

Trends of Active Range of Motion at Three Important Joints in School-going Boys of Amritsar, Punjab

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ABSTRACT The present study deals with the measurements of active ranges of motion at knee flexion, elbow flexion, shoulder flexion, shoulder extension, shoulder abduction, shoulder medial rotation and shoulder lateral rotation in 360 randomly selected, normal healthy school going boys of Amritsar aged 6-17 years. A double armed goniometer was applied to measure the ranges of motion of the subjects. The findings of the study show a gradual decrease of ranges of motion in knee flexion, elbow flexion, shoulder flexion, shoulder extension, shoulder abduction, shoulder medial rotation and shoulder lateral rotation from age group 6+ years to 17+ years.

INTRODUCTION

The active amount of motion that is available at a joint is called the range of motion. It reflects the flexibility of a particular joint. The greater the range of motion lesser is the chances of getting injury. The measurement of range of motion is extremely useful to the physicians, therapists and researchers to investigate the joint mobility. Restricted movement of any joint occurred due to bone fractures in accidents, diseases, viz. shoulder impingement syndrome, rheumatoid arthritis, muscle tightness, burns, congenital deformities etc. may easily be assessed with the help of measuring range of motion. Normal range of motion varies among individuals and is influenced by factors such as age, gender and whether the motion is performed actively or passively. The range of motion of a particular joint is usually measured by the number of degrees from the starting position of a segment to its position at the end of its full range of the movement with the help of double-armed goniometer. Fish and Wingate (1985) postulated that measurement error occurred due to improper identification of bony landmarks, inaccurate alignment of the goniometer, and variations in the amount of torque applied by the researchers.

Information regarding the normal ranges of motion at various joints in individuals with different age groups is scanty. Majority references are related to restricted range of motion in patients of various deformities. Few

reports related to normal ranges of motion were presented by Boone and Azen (1979), Boone (1979), Luttgens and Hamilton (1997), Awan et al. (2002), Dayanidhi et al. (2005) and McCully et al. (2005). Dayanidhi et al. (2005) reported that children of age group 5-9 years had greater upward rotation of shoulder than adults. Information regarding the trends of normal ranges of motion of various joints from Indian populations, especially from north India was lacking. To fulfill the lacunae of knowledge, the present study was planned. In the present study an attempt has been made to investigate the trends of active ranges of motion of three important joints, viz. knee, elbow and shoulder, in school going boys aged 6-17 years of Amritsar, Punjab, India.

MATERIALS AND METHODS

A total of 360 unrelated normal healthy school going boys aged 6-17 years were selected randomly from Govt. Senior Secondary school, Chheharta, Amritsar, Govt. Elementary School, Bhothu, Amritsar, Jiwan jyoti Public School, Chheharta, Amritsar and Govt. Senior Secondary School, Putlighar, Amritsar, for the study conducted during May, 2006 to November, 2006. The subjects were further divided into twelve age groups, comprising of 30 boys in each group. All the subjects between the ages 6.00 to 6.99 years were included in 6+ age group, 7.00 to 7.99 years in 7+ age group, and 8.00 to 8.99 years in

8+ age group and so on up to 17+ years after Eveleth and Tanner (1976).

Active ranges of motion of knee flexion, elbow flexion, five movements of shoulder joint, viz. flexion, extension, abduction, medial rotation and lateral rotation, were measured with the help of a double-armed goniometer according to the method described by Luttgens and Hamilton (1997) on all the subjects. Standard statistical calculations were also done for analyses.

RESULTS AND DISCUSSION

Estimation of the trends of normal ranges of motion of various joints is extremely essential in clinical purposes. How much the range of motion of a particular joint is restricted would be known only by measuring the deviation of it from its normal range. Table 1 shows the distribution of mean values and standard deviations of knee flexion, elbow flexion and five movements of shoulder joint in school going boys of Amritsar aged 6+ to 17+ years. In knee flexion, the maximum mean value (148.37 degree) was noted in age group 6+ years and the minimum (132.93 degree) in age group 17+ years. In elbow flexion, the maximum mean value (148.10 degree) was noted in age group 8+ years and the minimum (133.23 degree) in age group 17+ years. In shoulder flexion, abduction, medial and lateral rotations, the maximum mean values (173.10 degree, 180.43 degree, 67.93 degree and 111.20 degree respectively) were noted in age group 6+ years and the minimum (158.53 degree, 161.83 degree, 52.50 degree and 88.37 degree respectively) in age group 17+ years. For shoulder extension, the maximum mean value (67.53 degree) was observed in age group 7+ years and the minimum (54.23 degree) in 17+ years. The mean values of other age groups for all the measurements fall within these ranges. A gradual decrease of ranges of motion in knee flexion, elbow flexion, shoulder flexion, shoulder extension, shoulder abduction, shoulder medial rotation and shoulder lateral rotation was observed from age group 6+ years to 17+ years.

Annual rate of changes in the range of motion of knee flexion, elbow flexion and five movements of shoulder in school going boys of Amritsar are given in table 2. Once again, annually, a gradual decrease of ranges of motion was estimated in knee flexion, elbow flexion and five movements of shoulder joint, supporting the findings of

Table1: Distribution of range of motion in knee, elbow and shoulder joints in school going boys of different age groups of Amritsar.

Age group (in years)	Knee flexion		Elbow flexion		Shoulder flexion		Shoulder extension		Abduction		Medial rotation		Lateral rotation	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
6+	148.37	3.02	146.47	2.69	173.10	3.18	67.53	4.62	180.43	2.05	67.93	3.97	111.20	3.47
7+	145.77	2.70	147.4	2.04	171.13	2.71	68.50	3.17	179.73	1.91	66.47	3.81	110.20	4.60
8+	147.27	2.52	148.10	2.40	170.47	1.96	65.87	3.49	179.63	1.88	66.93	2.96	110.43	3.13
9+	144.07	2.78	144.37	1.97	169.23	1.83	64.80	2.92	178.57	1.61	65.73	3.71	106.13	3.66
10+	144.13	2.15	144.80	2.58	168.93	2.00	64.50	3.33	179.10	1.84	65.37	3.09	107.50	4.00
11+	143.30	1.97	144.07	2.55	167.13	1.91	64.70	3.00	176.93	1.80	64.13	2.67	104.30	3.87
12+	143.07	2.15	142.97	1.99	165.80	1.75	63.20	2.07	175.60	2.01	63.57	2.58	102.40	2.88
13+	141.00	1.58	141.10	2.19	164.33	2.15	61.27	1.76	173.53	2.18	61.10	2.31	100.13	2.70
14+	140.37	2.08	140.17	1.99	162.40	2.31	60.03	2.01	172.13	1.91	59.97	1.59	98.83	2.41
15+	138.17	2.05	138.13	2.56	160.63	2.25	56.83	2.53	167.43	2.50	56.40	2.59	95.90	3.19
16+	135.73	2.98	135.70	3.19	159.10	2.64	55.50	1.83	164.40	3.11	55.83	2.96	91.53	3.35
17+	132.93	3.40	133.23	3.94	158.53	4.21	54.23	3.88	161.83	2.74	52.50	3.94	88.37	4.44

Table 2: Annual rate of changes in ranges of motion at knee, elbow and shoulder joints in school going boys of different age groups of Amritsar.

Age group (in years)	Knee Flexion		Elbow Flexion		Flexion		Shoulder Extension		Abduction		Medial rotation		Lateral rotation	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
6-7	-2.6	-1.75	+0.93	+0.63	-1.97	-1.13	+0.97	+1.43	-0.7	-0.38	-1.46	-2.14	-1	-0.89
7-8	+1.5	+1.02	+0.7	+0.47	-0.66	-0.38	-2.69	-3.92	-0.06	-0.03	+0.46	+0.69	+0.23	+0.20
8-9	-3.2	-2.17	-3.73	-2.51	-1.24	-0.72	-1.01	-1.53	-1.1	-0.61	-1.2	-1.79	-4.3	-3.89
9-10	+0.06	+0.04	+0.43	+0.29	-0.3	-0.17	-0.3	-0.46	+0.53	+0.29	-0.36	-0.54	+1.37	+1.29
10-11	-0.83	-0.57	-0.73	-0.50	-1.8	-1.06	+0.2	+0.31	-2.17	-1.21	-1.24	-1.89	-3.2	-2.97
11-12	-0.23	-0.16	-1.1	-0.76	-1.33	-0.79	-1.5	-2.31	-1.33	-0.75	-0.56	-0.87	-1.9	-1.35
12-13	-2.07	-1.44	-1.87	-1.30	-1.47	-0.88	-1.93	-3.03	-2.07	-1.17	-2.47	-3.88	-2.27	-2.21
13-14	-0.63	-0.44	-0.93	-0.65	-1.93	-1.17	-1.24	-2.02	-1.14	-0.80	-1.13	-1.84	-1.3	-1.29
14-15	-2.2	-1.56	-2.04	-1.45	-1.77	-1.08	-3.2	-5.33	-4.7	-2.73	-3.57	-5.95	-2.93	-2.96
15-16	-2.44	-1.76	-2.43	-1.75	-1.53	-0.95	-1.33	-2.34	-3.03	-1.80	-0.57	-1.01	-4.37	-4.55
16-17	-2.8	-2.06	-2.47	-1.82	-0.57	-0.35	-1.27	-2.28	-2.57	-1.56	-3.33	-5.96	-3.2	-3.49

A – Annual change in ranges of motion; B – Annual rate of changes in ranges of motion.

Table 1. Boone (1979) in his study found that the older boys had lesser ranges of motion in knee, elbow and shoulder flexion than their younger counterparts. The findings of Boone and Azen (1979) also supported the view. Dayanidhi et al. (2005) reported significant differences in scapular kinematic patterns between children and adults. Children had a greater contribution from the scapulothoracic joint, especially upward rotation toward humeral elevation. The results of the present study, too, showed that, not only in shoulder joint, but in elbow and knee joints also, younger children have the greater ranges of motion than their older counterparts. The findings of the present study will be helpful to the clinicians, therapists and researchers as ready references to measure the restricted range of motion in knee, elbow and shoulder joints.

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