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SCAPULAR DYSKINESIA IN SECONDARY SCHOOL STUDENTS: PREVALENCE ASSOCIATED FACTORS ANDITS INFLUENCE ON HAND WRITING - AN EXPLORATORY STUDY

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ABSTRACT

BACKGROUND: Scapular dyskinesis is defined as visible alterations in scapular positions and motion patterns and is believed to occur as a result of changes in activation of scapular stabilizing muscles. Scapular dyskinesis is miscellaneous condition and appeared to be prevalent in adult asymptomatic factor. But in adolescent its prevalence is still unknown. So, this study aims to collect evidence regarding whether scapular dyskinesis is present insecondary school students.

METHODS: A Convenient sample of 50 secondary school students, aged between 14 to 16 years were taken from school. All the participants were assessed for demographics, anthropometric, type of dyskinesia, scapular muscles strength, pectoralis minor muscle lengthand hand writing school. All the participants were assessed for demographics, anthropometric,type of speed.

RESULT: Scapular dyskinesia test when done on 50 students 18 (36%) were tested positive. Among them 14 (28%) were tested bilaterally positive, 16 (32%) students were tested positive on left side and 15 (30%) students were tested positive on right side in scapular dyskinesis test. There were no any statistically significant difference between the strength, muscle length and handwriting speed between the student who had scapular dyskinesis and the students without scapular dyskinesis.

CONCLUSION: Scapular dyskinesis is 36% prevalent in secondary school students. Hand writing speed and other factors are not corelated with presence of scapular dyskinesis in this population.
KEYWORDS: Scapular Dyskinesis, School Students, Risk Factors, Hand Writing

INTRODUCTION

When scapular motion becomes altered, the appropriate term to use would be scapular dyskinesis. “Dys” (alteration of) “kinesis” (motion) is a general term that reflects loss of control of normal scapular physiology, mechanics, and motion. Scapular “winging” has been used as a term synonymous with dyskinesis; however, “winging” is best reserved for altered scapular motion driven by neurological compromise. [(1)]

Scapular dyskinesis (SDK) is defined as visible alterations in scapular positions & motion patterns & is believed to occur as a result of changes in activation of scapular stabilizing muscles.[(2)] Scapular mobility is one of the prerequisites for proper shoulder motionsand function. Scapula plays an important role in Glenohumeral kinematics and if any altered scapula motion may lead to Glenohumeral dysfunction. The altered position and the affected kinematics of the scapula will be termed as Scapular dyskinesis. [(3)] The prevalence of scapulardyskinesis was significantly higher in overhead athletes (61%) compared with non-overhead athletes (33%). [(4)]

There are three main types of SDK 1) The dorsal prominence observed over the inferior angle of scapula that is known as Type -1 scapula dyskinesis. 2)The dorsal prominence of theentire medial border is known as Type -2 scapula dyskinesis.3) The elevated superior border of scapula represents Type - 3 scapular dyskinesis. [(3)]

Clinical sign and symptoms of SDK are pain and or tenderness around the scapula when using the arm overhead or carrying heavy objects with the arm at the side, snapping or popping sensation around the scapula with shoulder movement, Loss of strength with shoulder and arm use. Asymmetrical posture (affected side usually sits lower), winging of the scapula and instability of the shoulder (feels like it moves out of place) [(5)]

The commonest causative mechanisms of dyskinesis have a soft tissue components, involving either intrinsic muscle pathology or inflexibility or inhibition of normal muscle activation. Decreased flexibility of pectoralis minor have been shown to create anterior tilt andprotraction of the scapula as a result of their pull on the coracoid. [(2)] The discovery of dyskinesis with physical impairments but without obvious pathology should prompt anevaluation for kinetic chain or muscle inflexibility causative factors. [(6)]

During normal shoulder elevation, the scapula moves in the direction of upward rotation, posterior tilt, and external rotation [(7)]. These movements were examined by the coordinated shift analysis during both flexion and abduction. Miura [(8)] showed that the scapulaabducted and upward rotated from 30° to 120° and adducted and upward rotated from 120° to 180° in shoulder flexion, whereas the scapula adducted and upward rotated from 0° to 90° andabducted and upward rotated from 90° to 180° in shoulder abduction. Therefore, scapulohumeral rhythm during elevation depends on the plane and elevation angle. Consequently, it is necessary to investigate the scapulohumeral rhythm in sagittal flexion andabduction in the coronal plane, respectively.

The scapular muscle group consisting of the Trapezius, Serratus anterior (SA). Pectoralis minor (PM), Pectoralis major, Levator scapulae (LS), Rhomboid muscle (RM), andTeres major (TM), is mainly responsible for scapular movement and dynamic stabilization ofthe scapula. An optimal interaction between these muscles is needed to provide stability and mobility of the scapula both at rest and during shoulder movements. These altered muscle activation patterns are associated with altered scapular kinematic, including reduced scapularupward rotation, external rotation and posterior tilt. [(4)]

Neurologically based winging is clinically observed when any portion of the scapula excessively departs from its contact with the thorax immediately upon the initiation of arm motion and remains disconnected throughout the ascent and descent phases of the arm movement. Conversely, altered scapular positioning can be observed in the resting position ofthe arm but is more often seen dynamically in the descent phase of arm motion. During the dynamic arm movement, scapular dyskinesis can be clinically characterized by medial or inferior medial border prominence, early scapular elevation or shrugging upon arm elevation,and/or rapid downward rotation upon arm lowering. [(9)] The leading theory is that arm function suffers when scapular dyskinesis is present due to an alteration in the coupled glenoid and humerus relationship. [(9)] However, a cause versus effect relationship between scapular motionand shoulder injury has not been concretely established. [(10)] Considering the literature has consistently noted that scapular dyskinesis, in isolation, is not an injury or a musculoskeletal diagnosis but rather a physical impairment, [(10)] scapular dyskinesis should be viewed as an impairment with a causative origin.

Treatment of SD aims at the restoration of scapular retraction, posterior tilt and external rotation. Specific exercises for scapular rehabilitation are [(11)] flexibility exercises: To increase the flexibility of the pectoralis minor and the external rotation and posterior tilt of the scapula, shoulder horizontal abduction at 90 degrees and 150 degrees of elevation. [(12)(13)(14)] Stabilization exercises based on stretching and strengthening to optimize scapularkinematics, and improve muscle strength and joint position sense [(15)(16)(17)]: Closed andopen kinetic chain exercises, including push-ups, lawnmower exercises, and resisted scapular retraction. [(15)(17)]

The serratus anterior and trapezius muscles play a key role in scapular stabilisation. They act as a force couple during upper extremity movements and are particularly important in the overhead position. [(18)(19)(20)] Also, they are the main muscles that cause dyskinesia, [(21)] so they should be considered well in rehabilitation. The push- ups on a stable surface stretch the serratus anterior and improve the general muscle strength with a Red Cord sling. The push-ups on an unstable surface increase the trapezius activation while decreasing the serratus anterior activation. [(22)(23)]

Shrug exercises activate the upper and lower trapezius and increase the upward rotation angle. So they are useful for the patient with SD and corresponding scapulardownward rotation syndrome. [(24)(25)] But, this exercise should not be in the first 4-6 weeks of rehabilitation, or it can delay the restoration of scapular muscle balance. [(26)]

In adolencents common musculokeletal condition are sports injuries, sprain, strain, contusion, injuries with fall, fracture, developmental dysplasis of the hip, Legg-Calvé- Perthes disease, slipped capital femoral epiphysis, Osgood-Schlatter disease, patellofemoral syndrome, radial head subluxation and a variety of bone fractures were studied in past but scapular dyskinesis in adolencents is not much explored by the researcher in past. [(27)]

In recent study by **Ashani Kasodariya, Dharti Pansala,**[(2)] scapular dyskinesis is explore in adult population, but in adolencent population no study is conducted so we want to exploremore about this topic.

AIM AND OBJECTIVES OF THE STUDY

AIM

To explore prevalence and associated factors of scapular dyskinesia and to check theinfluence of scapular dyskinesia on hand writing in secondary school students.

OBJECTIVES

1) To find prevalence of scapular dyskinesia in secondary school students.
2) To understand the mechanical factor contributing to scapular dyskinesia.
3) To identify risk factors, such as muscle weakness or imbalance, that predisposeindividuals to scapular dyskinesia.
4) To investigate the relationship between scapular dyskinesia and hand writing speed.

METHODOLOGY

- **Study design:** Exploratory study
- **Study duration:** 6 months
- **Study Population:** Secondary School Students
- **Sampling design:** Convenient sampling technique
- **Sample size:** 50
- **Study setting:** L.H. BOGRA HIGH SCHOOL, Surat
- **Inclusion Criteria:**
  - Seconday school student between Age 14-16
  - Sex: male and female
  - Parents gave consent for voluntary participation
- **Exclusion Criteria:**
  - Past History of any surgery, injury or pathology of neck or shoulder
  - Presence of any neurological condition that affected muscular strength andconsequent upper extremity range of motion,
  - Involved in any athletic or other sports
  - Unable to achieve ≥ 140 ° of shoulder elevation,
- **Materials and Tools:**
  - Handheld dynamometer
  - Measure tap
  - Weighing machine

- Stadiometer
- Dumbbells
- Plinth
- Stool
- Pen and paper
- Assessment form
- Consent form

➢ **Outcome measures:**

- Scapular Dyskinesis test
- Hand Held dynamometer
- Pectoralis Minor Index
- Handwriting Speed Test

➢ **Procedure:**

A Convenient sample of 50 seconday school students, aged between 14 to 16 years were taken from L.H. BOGRA HIGH SCHOOL, Surat. Participants were selected for study based on inclusion and exclusion criteria. Parents of all the participants were asked to give & sign consent form prior to participation in the study (Appendix I). All the participants were assessed for demographics, anthropometric, type of dyskinesia, scapular muscles strength, pectoralis minor muscle length and hand writing speed as described below.

Scapular Dyskinesis Test: [(28)]

Participants were evaluated for scapular dysfunction of the dominant shoulder utilizing the scapular dyskinesis test. The participants performed separate trials of bilateral shoulder flexion and abduction while holding either a 1.4 kg or 2.3 kg weight: 1.4 kg for body masses 68.1 kg. The test was modified by having the participants perform 10 repetitions for each movement. Movement velocity was standardized across all participants by way of a metronome set at 80 beats per minute resulting in a movement velocity of approximately 120 °/s; therefore, each trial lasted 30 seconds. Performance of the test was digitally recorded from a standardized distance and height for documentation purposes.

The presence of scapular dyskinesis was determined by scapular winging, dysrhythmia, or both as defined by McClure et al. [(29)] Scapular winging was defined as any posterior displacement of the medial border and/or inferior angle of the scapula away from the thorax. Dysrhythmia was defined as any early or excessive elevation or protraction, non-rhythmical motion while raising or lowering the arm, or rapid downward rotation while lowering the arm.

Figure 4 : Test for scapular dyskinesis

❖ **Evaluation of Flexibility using pectoralis minor index** [30]

The participant position will be in supine, arms by side, elbows flexed, palms upward and instructed to relax. The amount of tightness is measured by the extent to which the shoulder israised from the table. The length of pectoralis minor will be measured by the linear distance in centimeters using a measuretment tape between the posteri`or border of the acromion and the table. Distance should not exceed 2.54 cm (1 inch). A distance greater than this would suggest a muscle imbalance had occurred and the muscle had shortened.

❖ **Evaluation of strength using hand held dynamometer:** [31]

Isometric strength of the serratus anterior, upper trapezius, middle trapezius and rhoboids willbe measured by using hand held dynamometer.

- **The upper trapezius (UT)** muscle test will be performed in sitting position asdescribed by Hislop et al. The HHD (Hand held dynamometer) will be placed over the superior

aspect of the scapula. Force will applied directly downward (inferior) in the direction of scapular depression. The participant will be asked to perform scapular elevation against resistance of the dynamometer.

- **The middle trapezius (MT)** muscle will be tested in the prone position, accordingto Donatelli et al. The MT will be tested with the shoulder abducted to 90° with full glenohumeral external rotation. Pressure will be applied at the wrist of the participant, at the lateral aspect of the distal radius. The participant will be asked to perform a horizontal abduction with external rotation. HHD will be placed one inch proximal to the lateralepicondyle of the elbow.

- **Serratus anterior (SA)** strength measurement will be tested in sitting. Participants will be seated in a stable chair with lumbar support, but without scapular support and instructedto elevate the tested arm in the scapular plane to respectively 125° shoulder flexion, with the elbow in 90° of flexion. Angles will be checked with a standard goniometer. Axial pressure will be applied with the HHD on the olecranon in the scapular plane.

- **Rhomboids** muscle will be tested in the prone position with the hand behind backwith elbow flexion and full glenohumeral internal rotation. Pressure will apply at the wrist of the participant, at the lateral aspect of the distal radius. The participant will be asked to lift the hand towards wall. HHD will be placed over back of shoulder.

Participants were asked to perform isometric contraction for 5 seconds. Three trials were performed for each muscle with at least 60 seconds rest between trials. The average of the three trials for each was used to assess the isometric scapulothoracic muscle strength.

(B)

(C) **(D)** **(E)**

Figure 5: Strength test positions for muscle using hand-held dynamometer (A) Test position for Upper trapezius muscle. (B) Test position for Middle trapezius muscle (C) Test position for serratus anterior muscle (D) Test position for lower trapezious. (E) Testposition for romboids

- **Evaluation of Flexibility using pectoralis minor index** (32)

The participant position will be in supine, arms by side, elbows flexed, palms upward and instructed to relax. The amount of tightness is measured by the extent to which the shoulder is raised from the table. The length of pectoralis minor will be measured by the linear distancein centimeters using a measuretment tape between the posterior border of the acromion and the table. Distance should not exceed 2.54 cm (1 inch). A distance greater than this would suggest a muscle imbalance had occurred and the muscle had shortened.

Figure 6: Pectoralis minor index measurement

STATISTICAL ANALYSIS

Statistical analysis for this study was done using JAMOVI version 2.3.28 Software. Microsoftword 2016 and Excel 2016 was used to generate graphs and tables. This study included Age, BMI, Scapular Muscle Strength (Serratus Anterior, Upper Trpezius, Middle Trapezius And Rhomboids), Flexibility (Pectoralis Minor) And hand writing speed as quantitative variables. This study included gender, handedness, type of SD, Side of affection of SD, family type, socio-economic status, family income as a qualitative variable. Mean, median and standard deviation were calculated for all quantitative variables and qualitative variables were represented as percentage of total number of participants.

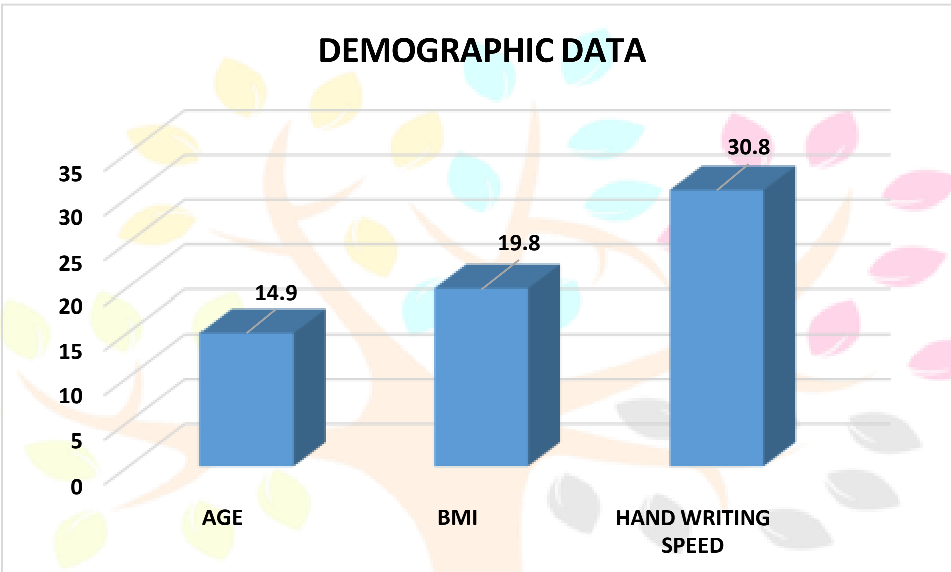
Shapiro-Wilk test was applied to check the normality of data. All quantitative data of this studydid not follow the normal distribution ($p>0.05$). Based on that, data were analysed by non- parametric tests i.e. Mann Whitney U test was used for between group comparisons. While, chi-square test was used for qualitative variables. Confidence interval was kept 95% and the level of significance for all statistical data was set $\alpha = 0.05$.

RESULT

Total 50 secondary school students of L.H. BOGRA HIGH SCHOOL were participated in the study. Mean Age of participants was 14.9±0.452, minimum age was 14 and maximum age was 16 years. Mean weight of participants was 49.2±10.8, Minimum weight was 32 and maximum weight was 80kg. Mean height of participants was 1.57 + 0.0645, Minimum height was 1.47 and maximum height was 1.68 meter. Mean BMI of participants was 19.8±4.46, minimum BMI was 12.5 and maximum BMI was 36.5 kg/m^2. All the students were studying in 9th standard. Mean hand writing speed of participants was 30.8±6.18, minimum 19 and maximum 44 words per minute. (Table-1, Graph 1)

Sr.no	VARIABLE	MEAN +SD	MEDIAN	MINIMUM	MAXIMUM
1	AGE	14.9 ± 0.452	15	14	16
2	HEIGHT	1.57 ± 0.0645	1.57	1.47	1.68
3	WEIGHT	49.2 ± 10.8	46.5	32	80
4	BMI	19.8 ± 4.46	19.8	12.5	36.5
5	HAND WRITING SPEED	30.8 ± 6.18	31	19	44

TABLE 1: DEMOGRAPHIC DATA



Graph 1 - DEMOGRAPHIC DATA

Out of the 50 total number of students who participated in the study, 28(56%) were females and remaining 22 (44%) were males with a male to female ratio of 14:11. Most of theparticipants 48(96%) were right-handed and remaining 2 (4%) were left-handed. (Table-2, Graph-2,3)

Number of siblings among participants were different i.e. 6 (12%) students have no siblings, 32 (64%) students have one sibling, 7 (14%) students have two siblings, 4 (8%) students have three siblings and 1 (2%) student has four siblings. Out of 50 students 6 (12%)felt pain around neck, shoulder and upper back while the other 44(88%) didn't have pain. (Table-2)

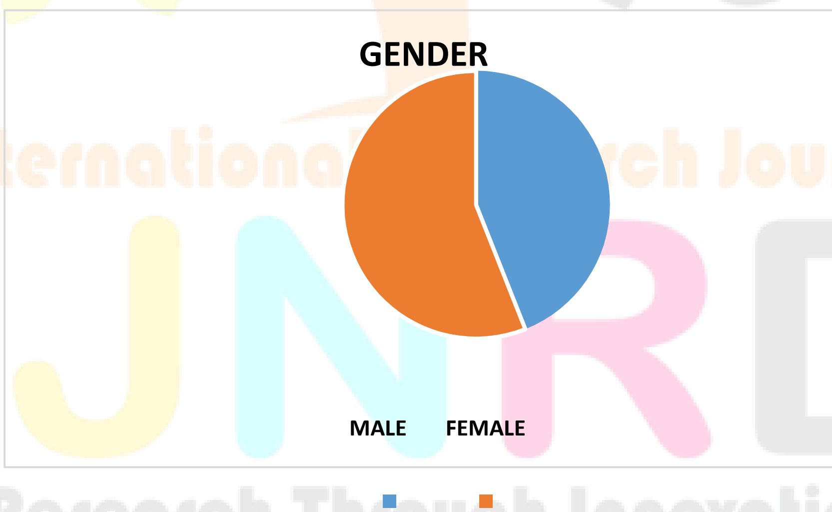
Sr.no	VARIABLE	CATEGORY	N	PERCENTAGE
1	GENDER	MALE	22	44%
		FEMALE	28	56%
	HANDEDNESS	RIGHT	48	96%
		LEFT	2	4%
	SIBLINGS	0	6	12%
		1	32	64%
		2	7	14%
		3	4	8%

		4	1	2%
	PAIN	YES	6	12%
		NO	44	88%
2	FAMILY TYPE	JOINT FAMILY	8	16%
		NUCLEAR FAMILY	42	84%
3	ANNUAL FAMILY INCOME	< 4 LACS	20	40%
		BETWEEN 4-6 LACS	19	38%
		>6 LACS	11	22%
4	FAMILY TYPE	LOWER CLASS	8	16%
		UPPER LOWER CLASS	14	28%
		LOWER MIDDLE CLASS	16	32%
		UPPER MIDDLE CLASS	12	24%
		UPPER CLASS	0	0%

TABLE 2: CATEGORIAL VARIABLE

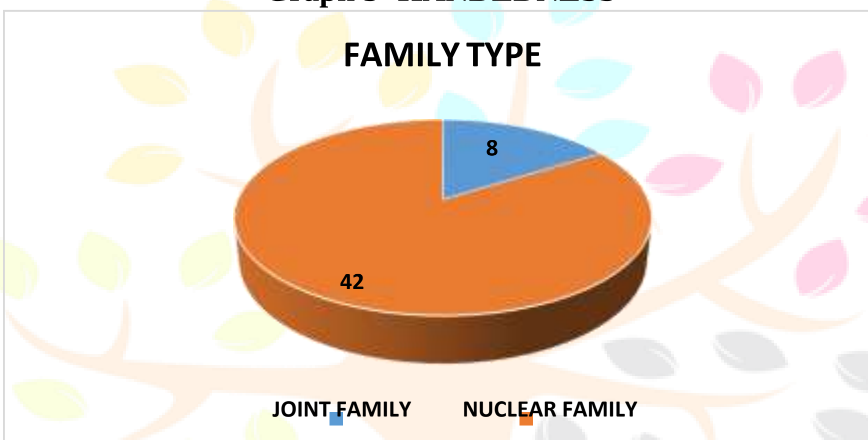
When family type and income were analyzed, we found that 8 (16%) students belongedto joint family while the other 42 (84%) live in nuclear family. 20 (40%) students' family income was < 4 lacs while 19 (38%) had income between 4-6 lacs and 11 (22%) had income >6 lacs. According to kuppuswammy Socioeconomic status 8 (16%) students belonged to lower class, 14(28%) were from upper lower class, 16 (32%) were from lower middle class, 12 (24%) from upper middle class and none of the student was belonged to upper class. (Table-2, Graph – 4,5,6)

Scapular dyskinesia test when done on 50 students 18 (36%) were tested positive. Among them 14 (28%) were tested bilaterally positive, 16 (32%) students were tested positiveon left side and 15 (30%) students were tested positive on right side in scapular dyskinesis test. (Table-2)

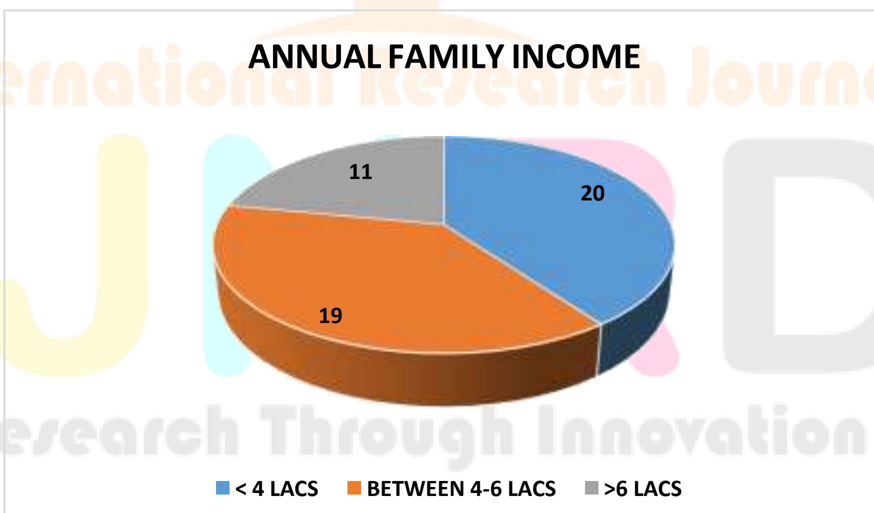


Graph 2 – GENDER

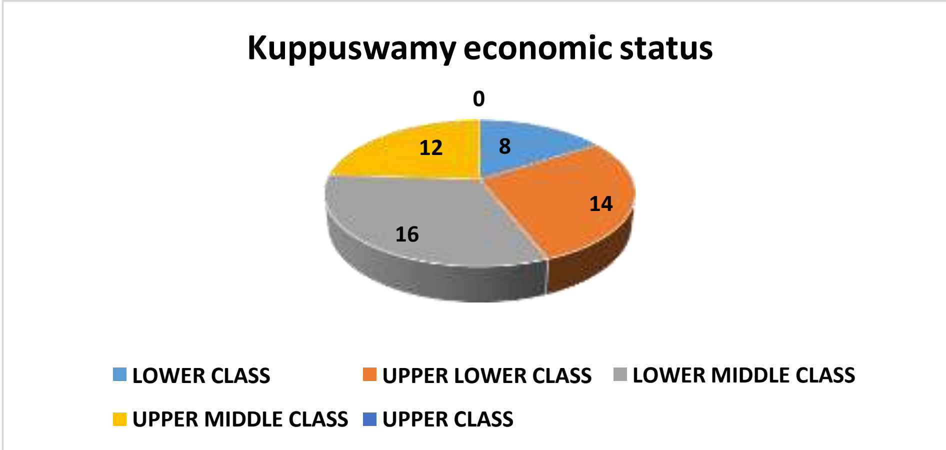
Graph 3- HANDEDNESS



Graph 4 – FAMILY TYPE



Graph 5 – ANNUAL FAMILY INCOME



Graph 6 – KUPPUSWAMY ECONOMIC STATUS

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When compared right scapular muscle strength between the students with right scapular dyskinesis (positive scapular dyskinesis test) and students without right scapular dyskinesis (Negative scapular dyskinesis test) mean upper trapezius strength of positive group was 55.07+10.63 and negative group was 59.53+18.56 and P value was 0.389 (Table-3, Graph-7) mean middle trapezius strength of positive group was 44.83+11.53 and negative group was 45.02+10.42 and P value was 0.955 (Table-3, Graph-8), mean lower trapezius strength of positive group was 30.78+6.37 and negative group was 29.13+7.39 and P value was 0.456 (Table-3, Graph-9), mean serratus anterior strength of positive group was 38.39+11.39 and negative group was 43.15+11.33 and P value was 0.181 (Table-3, Graph- 10), mean rhomboid muscle strength of positive group was 43.81+9.03 and negative group was 49.55+14.00 and P value was 0.151(Table-3, Graph-11). When compared right scapular muscle flexibility of pectoralis minor between them mean length of positive group was 8.27+1.87 and negative group was 7.64+1.73 and P value was 0.259 (Table-3, Graph-12)

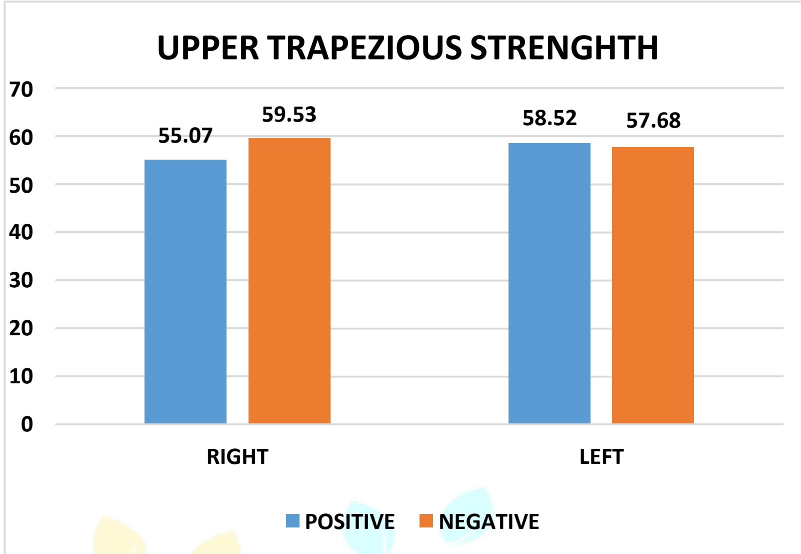
When compared left scapular muscle strength between the students with left scapular dyskinesis (positive scapular dyskinesis test) and students without left scapular dyskinesis (Negative scapular dyskinesis test) mean upper trapezius strength of positive group was 58.52±14.36 and negative group was 57.68±17.56 and P value was 0.865 (Table-4, Graph-7), mean middle trapezius strength of positive group was 47.78±9.11 and negative group was 49.51±8.78 and P value was 0.518(Table-4, Graph-8), mean lower trapezius strength of positive group was 30.32±7.67 and negative group was 31.68±8.79 and P value was 0.593 (Table-4, Graph-9), mean serratus anterior strength of positive group was 39.74±8.58 and negative group was 41.49±10.09 and P value was 0.544 (Table-4, Graph-10), mean rhomboid muscle strength of positive group was 45.42±9.24 and negative group was 47.43±12.47 and Pvalue was 0.562 (Table-4, Graph-11). When compared left scapular muscle flexibility of pectoralis minor between them mean length of positive group was 7.71±1.26 and negative group was 7.58±1.70 and P value was 0.7829. (Table-4, Graph-12)

SD TEST	MUSCLE STRENGTH					MUSCLE LENGHTH
	UT	MT	LT	SA	RHM	PM
POSITIVE	55.07±10.63	44.83±11.53	30.78±6.37	38.39±11.39	43.81±9.03	8.27±1.87
NEGATIVE	59.53±18.56	45.02±10.42	29.13±7.39	43.15±11.33	49.55±14.00	7.64±1.73
P VALUE	0.389	0.955	0.456	0.181	0.151	0.259

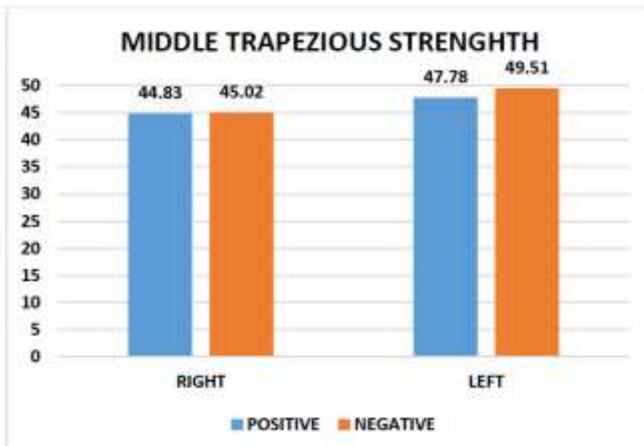
TABLE 3: RIGHT SIDE SCAPULAR DYSKINESIS TEST

SD TEST	MUSCLE STRENGTH					MUSCLE LENGHTH
	UT	MT	LT	SA	RHM	PM
POSITIVE	58.52±14.36	47.78±9.11	30.32±7.67	39.74±8.58	45.42±9.24	7.71±1.26
NEGATIVE	57.68±17.56	49.51±8.78	31.68±8.79	41.49±10.09	47.43±12.47	7.58±1.70
P VALUE	0.865	0.581	0.593	0.544	0.562	0.782

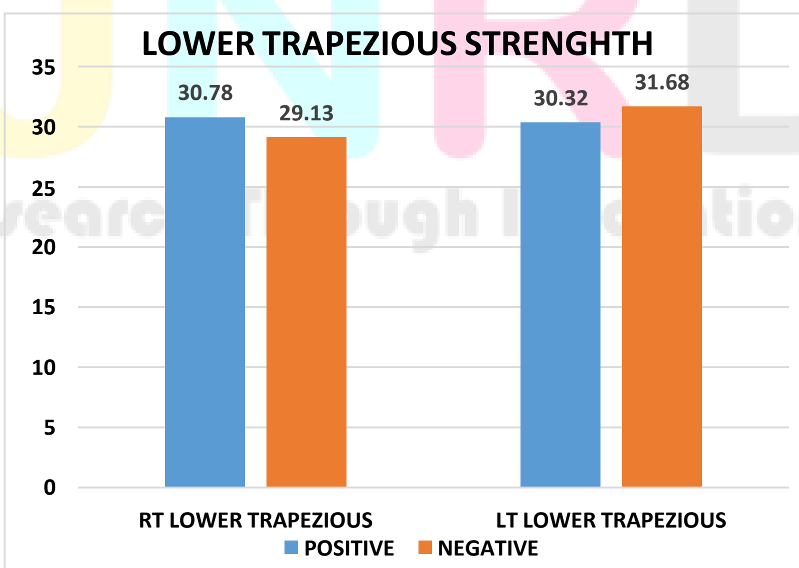
TABLE 4: LEFT SIDE SCAPULAR DYSKINESIS TEST



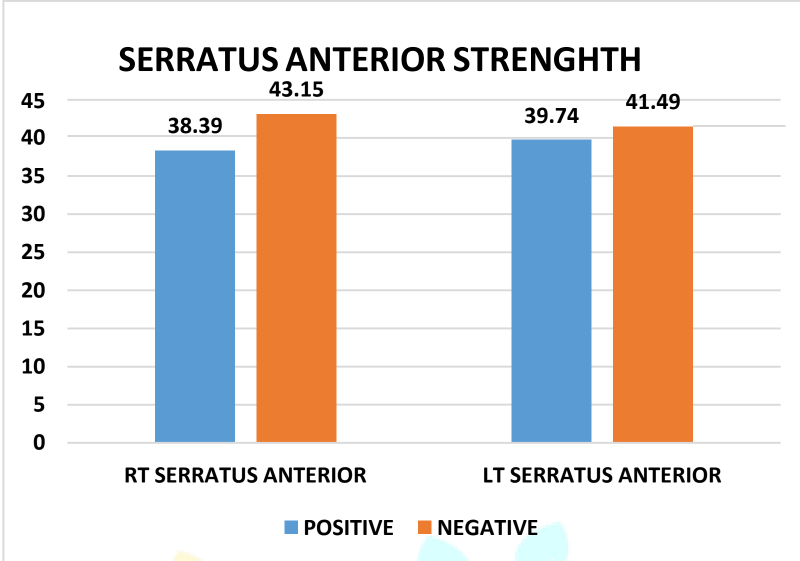
Graph 7 – UPPER TRAPEZIOUS STRENGHTH



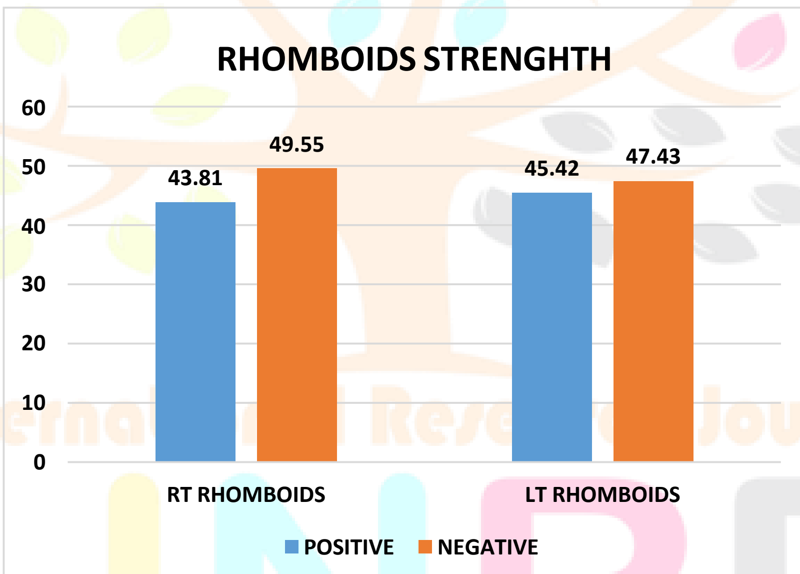
Graph 8 – MIDDLE TRAPEZIOUS STRENGHTH



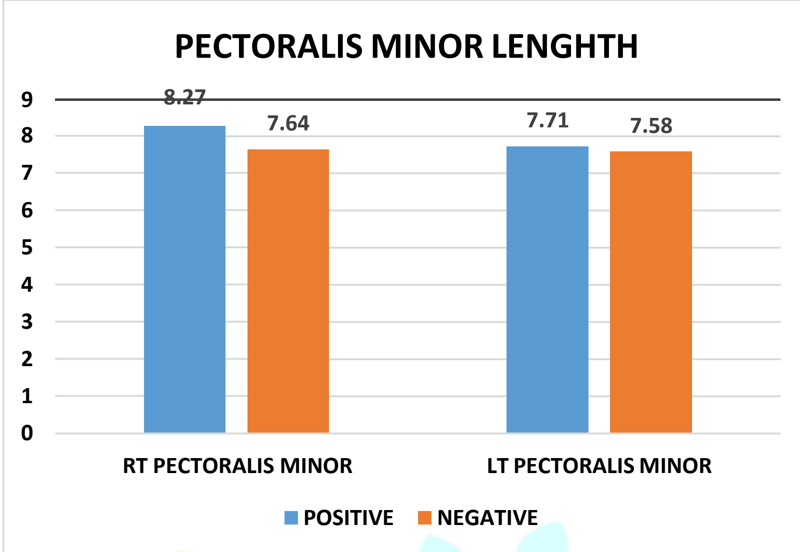
Graph 9 – LOWER TRAPEZIOUS STRENGHTH



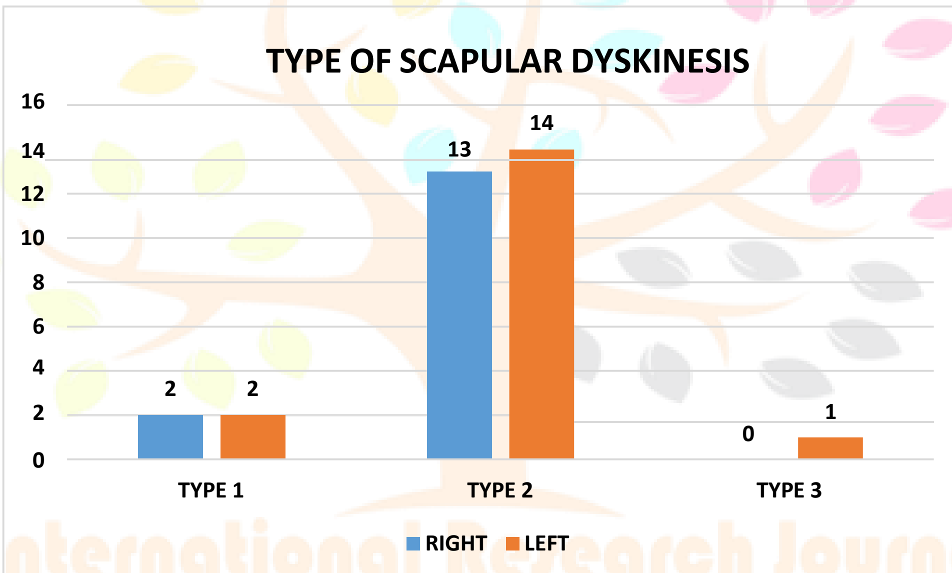
Graph 10 – SERRATUS ANTERIOR STRENGHTH



Graph 11 – RHOMBOIDS STRENGHTH



Graph 12 – PECORALIS MINOR LENGHTH



Graph 13 – TYPE OF SCAPULAR DYSKINENSIS

➢ DISCUSSION

The present study included 50 secondary school students as a participant of the study. The purpose of present study was to explore prevalence and associated factors of scapular dyskinesia and to check the influence of scapular dyskinesia on hand writing in secondary school students.

Scapula play a vital role in dynamic stability on Glenohumeral joint during shoulder movements. The upward rotation movement of the scapula completes the Glenohumeral abduction and flexion. Once there is muscle imbalance in the anterior musculature the scapula mobility is markedly affected. There will be asymmetry in the motion of scapula and that reduces the stability of scapula with Glenohumeral motions. Dyskinesia of scapula leads to loss of stability and altered kinematics during shoulder motions.

Previous study conducted by **Matthew B. Burn et al** compare the reported prevalence of scapular dyskinesis in overhead and non-overhead athletes. The authors hypothesized that overhead athletes would demonstrate a significantly greater reported prevalence of scapular dyskinesis compared with non-overhead athletes due to increased forces and stress on the shoulder. Overhead athletes did have a greater reported prevalence of scapular dyskinesis (61%) compared with non-overhead athletes (33%); however, the reported prevalence of scapular dyskinesis in non-overhead athletes was higher than the authors expected. In this study, scapular dyskinesis test was performed in secondary school student and it was found that p value of this result is <0.5 for left and right side. So, there is low chances of scapular dyskinesis in secondary school going students because they have good muscle power, good posture, good strength of pectoralis minor muscle.[(4)]

Previous study conducted by Sevgi sevi Yesilyaprak, on Having a shorter pectoralis minor and upper trapezius length substantially increase the likelihood of having visually observable scapular dyskinesis but in this study most student have good pectoralis minor and upper trapezius strength in secondary school going student so there is a low chance of scapular dyskinesis.[(33)]

Previous study is conducted by **Ashani Kasodariya, Dharti Pansala,** a narrative review on Scapular Dyskinesis: A commonly seen mysterious condition in asymptomatic adults. Result

of the review support strong evidence regarding presence of scapular dyskinesis in asmptomatic adults. Which supports the result of present study and presence of scapular diskynesis in this population.[(2)]

CONCLUSION

Scapular dyskinesis is 36% prevalent in secondary school students. Hand writing speed and other factors are not corelated with presence of scapular dyskinesis in this population.

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