, eventually the antagonist will be inhibited due to the receival of continuous inhibitory impulses. This inhibition causes the decreased ability exert torque and stabilise the scapula thus causing disorganisation of normal muscle firing patterns. Most commonly the muscles that are affected are serratus anterior, lower and middle trapezius, rhomboids.

The purpose of the study was to identify the prevalence of scapular dyskinesia in healthy individuals between the age of 25 to 35 years post the lockdown due to the Covid pandemic. It was found that out of the 100 participants in the study, 61 had scapular dyskinesia.

A study further supports the greater prevalence of scapular dyskinesia in overhead athletes as compared to non-overhead athletes due to increase forces and stress on the shoulder. Identifying scapular dyskinesia allows for early therapeutic intervention does she want to improve for shoulder symptoms.

CONCLUSION

This study concludes that there is prevalence of scapular dyskinesia in healthy individuals between the age of 25 to 35 years. It was found that out of 100 participants included in the study 60% of them had scapular dyskinesia with a mean value of - level 1(right side) was 8.9910, level 1(left side) was 8.7270, level 2(right side) was 9.3440, level 2(left side) was 9.1250, level 3 (right side) was 8.4780, level 3(left side) was 8.2830.

Hence it can be concluded that post the covid pandemic lockdown there has been a prevalence of scapular dyskinesia in healthy individuals between the age of 25-35 years, due to faulty postures and muscular imbalance following the same. Early identification is necessary as it will form a baseline for future studies on rehabilitation. This study also proves that scapular dyskinesia prevails not only in athletes but also in the population of healthy individuals with various jobs such as desk jobs, household chores, activities involving prolonged sitting in posture.

Study Limitations

The sample size was small due to the study being conducted during the covid pandemic.
Types of scapular dyskinesia were not included

Further Suggestions

Further studies can include rehabilitation of scapular dyskinesia.
It needs to be done in a larger population for better results and early identification.
Studies can include the percentage of a particular type of dyskinesia.
The reason for the greater prevalence of the same in females can be found out.

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Ethical Approval: Approved

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