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Research Article

SCAPULAR DYSKINESIS ON DOMINANT SIDE AMONG PRIMARY SCHOOL TEACHERS

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ABSTRACT

The common mode of teaching method is blackboard teaching in primary schools in India which requires long hours of repeated, sustained overhead elevation of arm could cause functional limitations. Therefore this study evaluated the presence of scapular dyskinesia among this population. Methods: Case control study was carried on 102 participants (51 teachers and 51 non teachers). Scapular positioning was assessed bilaterally using modified lateral scapular slide test at various positions in all participants. Results: Scapular dyskinesia in primary school teachers was on average seen around 50.04. Intergroup comparison of mean distances of dominant of teachers and non teachers was found to be significant at all positions of modified scapular slide test except at 180 degrees of abduction. Conclusion: There exists presence of scapular dyskinesia among 50.04% primary school teachers. This warrants the need to address scapular dysfunction in primary school teachers.

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INTRODUCTION

Teachers are extremely important constituent in society as they mould young intellectual minds in formative years of life into responsible citizens. Teachers have to adapt various postures during their hours of teaching i.e. head down while calculating grades, stooped sitting, standing during explanation and overhead elevation of arm during blackboard teaching. The common mode of teaching method is blackboard teaching in primary schools in India.

Study carried out by an ergonomist at UK's Loughborough University on teachers reported 88% experienced back pain, 73% experienced neck and shoulder pain, 53% experienced knee pain and 33% experienced hip pain. Overall, epidemiologic evidence suggests a relationship between repeated or sustained shoulder postures with more than 60 degrees of flexion or abduction and shoulder musculoskeletal disorders, including both tendinitis and nonspecific pain (Holmstrom EB *et al*, 1992).

Previous studies have demonstrated teachers were prone to develop repetitive strain injuries (RSIs) due to prolonged posture, static works and repetition which affects the area of

upper limb, neck, shoulder and low back (Chaiklieng *et al*, 2012). Author (Niloofer *et al*, 2013) stated that the sustained overhead posture, maintained during blackboard writing causes musculoskeletal fatigue and hence work related musculoskeletal disorder.

Primary school teachers are habituated to write on blackboard as a part of teaching. It requires repetitive elevation of arm and it is brought about by the combined and coordinated movement of scapula, clavicle and humerus along with contribution from the muscles surrounding them called 'scapulohumeral rhythm'. Significance of this rhythm lies in providing stability proximally at shoulder for efficient work of distal segment of the upper extremity. This repetitive task predisposes teachers to scapular muscles fatigue, imbalance or weakness (Kibler *et al*, 2003), postural abnormality (Kibler *et al*, 2002), lack of muscular capsular flexibility (Juul-Kristensen *et al*, 2011) etc. thus resulting in alteration of this normal scapulohumeral rhythm. The condition of altered scapular mechanics and motion is called 'scapular dyskinesia', where 'dys' indicates alteration and 'kinesia' motion (Kibler *et al*, 2010). Scapular dyskinesia is a condition responsible for alteration of the normal position and kinematics of the scapula rather than a disease. The symptomatic patient with scapular dyskinesia may

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complain of pain in the anterior and/or the poster superior aspect of the shoulder or in the upper part of the lateral arm below the acromion (Postacchini et al, 2013). In fact, it may be found either in asymptomatic or symptomatic patients with or without related to overhead sports- such as baseball, rugby, water polo, tennis, volleyball, swimming and badminton, as reported in the literature (Ellenbecker et al, 2012; Kawasaki et al, 2012; De Mey et al, 2013).

Therefore it was important to evaluate the scapular positioning during shoulder movements among primary school teachers due to high prevalence of repetitive strain on shoulder during blackboard writing in order to understand the cause of RSD's. Thereby this study aimed to evaluate presence of scapular dyskinesia in this population with the help Modified lateral scapular slide test using vernier calliper among primary school teachers and comparing with their aged matched non teachers. This study justifies the importance of early diagnosing scapular dyskinesia among primary school teachers to promote health and secondly for early prevention and management of associated secondary impairment in form of shoulder dysfunction.

METHODOLOGY

Ethical clearance was obtained from the institutional ethical committee. A case control study was undertaken on primary school teachers and compared with age matched normal healthy individuals. Primary Schools across Pune city was selected through cluster sampling. Total fifty one teachers of both genders aged between 25-45 years (mean: 38.13±5.31) having teaching experience of more than 5 years (mean: 12.60±6.39) with no history of trauma, using blackboard as means of teaching (Jefferson et al 2009) for more than five years experience, with and without shoulder pain secondary to repetitive stress disorder (Group 1) and fifty one age matched non teachers (Group 2) were included. The purpose and procedure of the study was explained to participants. A written consent was obtained. Selected participants were evaluated for the presence of scapular dyskinesia on both sides using a valid and reliable method - modified lateral scapular slide test (Shadmehr et al, 2014).

Modified Lateral Scapular Slide Test: A digital Vernier caliper with an accuracy of 0.01 mm (Mitotuyo Company, Japan), a goniometer with extendable arm (Lafayette Instrument Company, USA), and weight cuffs of 1, 2kg were used in these experiments. 6 test positions were as follows: In the first position of the test (P1), the upper limbs were hanging beside the body and the examiner measured the least linear distance between T7 spinous process and inferior angle of scapula in mm order using digital caliper was noted. In the second position of the test(P2), the upper limbs were at 90 degrees of abduction with internal rotation of arms and the examiner found T7 spinous process and scapula inferior angle by touching, the least linear distance between them was measured using caliper in both sides. The third position of the test (P3), the subjects were asked to keep their upper limbs at 90 degrees of scaption with internal rotation of shoulder without having a weight cuff in their hands. Then 1, 2 weights were given to the subjects in the fourth (P4), fifth (P5) and they were asked to keep their upper limbs at 90 degrees of scaption with internal rotation of shoulder (along with mentioned

markers) while keeping weights. In these positions the examiner measured the mentioned distance again. Lastly in the sixth position of the test (P6), the subjects were asked to keep their trunk fixed and move up their arms upto 180 degree without having weights in hands.

Statistics

Data analysis was done using SPSS version 20.0 software. Paired t test for intragroup comparison and unpaired t test for intergroup comparison was used. The statistical significance was set at 95% confidence interval and the p value was <0.05 was considered significant.

RESULTS

1. Descriptive statistics was used to analyze demographic data for 102 participants. The mean and SD of age, teaching experience, hours of teaching were calculated. (Table:1) revealed that population included in the study was homogenous based on age and having teaching work experience (mean: 12.60±6.39) and hours of teaching (mean 3.37±1.71)for teachers.

Table 1 Descriptive data for age, teaching experience, hours of teaching

Variables	Teachers (n=51)	Non teachers (n=51)
	mean ± SD	mean± SD
Age	38.13±5.21	38.27±5.25
Work experience	12.60±6.39	-
Hours of teaching per day	3.37±1.71	-

2. The percentage of dyskinetic scapula at various positions of shoulder joint in teachers was presented in Table 2. Overall average of about 50.04% teachers have dyskinetic scapula.

Table 2 Prevalence of scapular dyskinesia in various positions of shoulder among primary school teachers (N=51)

Positions / Distances	Normal scapula		Dyskinetic scapula				
	0 mm	1-14 mm	15-20mm	>20mm	Total number (n=51)	Number of dyskinetic scapula	Percentage of presence of dyskinesia
At 0 deg	2	33	10	6	51	16	31.37%
At 90 deg	3	25	8	15	51	23	45%
In Scaption	1	27	8	15	51	23	45%
Scaption+1kg load	0	25	12	14	51	26	51%
Scaption+2kg load	0	17	12	22	51	34	66%
At 180 deg	1	17	17	16	51	33	64%

3. The percentage of dyskinetic scapula at various positions in non-teachers was presented in Table 3. About only 2% of non teachers have dyskinetic scapula at different

Table 3 Prevalence of scapular dyskinesia in various positions of scapula among Non teachers. (n=51)

Positions / Distances	Normal		Dyskinetic scapula				
	0 mm	1-14 mm	15-20mm	>20mm	Total number (n=51)	Number of dyskinetic	Percentage of presence of dyskinesia
At 0 deg	4	45	2		51	2	4%
At 90 deg	1	50			51	0	0%
In scaption	1	48	2		51	2	4%
Scaption+1kg load	2	48		1	51	1	2%
Scaption+2kg load	1	49		1	51	1	2%
At 180 deg	1	49		1	51	1	2%

4. The results in Table 4 depicts mean comparison of distances from inferior angle of scapula to spinous

process on dominant and non dominant side in teachers using paired t test showing *p* value significant at all positions of the modified lateral scapular slide test i.e. 0 degree, 90 degree, 90 degree scaption, scaption +1kg, scaption +2kg and 180 degree.

Table 4 Comparison of mean value of distances (mm) from inferior angle on dominant and non-dominant in Teachers using paired t test in various positions of Modified lateral scapular slide test:

Positions	Dominant (mean± SD)	Non dominant (mean± SD)	<i>p</i> value
At 0 deg	89±12.87	78.2±10.6	0.00*
At 90 deg	107±12.15	95±13.42	0.00*
In Scaption	117.5±14.86	104±13.71	0.00*
Scap+1kg load	120±12.29	104±14.13	0.00*
Scap+2kg load	123±13.62	104.96±12.34	0.00*
At 180 deg	121±13.7	103.86±14.36	0.00*

5. Table:5 illustrates results on comparison of mean distances from inferior angle of scapula to spinous process on dominant side of teachers and non teachers using unpaired t test with *p* value significant at 5 positions of the test i.e. 0 degree, 90 degree, scaption, scaption+1kg, scaption +2kg.

Table 5 Comparison of Mean value of distances from inferior angle of scapula on dominant side among teachers and non-teachers using unpaired t test in various positions of Modified lateral scapular slide test:

Positions	Teachers mean± SD	Non teachers mean± SD	<i>p</i> value
At 0 deg	88±12.89	70±12.37	0.00*
At 90 deg	106.8±12.03	101.05±9.8	0.011*
In Scaption	117.56±14.6	109.68±10.48	0.02*
Scaptn+1kg load	120.11±12.18	110.94±10.32	0.00*
Scap+2kg load	122.98±13.52	107.33±11.62	0.00*
At 180 deg	120.56±13.91	116.88±15.61	0.211

DISCUSSION

Numerous studies have recognized the prevalence of musculoskeletal neck and shoulder pain among school teachers (Jefferson *et al*, 2009). However very little data are currently available that empirically describes scapular alterations among these school teachers.

Thus in an effort to ascertain the presence of scapular dyskinesia among school teachers, this case control study was carried out using modified lateral scapular slide test. Overall 50.04% school teachers had scapular dyskinesia on the dominant side at various arm positions whereas very few non teachers showed scapular dyskinesia. Presence of scapular dyskinesia among teachers population was supported by the study conducted by Niloofer and colleagues, which observed alteration in scapular positioning among female teachers using blackboard having different teaching experience (Niloofer *et al*, 2013).

The present study revealed the presence of dyskinetic scapula at all the positions of modified lateral scapular slide test on dominant side compared to non dominant side among teachers (*p* < 0.05). This could be justified by altered muscle activation or strength imbalances, i.e. reduced firing of Serratus anterior and increased upper Trapezius activation; Pectoralis minor or

posterior shoulder tightness and thoracic kyphosis or flexed thoracic postures (Niloofer *et al*, 2013). It has been proved in the previous researches that alteration in scapular positioning (Corrie *et al*, 2001) or when the scapular stabilizers muscles are weak or fatigued, scapulohumeral rhythm is compromised, and shoulder dysfunction results (Kamkar *et al*, 1993). On the other hand, (David *et al*, 2006) have said that fatigue of the shoulder girdle musculature results in altered scapulothoracic kinematics.

This study evaluated the scapular position at various degrees of GH abduction - 0 deg, 90 deg, 90 degrees in scaption plane with and without 1kg and 2 kg weight and at 180 deg. Scapular dyskinesia was observed at 0 degrees of GH abduction in school teachers on comparing with non teachers on dominant side. In the dependent position (0 degree) the scapula is stabilized primarily through a balance forces. The weight of the arm creates a downward rotation, protraction and forward tilting moment on the scapula which is balanced by the support of upper Trapezius, Serratus anterior, Rhomboids and middle Trapezius [Carolyn]. Thus the prolonged static posture adopted by the teachers during their teaching hours may cause alteration in force couple of the muscles described above and lack of strength in static stabilizing musculature among teachers may lead to dyskinesia.

The results of the present study depicted significant difference (*p* ≤ 0.05) at 90 degree in both inter as well as intra group (P2). McClure *et al*.(2001) found that during scapular plane elevation of the arm in normal subjects, there was a consistent pattern of scapular upward rotation, posterior tilting, and external rotation along with clavicular elevation and retraction. This is well supported by the literature from the work of (Curtis *et al*, 2006) which stated that the abduction and internal rotation of the humerus at 90 degree which closely approximates the humeral head against the coracoacromion hood challenges the scapular stability, further it mentioned that the scapular stabilizers like Serratus anterior are forced to contract to rotated the scapula upwardly to prevent impingement of suprahumeral structures. This position challenges the force couple of Serratus anterior and lower Trapezius and hence alteration in scapular positioning observed, can be well justified.

The present study also reported significant difference at 90 degree scaption. The study by (Zerpa *et al*, 2014) stated the work task involved in blackboard writing which positions arm in scapular abduction requires all three divisions of Trapezius muscles to work in coordination and time sequentially to elevate and control scapular motions at varying degrees when writing on board. Also the research work of (Antony *et al*,) which stated increased shoulder moment causing higher muscle activation levels in the larger muscle groups(Trapezius) thus on performing action for prolong time, predisposes to scapular mal-positioning.

This study also recorded significant difference with scaption+1kg and scaption+2kg positions. Thus above finding can be well justified by the work of (Shadmehr *et al*, 2014) who believed that applying the loads in scaption recruits more motor units from stabilizing muscles of the scapula and leads to a higher coordination in surrounding muscles that have a major contributing role in the scapular mobility and stability. Thus

lack of strength in scapular stabilizers, reduces activation and may have lead to dyskinesia.

Lastly this study presented *p* value insignificant at 180 degree on inters group comparison. It's already mentioned in the literature that during 180 degree of abduction there is mechanical locking of glenohumeral joint and there is no scope for scapula to move forward, hence scapular dyskinesia is least evident (Culham et al, 1993).

The scapula functions as a biomechanical linkage between the shoulder complex and the cervical spine and provides both mobility and stability of the neck/shoulder region. The association between abnormal scapular positions and motions and gleno humeral joint pathology already established. We demonstrated presence of scapular dyskinesia among teachers population, and its relation with shoulder pathology. This study finding recommends addressing dyskinesia or scapular mal-positioning by all teachers, clinicians and physiotherapists to prevent further functional disabilities.

An effective scapular strengthening plan should be recommended for teachers, to normalize scapular firing and control can influence the position of scapula in normal position, preventing the chances of shoulder RSDs. And exercise protocol should be implemented to correct the dyskinesia in primary school teachers. Additionally, regular ergonomic sessions on awareness of common RSDs, causes and their preventing strategies should be incorporated.

Scope of further study

A longitudinal study can be implemented to confirm the importance of scapular muscles strengthening in preventing scapular dyskinesia and hence shoulder pathologies among teachers.

CONCLUSION

There exists presence of scapular dyskinesia among primary school on dominant side at various positions of the shoulder joint which alerts the practitioner to address scapular dyskinesia as a part of routine evaluation.

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