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ASSOCIATION OF BLACKBOARD TEACHING WITH SCAPULAR POSITIONING AND SHOULDER PAIN AND DISABILITY AMONG SCHOOL TEACHERS IN DEHRADUN

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ABSTRACT

Background: *Blackboard is the most used material by the teachers during their practice of the profession, hence making them one of the high-risk groups for developing occupational-related neck pain and upper limb pain. Therefore, there was a need to find out the association of blackboard teaching with SP and access the level of shoulder pain and disability in these teachers.* ***Methods****: 60 subjects were selected as per inclusion and exclusion criteria. Based on their teaching experiences, the subjects were divided into three groups: Group A with 5-10 years of teaching experience, Group B with 10-15 years of teaching experience and Group C was above 15 years of teaching experiences. Subjects were asked to fill the Shoulder Pain and Disability Index (SPADI) questionnaire and then the clinical test for scapular positioning (SP) i.e Lateral Scapular Slide Test (LSST) was performed and data for both SPADI and SP was collected.* ***Results****: There was a significant difference between the scapular positioning (SP) and shoulder pain and disability index (SPADI) when compared between three groups which was found statistically significant (p=0.000). A positive correlation was also found between SP and SPADI among all the three groups.* ***Conclusion****: It was hence concluded that there was an association of blackboard teaching with scapular positioning (SP) and shoulder pain and disability among the school teachers having different teaching experiences. Also, it was proved that there was a significant correlation between the altered SP and perceived shoulder pain and disability among these teachers.*

KEY WORDS

Blackboard teaching; Scapular Positioning; Shoulder Pain and Disability Index; Lateral Scapular Slide Test

INTRODUCTION

Teaching is a profession in which majority of women are employed and it is a demanding job.[1] School teachers, in general, during the course of their work may be subjected to conditions that cause physical health problems and the frequently reported health complaints among teachers are shoulder pain (73.4%),neck pain (68.9%),headache (67.1%) and lower back pain (59.2%).[2] Thus we can say teaching leads to physical and mental stress with an impact on functional performance [3] and hence teaching can become a health hazard when it is carried out in an inappropriate way.[4]

Black board teaching requires a stressful overhead activity and regarding the overhead activities, in previous studies it has been seen that overhead work requiring arm elevation and head extension is considered to be closely related with shoulder-neck disorders among sports persons (rock climbers) [5],swimmers and other overhand athletes [6] ,violinists [7] also in farmers.[8,9] 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.[10]

From the reviewed literature, it appears that the prevalence of musculoskeletal disorders (MSD) is positively associated with female gender. Supporting this hypothesis are the results of a Turkish study which reported that female teachers are at risk of shoulder pain when compared to their male counterparts.[11] Prevalence of musculoskeletal problems gradually increase with length of employment in teachers.Cardoso et al.[4] in his study found that the complaints of musculoskeletal pain in upper limb in teachers were significantly associated with working more than 5 years,more than 30 students per class,weekly schedule greater than 40.

Abnormal scapular kinematics and associated muscle dysfunction are assumed to contribute to shoulder pain pathology.Several studies have revealed scapular muscle dysfunction in patients with shoulder pain.[12,13,14] A high incidence of shoulder pain among athletes performing repetitive overhead activity has been reported.[6,15,16] Observation of the scapular posture is one of the most important components of the physical examination in overhead athletes.[17,18,19] As teachers using blackboard are regularly doing overhead activities, scapular positioning becomes an important factor to be assessed.

The work tasks of school teachers often involves significant use of a 'head down' posture,such as frequent reading,marking of assignments, and writing on a blackboard.Considering the posture adopted when using a blackboard,its use appears to represent a fatigue factor for the musculoskeletal structure, and making them one of the high-risk groups for developing occupational-related neck pain and upper limb pain. Therefore,there was a need to find out the association of blackboard teaching with scapular positioning among the school teachers who used blackboard as their mode of teaching. We also wanted to access the level of shoulder pain and disability in these teachers. In addition to design a proper treatment program we need to find out a possible correlation between scapular positioning and shoulder pain and disability in these school teachers.

METHODS

Case Description -

The nature of sampling in the study was convenient sampling. Total 60 subjects from different schools of Dehradun were included in the study based on inclusion and exclusion criteria.Inclusion criteria for the study was-(a) Only females were recruited for the study,(b) Symptomatic permanent teachers active during data collection period and working in direct contact with the students in classroom using blackboard as a mode of teaching,(c) Teaching on blackboard for more than 2 hours daily per day,(d) Presence of shoulder pain due to any pathology present during and after teaching on the dominant side,(e) Teaching experience: Group A- Teachers having 5-10 years of experience ,Group B-Teachers having 10-15 years of experience ,Group C-Teachers having more than 15 years of experience.Exclusion criteria included- (a) Any recent history of fracture or surgery of shoulder,upper limb,neck or thorax ;(b) Neurological disorders related to upper limb ;(c) Shoulder instability and dislocation and (d) Any regional tumour and metastasis of upper limb. Subjects selected were divided into three groups, based upon their teaching experiences: Group A,Group B and Group C. The mean age,teaching experience,height and weight of Group A were 39.90±5.74,7.00±1.65,5.23±0.14,57.35±8.81 respectively. The mean age,teaching experience,height and weight of Group B were 47.05±6.96,13.60±1.93,5.24±0.16,60.20±7.79 respectively. The mean age,teaching experience,height and weight of Group C were 52.55±5.17,26.00±4.17,5.19±0.14,62.85±10.6 respectively. Instrumentation used in the study were- (a) A vernier caliper ,(b) A marker ,(c) A goniometer and (d) SPADI (Shoulder Pain and Disability Index)

Vernier caliper alingnment

A vernier caliper (ICC reliability range of 0.73-0.88)[20] was used for measuring the distance from the inferior angle of scapula to the nearest spinous process recorded in centimeters.

(a) The lateral arm of the caliper was placed at the tip of the infero-medial angle of the scapula.
(b) The medial arm was positioned at the reference point on the spine.

This procedure was repeated three times for both the sides and the average of the measurements was used for the analysis. (**Fig. 1**)

Fig. 1: Positioning of the vernier caliper

Outcome Measures-

All the subjects were thoroughly assessed and selected based upon the inclusion and exclusion criteria.Informed consent was obtained from the subjects after explaination of the procedure to them.Based on their teaching experiences, the subjects were divided into three groups Group A,B and C. All the subjects were then asked to fill the SPADI questionnaire and the clinical test for scapular positioning (SP) i.e Lateral Scapular Slide Test (LSST) was performed and data for both SPADI and SP was collected.

Measurement-

The shoulder pain and disability was measured with Shoulder Pain and Disability Index (SPADI) and Scapular Positioning (SP) was measured by Lateral Scapular Slide Test (LSST).

1) Shoulder Pain and Disability Index (SPADI)

SPADI consists of two dimensions (pain and disability) with a total of 13 questions.[21] The pain dimension consists of five questions pertaining to the severity of an individual's pain. Disability was assessed with eight questions designed to measure the degree of difficulty an individual had with various activities of daily living requiring the use of the upper extremities. To answer the questions, the patients place a mark on a 10-cm VAS for each question. Scores from both dimensions were then averaged to derive a total percentage score. Higher scores reflected more pain and greater disability.

Minimum Detectable Change = 13 points

2) Scapular positioning (SP)

As described by Kibler[19] the test to clinically measure the static scapular positions called the Lateral Scapular Slide Test (LSST) was performed. LSST evaluated three positions of the scapula on dominant and non-dominant sides in relation to a fixed point on the spine.

The following steps were followed-

1. Palpation was done to find the bony landmarks.[22]
2. Position 1: Arms relaxed at the sides
   - In this position, the inferior-medial angle of the scapula was palpated and marked on both the dominant and non-dominant sides. The reference point on the spine is the nearest spinous process, which was marked with an "X". The measurements from the reference point on the spine to the medial border of the scapula was measured on both sides.(Fig.2)
3. Position 2: Hands on the hips, the fingers anterior and the thumb posterior with approximately 10° of shoulder extension.
   - Here, the new position of the inferomedial border of the scapula was marked, and the reference point on the spine was maintained.
   - The distances once again was calculated on both sides.(**Fig.3**)
4. Position 3: Arms at or below 90° of arm elevation with maximal internal rotation at the glenohumeral joint.
   - Here, also the new position of the inferomedial border of the scapula was marked, and the reference point on the spine was maintained.

- The distances once again was calculated on both sides.(**Fig.4**)

Fig. 2: Position 1

Fig. 3: Position 2

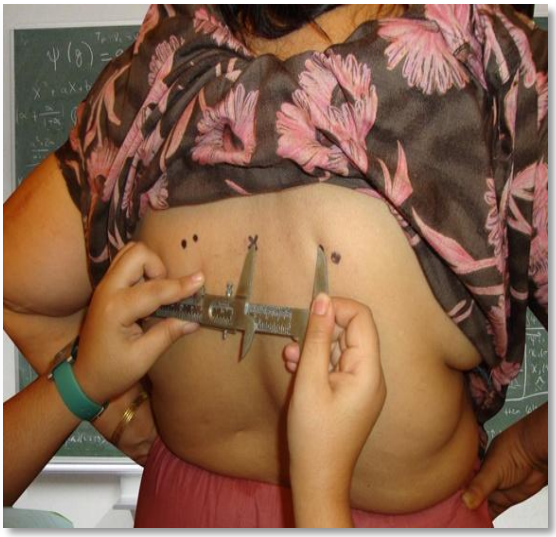


Fig. 4: Position 3

ANALYSIS AND RESULTS

Statistical Analysis-

The data was analysed by using SPSS version 16.0 software.

Descriptive statistics was used to calculate mean value and standard deviation of demographic data. One way ANOVA was used to compare the data between the groups.

Post hoc multiple comparisons were applied between Group A,Group B and Group C comparing SPADI and SP.

Pearson correlation was used to find the correlation between the two variables.

The statistical significance was set at 95% confidence interval and the p value was <0.05 was considered significant.

Results-

Descriptive statistics was used to analyse demographic data for 60 participants. The mean and SD of age,teaching experience, height and weight of the three groups was calculated (**Table 1**).

Table 1: Descriptive Data for Age,Teaching experience,Height and Weight

Variables	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Age	39.90	5.74	47.05	6.96	52.55	5.17
Teaching Experience	7.00	1.65	13.60	1.93	26.00	4.17
Height	5.23	0.14	5.24	0.16	5.19	0.14
Weight	57.35	8.81	60.20	7.79	62.85	10.68

Fig. 5: Comparison of mean value for age between the three groups

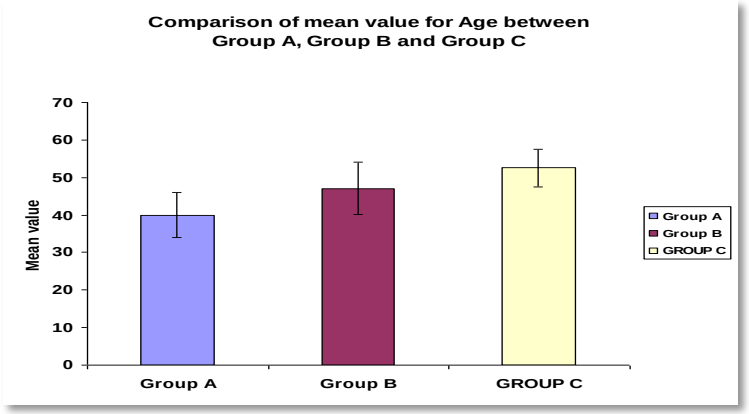
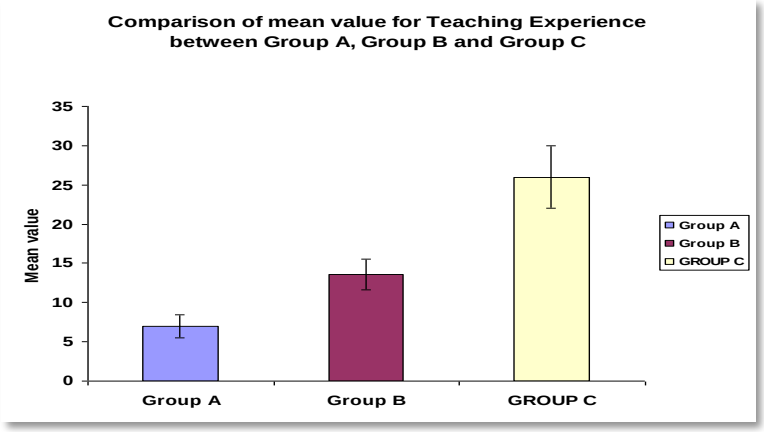


Fig. 6: Comparison of mean value for teaching experience between the three groups



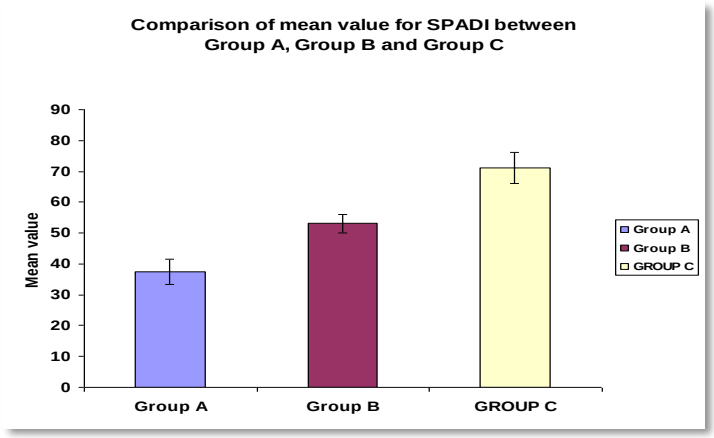
One way ANOVA was done to compare the data of SPADI and SP.

Post hoc multiple comparison tests for SPADI done between the groups showed significant diferrence for all the groups. [Group A Vs Group B (p=0.000), Group B Vs Group C(p=0.000) and Group C Vs Group A(p=0.000)]. (**Table 2**).

Table 2: Comparison of SPADI between all the three groups

Variable	Groups	Mean ± SD	F value	P value
SPADI	1 vs 2	15.55 ± 1.34	313.501	0.000
	2 vs 3	18.15 ± 1.34		0.000
	1 vs 3	33.20 ± 1.34		0.000

Fig.7: Comparison of mean value for SPADI between the three groups

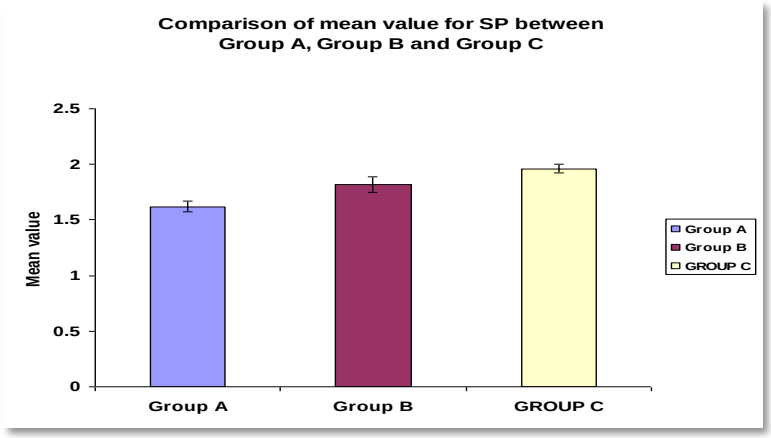


Post hoc multiple comparison tests for SP done between the groups showed significant diferrence for all the groups. [Group A Vs Group B (p=0.000), Group B Vs Group C(p=0.000) and Group C Vs Group A(p=0.000)] (**Table 3**).

Table 3: Comparison of SP between all the three groups

Variable	Groups	Mean ± SD	F value	P value
SP	1 vs 2	0.20 ± 0.01	207.525	0.000
	2 vs 3	0.14 ± 0.01		0.000
	1 vs 3	0.34 ± 0.01		0.000

Fig. 8: Comparison of mean value for SP between the three groups



Pearson correlation was done to find correlations between SPADI and SP. The positive correlation was found, which was found to be significant (r=0.965). (**Table 4**)

Table 4: Correlation between SPADI and SP

Correlation	r-value	p-value
SPADI Vs SP	0.965	0.000

Fig.9: Correlation graph for Group A

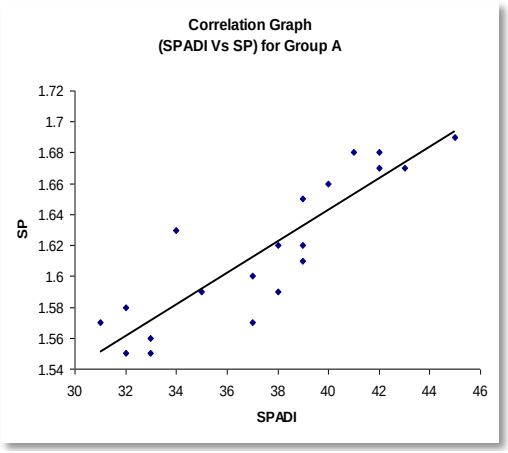


Fig 10: Correlation graph for Group B

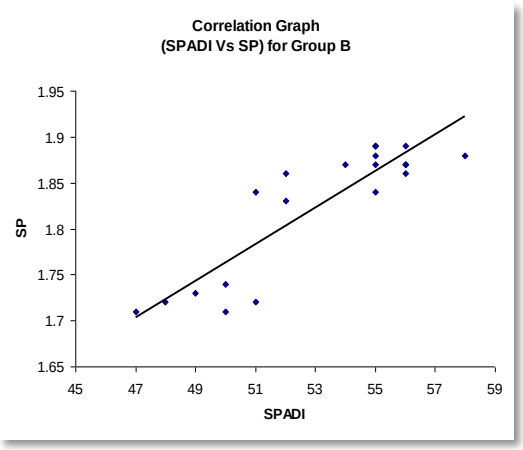
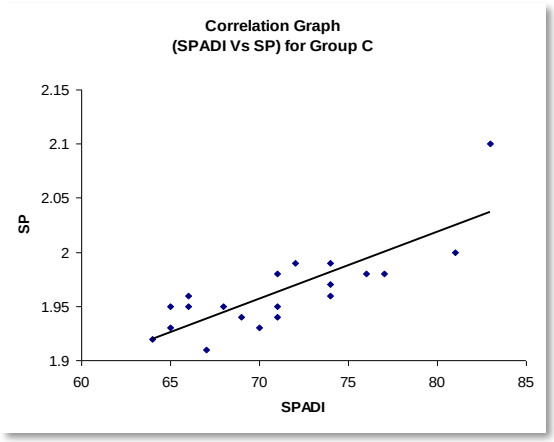


Fig. 11: Correlation graph for Group C



DISCUSSION AND CONCLUSIONS

Discussion-

Teachers are a boon to the society. Apart from the occupational stress, teachers face physical health problems also. Out of which prevalence of shoulder pain has been reported as the most common complaint by most of the teachers.[2,23] Arun Garg et al.[24] have reported that females have very low shoulder strength especially for jobs requiring overhead work. In support with that the results of the present study depicted that there was significant alteration of scapular position in female teachers using blackboard for more than 2 hours daily. In addition there was a significant presence of pain and disability which could be due to altered scapular position. Also the results of the present study showed that there was a significant difference in scapular positioning (SP) and shoulder pain and disability index (SPADI) between the teachers having different teaching experiences.

When scapular positioning (SP) was considered it was found that Group C showed the highest average reading (1.96cm) and while Group A showed the least reading (1.62cm). According to the readings given by Kibler[19] it was asserted that a bilateral difference of 1.5cm (15mm) should be the threshold for deciding whether scapular asymmetry is present or not. The reason behind the change in scapular position as teaching experience increases could be due to the increase in stress. In addition we can say that increased overhead activities alters the scapular positioning (SP).In support of this B.Ackermann et al.[7] depicted that during violin playing it has been reported to cause muscular imbalances around the scapulae and shoulder, where the scapulae and shoulders may be repositioned to be excessively protracted and elevated. This same phenomenon may be a possible reason in the present study. Also, in case of rock climbers[5] and overhead throwing athletes, they often present with abnormal scapular function in the form of winging, poor retraction, poor

protraction, poor positioning or some other forms of dyskinesia.[25] These could be the alterations present in the teachers in the present study.

From the results it can be seen that with increase in the teaching experience the change in scapular position also increases. The reason for this can be due to altered muscle activation or strength imbalances, mainly reduced serratus anterior and increased upper trapezius activation; pectoralis minor or posterior shoulder tightness and thoracic kyphosis or flexed thoracic postures. Based on anatomical relationships, it could also be believed that reductions in scapular upward rotation and posterior tilt during arm elevation could reduce the available subacromial space, thus contributing to development or progression of impingement as well as a poorer environment for tissue healing.[13] It could also be added that with continous loading and presence of kinetic changes for prolonged time along with the undergoing degeneration that occurs with age progression without giving the tissues much relaxation, so it is seen that as teaching experience increases the scapular dyskinesis could have also been increased.

When shoulder pain and disability index (SPADI) was considered it was found that Group C showed the highest score with a mean of 71.20, while Group A showed the least with a mean of 37.50 which depicts that it is more than the minimum detectable change equals to 13 points which says that teachers were having higher level of pain and disability. As the teaching experiences of the teachers were increasing, their pain and disability were also increasing. Usually it is seen that the prevalence of shoulder pain in association with disability is present in about 20% of the general population.[26] In our case we could suggest that the disability found in the present study could be related to scapular positioning. It has been proved in the previous researches that alteration in scapular positioning[27] or when the scapular stabilizers muscles are weak or fatiqued, scapulohumeral rhythm is compromised, and shoulder dysfunction results.[28] On the other hand, D. David Ebaugh et al.[29] have said that fatigue of the shoulder girdle musculature results in altered scapulothoracic kinematics. Multifactorial situations may also cause overload of this joint complex, as follows: marked repetitiveness of movements; upper limb positioning, especially with shoulder abduction; muscular fatigue; work organization factors and annulling of mechanisms of work regulation, such as overload (reduction or lack of intervals) and psychosocial factors which generate tension and stress.[30] Shoulder pain and disability is very much related to overhead activities and age. As age increases degeneration could be a major cause of disability. Also, the findings of the present study was supported by the work of Yuichiro et al.[31] who had already reported that the prevalence of musculoskeletal problems gradually increase with length of employment in teachers. Also, physical work load and mechanical load exerted on connective tissues for prolonged period of time could also increase the risk of injury and disease.[32] Hence, it can be presumed that as the teachers did repetitive blackboard teaching and are teaching from atleast 5 years for prolonged period so their pain and disability also increased and with increased age they showed more disability. Geraldo et al.[33] stated that postural alterations may impair the musculoskeletal system ability to perform precise movements so, with the time and frequency of repetition of the task, the pain arises as a result of these imprecise movements. Further, the present study was supported by Wing.K.Chang[34] who depicted that athletes like swimmers, tennis and volleyball players performing repetitive overhead activities had increase in their shoulder pain.

In the present study, a positive correlation was also found between the scapular positioning (SP) and shoulder pain and disability index (SPADI).Cools et al.[35] have quoted further from a study done by Davis.G.J that movement of one segment affects segments proximally and distally. When weakness or dysfunction is present in the scapular musculature, normal scapular positioning and mechanics may alter[12,13] and also the shoulder function becomes inefficient predisposing the individual to shoulder injury.[36] In support of this, Lori et al.[13] have cited that changes in timing and function of the upper and lower trapezius as well as the serratus anterior lead to changes in scapular kinematics, and thus most likely alter glenohumeral kinematics as well. So we can say that as scapular dyskinesia increases pain and disability also increases. Ludewig et al.[37] stated that in

adults, abnormal scapular kinematics are believed to contribute to shoulder pain and pathology. Moreover, altered scapular position can change the length-tension relationship of the muscles attached to the scapula, specifically rotator cuff. Theoretically, a dysfunctional rotator cuff can therefore result from alteration in the scapular position and scapular muscle strength.[13] Also, recently researches have shown that normal shoulder function depends upon its scapula muscles such as trapezius muscle and have emphasized on the importance of muscular ability to achieve stable scapula and prevent the development of shoulder pain and the upper limb pain and dysfunction.[38,39] Moreover, Donald.H.Johnson et al.[40] have clearly stated that a patient with a scapular problem often presents with a history of shoulder impingement or pain. Common complaints among people doing overhead activities are difficulties generating force and pain over the posterior aspect of the shoulder joint. Hence, the results of the present study showed a significant correlation between the scapular positioning (SP) and shoulder pain and disability index (SPADI).Major public focuses on the stress problem but passes over the prevalence of somatic health problems in the teaching profession.[2] Thus, the available evidence in the present study supports the use of therapeutic exercise regime in rehabilitating these patients.

Conclusions-

It was hence concluded that there was an association of blackboard teaching with scapular positioning (SP) and shoulder pain and disability among the school teachers having different teaching experiences. Also, it was proved that there was a significant correlation between the altered scapular positioning and perceived shoulder pain and disability among these teachers which depicts that scapula dyskinesia can be a reason of pain and disability in these teachers. As the results of the present study depicted that there is a marked alteration of scapular position in teachers using blackboard for prolonged period of time which needs to be corrected. Further proper rehabilitation protocol is needed to maintain the muscle strength and scapular position which will in turn have a significant effect on pain and disability. Also, there is a need for ergonomical corrections and work environmental modifications for teachers in order to prevent any neck or upper limb problems that might occur in their near future. Future studies can be done to identify the exact height of blackboard best for teachers or any other modifications like use of audio-visual aids so that in future they don't face neck and upper limb problems which might occur due to change or alteration in scapular positioning (SP) and also various studies for development of ergonomics or modification and their effect on posture can also be done.

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Conflict of interest

Limitations of the study were that only female subjects were only included in the study, non-availability of more reliable tool like Acromion Marker Cluster (AMC) and Palpation meter (PALM) for measuring scapular positioning (SP) could not be used and the subjects were not blinded to the present study.

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