



Journal of Medical Sciences

ISSN 1682-4474

science
alert

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JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued six times per year on paper and in electronic format.

For further information about this article or if you need reprints, please contact:

Asghar Akbari
Department of Physical
Therapy,
Paramedical School,
Zahedan University of
Medical Sciences,
Mashahir Square, Zahedan,
Islamic Republic of Iran

Tel: (+9841) 3254207
Fax: (+98541) 324207

Prevalence of Shoulder Postural Impairments in 10-12 Years Old Primary Students of Zahedan

Asghar Akbari and Razieh Gannad

The purpose of this study was to determine the prevalence of shoulder postural impairments in 10-12 years old primary school students of Zahedan in 2005. One hundred-fifty three students participated in this descriptive study through multi-stage clustering sampling. The Level of shoulders (cm) and the rounded shoulders (cm) were measured using checkered board and board with red line in its center, respectively. Scapular symmetry (cm) was measured using Kibler test. The level of dominant shoulder was higher than non-dominant shoulder in 89.7% of right-handed students. Scapular asymmetry was not seen in zero ($p = 0.42$) and 90 ($p = 0.3$) degrees of shoulder abduction in dominant shoulders of the right handed students. Rounded shoulders were seen in 56.2% of students. Although, rounded shoulders was more common in 10 years old (in 61.6%) ($p = 0.002$). Shoulder depression was seen in 61.3% of students that carrying shoulder bag ($p = 0.028$). Present results showed that long term settling in abnormal posture with regard to flexibility of musculoskeletal system resulted in rounded shoulders. Also, carrying shoulder bag can lead to shoulder depression. The results support the effectiveness of proper postural and writing training for preventing shoulder postural impairments.

Key words: Shoulder, posture, primary school, scapular, bag

INTRODUCTION

Understanding of the physiological basis of normal postural control, their deviations from normal and types of postural abnormalities are necessary for prevention and treatment of postural control impairments (Akbari and Karimi, 2003). Since controlling the body's position in space is an essential part of regaining functional independence, restoring postural control is a critical part of rehabilitation (Cook and Woollacoatt, 1995). Posture is a term used to describe the orientation of any body segment relative to the gravitational vector. It is an angular measure from the vertical (Cook *et al.*, 1988). Its control is a complex process including reception and interpretation of information about body movement, integration of sensory motor information and execution of appropriate movement to achieve the goal of upright postural control (Akbari *et al.*, 2004). Postural control system is dependent to complex interaction of musculoskeletal and neural systems for control of body posture in space (Shumway-cook and Horak, 1986). Sagittal and coronal plans joining make gravity line which the body is balanced around it. It is aligned in a point just in front of the coronal axis of the shoulder joint in normal posture (Shafer, 1983). Normal posture allows different parts of the body are arranged in proper biomechanical alignment and dominated accelerative forces. In results, body was protected against injuries or deformities (Assaiante *et al.*, 2005). Shoulder joint and arm position is dependent on arrangement of scapular bone. In a normal posture, flat scapular bone is aligned on the upper part of back and almost between second and seventh thoracic vertebrae. Two scapular bones are symmetric (Edvard, 1987). Aligning of scapular bone in abnormal posture is caused impairment of shoulder joint. This impairment is a cause of chronic pain and injuries (Dulton, 2001).

In primary school students due to lack of proper and enough training in regard to normal position, lack of appropriate teaching equipments with ergonomic essentials, excessive writing activities in abnormal postures and using heavy bags were increased risk of abnormal postures. Thus, it will be developed prevalence of musculoskeletal impairments (Magge, 2002). Another study showed that cause of many disorders of students was deficit in body postural mechanism (Dulton, 2001). Hong and Cheung (2003) reported that carrying backpack, which its weight more than 15% of their body weight would make postural and gait impairments in primary students. Results of another study indicated that movements of the scapula into a protracted or retracted position were decreased isometric strength of shoulder

elevator muscles (Smith *et al.*, 2002). Kibler (1997) evaluated symmetry of scapular bones using scapular slide test. He showed that scapular bones were not symmetric in athletics with pathological signs and in athletics without pathological signs was aligned symmetrically. Postural difference between symptomatic men and women were studied. The results of this study stated that rounded shoulders were higher in women in respect to men (Laferty, 1994). Another study pointed that more abnormalities were seen in spinal column of tall peoples due to their tendency to forward bending and kyphosis (Ofogh, 2000).

In previous studies, some of spinal column and shoulder girdle abnormalities were recognized and their relationship with background factors were defined (Ofogh, 2000; Laferty, 1994; Raine and Twomey, 1997). But, it has not pay attention to primary causes and predisposing factors. As there, these abnormalities were seen in school children and adolescents, recognition of possible causes is essential for prevention these abnormalities, which became high economic costs and indirect losses in productivity. On the other hand, high flexibility of musculoskeletal system in children, excessive writing activities and their performing in abnormal postures as well carrying heavy bags can resulted in injuries and deficit in developmental posture of a children (Korovessiss *et al.*, 2004). So, we want to recognize types of shoulder postural abnormalities in primary students and then to plan possible methods for prevention of impairments. The aim of this study was to determine asymmetry of scapular bone, level of dominant shoulder and rounded shoulders in 10-12 years old primary school students of Zahedan. We hypothesized that level of dominant shoulder was elevated in respect to non-dominant shoulder in primary students, as well protraction of dominant shoulder and rounded shoulders were common.

MATERIALS AND METHODS

Subjects: This cross-sectional descriptive study was performed in schools of Zahedan city in 2005. The pilot study performed on thirty primary students determined that a total of 144 subjects were necessary for main study. One hundred-fifty three students ranging between 10-12 years old participated in the study through multi-stage clustering sampling. Prior to commencement of the study, approval was sought from the research council of Zahedan University of Medical Sciences. The purpose of the study and testing protocol to be used were explained to the subjects. The individuals were blinded to the aims and hypotheses of the study. One hundred-fifty three

boy and girl students ranging between 10-12 years old were recruited from Zahedan primary school. Subjects with musculoskeletal and neural impairments in shoulder and spinal column and bone fractures of these regions were excluded.

Methods: Data were collected through interview, inspection and examination. The levels of shoulders (cm) were measured using checkered board by one-centimeter boxes. This board was attached on the wall in parallel with subject shoulder. A line was drawn on the floor in parallel with wall and 10 centimeter apart from it. During examination, subjects were located against the wall and in front of this line. Two points in parallel with apex of the shoulder and the earlap were marked. Vertical distance between two points and their difference with other side were calculated.

The rounded shoulders (cm) were measured with same method. A red line was drawn in midline of the checkerboard. Subjects were positioned in front of the checkerboard just as earlap would be in parallel with red line. Then, one point in parallel with the apex of shoulder was marked on the checkerboard and distance between this point and red line was calculated.

Scapular asymmetry was measured using kibler test. The distance (cm) of inferior angle of the scapula to seventh thoracic vertebrae were measured at zero, 45 and 90 degrees of shoulder abduction in both sides. Difference more than one centimeter between two sides was considered as abnormality. If this measure was greater in dominant side, it had shown dominant shoulder

protraction, but if it was greater in non-dominant side, it had shown dominant shoulder retraction (Kibler *et al.*, 2002; Koslow *et al.*, 2003).

Statistical analysis: Data were analyzed using SPSS10. Descriptive statistics, absolute and relative frequency, mean and standard deviation, Chi-Square and Fisher's exact test were used for data analyzing. The level of significance was set at $p < 0.05$.

RESULTS

Our results showed that level of dominant shoulder in 89.7% primary students ranging 10-12 years old was higher than non-dominant shoulder (Table 1). Also, we did not find any scapular asymmetry in rest position ($p = 0.4$) and 90 degrees of arm abduction ($p = 0.3$). Retraction was common in 45 degrees of abduction in left-handed students ($p < 0.0001$) (Table 2). The rounded shoulders were seen in 56.2% participants.

There was no significant relationship between scapular asymmetry and age ($p = 0.62$). But rounded shoulders were common in lower ages ($p = 0.002$) (Table 3).

Table 1: Percentage of level of shoulders according to dominant hand in 10-12 years old primary students of Zahedan city in 2005

Dominant hand Variable	Right		Left		Total	
	No.	%	No.	%	No.	%
Depression	19	82.6	4	17.4	23	100
Shrugging	61	89.7	7	10.3	68	100
Normal	59	95.2	3	4.8	62	100

$\chi^2 = 3.37, df = 2, p = 0.18$

Table 2: Percentage of scapular symmetry in rest, 45 and 90 degrees of arm abduction in 10-12 years old primary students of Zahedan city in 2005

Arm position	Dominant hand	Right hand		Left hand		Total	
		No.	%	No.	%	No.	%
Rest *	Normal	92	92.9	7	7.1	99	100
	Protraction	37	88.1	5	11.9	42	100
	Retraction	10	83.3	2	16.7	12	100
45 degrees of abduction**	Normal	103	93.6	7	6.4	110	100
	Protraction	30	93.8	2	6.3	32	100
	Retraction	6	54.5	5	45.5	11	100
90 degrees of abduction***	Normal	101	91.8	9	8.2	110	100
	Protraction	26	92.9	2	7.1	28	100
	Retraction	12	80.0	3	20.0	15	100

* $\chi^2 = 1.71, df = 2, p = 0.42$, ** $\chi^2 = 18.8, df = 1, p = 0.0001$, *** $\chi^2 = 2.4, df = 2, p = 0.3$

Table 3: Percentage of rounded shoulders and scapular symmetry according to age in 10-12 years old primary students of Zahedan city in 2005

Variable	Scapular position	10 years		11 years		12 years		Total	
		No.	%	No.	%	No.	%	No.	%
Rounded shoulders *	Normal	53	61.6	24	27.9	9	10.5	86	100
	Abnormal	72	32.8	31	46.3	14	20.9	67	100
Scapular symmetry **	Normal	55	48.7	43	38.1	15	13.3	113	100
	Protraction	17	50.0	11	32.4	6	17.6	34	100
	Retraction	3	50.0	1	16.7	2	33.3	6	100

* $\chi^2 = 12.62, df = 2, p = 0.002$, ** $\chi^2 = 2.61, df = 4, p = 0.62$

Table 4: Percentage of scapular symmetry, rounded shoulders and level of shoulder according to type of bag in 10-12 years old primary students of Zahedan city in 2005

Variable	Scapular position	Backpack		Shoulder bag		Hand bag		Total	
		No.	%	No.	%	No.	%	No.	%
Rounded shoulders*	Normal	50	58.1	22	25.6	14	16.3	86	100
	Abnormal	46	68.7	10	14.9	11	16.4	67	100
Scapular symmetry **	Normal	71	62.8	24	21.2	18	15.9	113	100
	Protraction	22	64.7	5	14.7	7	20.6	34	100
	Retraction	3	50.0	3	50.0	0	0.0	6	100
Level of shoulder ***	Depression	21	91.3	1	4.3	1	4.3	23	100
	Shrugging	37	54.4	1	4.3	1	4.3	68	100
	Normal	38	61.3	19	27.9	12	17.6	62	100

* $\chi^2 = 2.7$, $df = 2$, $p = 0.26$, ** $\chi^2 = 4.6$, $df = 4$, $p = 0.33$, *** $\chi^2 = 10.89$, $df = 4$, $p = 0.028$

There was no significant relationship between gender and level of the shoulders ($p = 0.18$), rounded shoulders ($p = 0.09$) and scapular symmetry ($p = 0.7$).

The type of bag was not effective in producing scapular asymmetry ($p = 0.33$) and rounded shoulders ($p = 0.26$). Depression was seen following carrying shoulder bags ($p = 0.028$) (Table 4).

There was no significant relationship between height and level of the shoulders ($p = 0.38$), rounded shoulders ($p = 0.44$) and scapular asymmetry ($p = 0.058$).

There was no significant relationship between writing activity in home and level of the shoulders ($p = 0.49$), rounded shoulders ($p = 0.92$) and scapular asymmetry ($p = 0.54$). Also, there was no significant relationship between writing activity in school and level of the shoulders ($p = 0.3$), rounded shoulders ($p = 0.81$) and scapular asymmetry ($p = 0.32$).

DISCUSSION

The findings showed that rounded shoulders were common in 56.2% of primary students. Prevalence of this abnormality was higher in 10 years old students than 11 and 12 years old. Protraction was not seen in dominant shoulder. As well, the findings did not show any difference between level of dominant and non-dominant shoulders in primary students. Following carrying shoulder bags, depression was seen in that shoulder but rounded shoulders weren't. Comparing of other variables showed that there was no relationship between gender and level of shoulders, rounded shoulders and scapular symmetry. There was no relationship between these variables with home and school writing activities. As well, there was not seen relationship between age and scapular symmetry.

The rounded shoulders in lower ages of primary students is due to excessive flexibility of musculoskeletal system and abnormal writing position, kyphotic posture and forward bending (Shafer, 1983). Julius *et al.* (2004) reported the effects of weak and kyphotic posture in

shoulder pains. They showed that weak posture resulted in mechanical changes such as local compression and stretching of main nerves of extremity, as median nerve. In similar researches, this result has been emphasized. Kyphosis and rounded shoulders were attributed to the abnormal spinal column postures (Braun, 1991; Laferty, 1994). Normal mechanism of muscles was disturbed following aggravating of rounded shoulders and upper thoracic vertebrae kyphosis was increased. Upper thoracic muscles and inferior fibers of trapezius were stretched and supraspinatus, infraspinatus, teres minor and pectoralis major muscles were shortened. Thus, following exaggerated of rounded shoulders deformity due to compensatory mechanisms in above muscles, trigger points were commonly seen in these regions (Cailliet, 1983). Griegle *et al.* (1992) revealed that Subjects with kyphosis and rounded shoulders had an increased incidence of interscapular pain and those with a forward-head posture had an increased incidence of cervical, interscapular and headache pain.

Appropriate shoulder joint position is the main point for treatment of these abnormalities. As well, inappropriate posture can cause additional problems; it is better to consider in preschool ages and mainly in primary schools. In fact, training and exercising are suitable modalities for maintenance of good posture and prevention of abnormalities. Using this method, economical and social problems that due to postural disorders and impairments will be decreased (Griegle *et al.*, 1992).

This study revealed that retraction was common in 45 degrees of abduction in left-handed students. It seems that cause of problem is positioning of upper extremity in 45 degrees of abduction during writing activities. On the other hand, left-handed children move the scapula in retracted position for comfort and performing homework. Following this position, flexible muscles of students in retracted side were shortened (Smith *et al.*, 2002). Scapular movement and shoulder rhythm were disturbed following muscles shortening and the joint would be painful (Kibler and McMullen, 2003).

Our results showed that there was no relationship between gender and level of the shoulders, rounded shoulders and scapular asymmetry. There is no difference in structure of shoulder joint and scapular bone between two genders. But, some researchers reported significant relationship between gender and spinal column disorders (McCreary, 1983).

The type of bag was not effective in producing of rounded shoulders. Force of shoulder and handbags are in parallel with gravity, which opposed by shoulder elevators muscles. Shoulder depression was seen following shoulder bags carrying in our study. On the other hand, risk of producing of trigger points was increased in shoulder elevators following long lasting use of this bag. As well, force of backpacks is in direction of retractor muscles, which opposed by protractor muscles (Linnamo *et al.*, 2000). Another research reported that the droopy shoulder syndrome resulted in brachial plexus stretching and pain (Akalin *et al.*, 2001). Also, in agreement with present results, Pascoe *et al.* (1997) showed that daily physical stresses associated with carrying of shoulder book bags significantly alter the posture and gait of youth. Cottalorda *et al.* (2003) recommended that Children should be advised to carry their backpack on two shoulders rather than use a one-strap backpack. Mackie *et al.* (2005) stated that school students should wear their backpacks with the least weight possible, use the hip-belt if present, allow a reasonable amount of looseness in the shoulder straps and should position the heaviest items closest to their back. Lay and Jones (2001) confirmed the detrimental effect of a kyphotic posture on pulmonary mechanics and the necessity for health-care professionals to advocate proper postural advice to school children, teachers and parents.

We recommend that children in their developmental stage avoid carrying shoulder bag and in place of it, carrying their bags with two shoulders. In addition, improving of classrooms conditions, using of benches and desks according to ergonomic principles and training of proper writing positions are necessary for prevention of postural impairments.

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