A PROSPECTIVE CROSS-SECTIONAL STUDY OF JOINT MOTION IN HEALTHY ADULT SUBJECTS

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Abstract- Normal range of joint motion is an important factor in joint examination in clinical practice which is related to factors such as age, sex and geographic region. There is no data in the literature on the range of joint motions in healthy Iranian adults. We studied joint motions in 100 healthy volunteer subjects, 49 men and 51 women, from 19 and 58 years of age. The joint mobility was examined in saggital, frontal, transversal and rotating levels (SFTR). The normal range of motion of all peripheral and axial joint was examined using the standard goniometric technique. There were no significant difference in elbow flexion, shoulder adduction, inward rotation of shoulder and inward and outward rotation of hip, in relation to the age and gender of the studied subjects. There was inverse relationship between joint motion indices and age.

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Key words: Joint motion, healthy adults, goniometer

INTRODUCTION

Inflammatory and infectious diseases as well as mechanical insults to joints can cause restriction of joint motions.

Early detection of restriction of joint motions in disease states requires that the normal range of joint motions be known. The key to effective therapy, in these conditions, is largely depended on the knowledge and understanding of normal and abnormal range of joint motions which vary with the patient's age and gender as well as the applied technique of measuring the joint motion (1-4).

Goniometric method is the gold standard technique for measurement of joint motions in different rotations including saggital, frontal, transversal and rotational (SFTR) (5).

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In this study we examined 100 healthy volunteered adults and measured range of motions of their main peripheral and axial joints.

MATERIALS AND METHODS

From July 1999 to June 2000, 100 healthy adult volunteer medical students and hospital staff of a large university hospital, Imam Khomeini Hospital, were randomly selected and enrolled in the study. Subjects with history of joint, ligament or tendon diseases, bone fractures and muscular or nervous disease were excluded. Those with clinical evidence of joint edema, scar or deformity were also excluded. Saggital, frontal, transversal and rotation methods were used to examine peripheral and axial joint motions using the standard goniometric method (company mark-ORMED, Rheumatologist) (8). Informed written consents were obtained prior to the study.

Standard *t* test method was used for data analysis by MPH researcher with SPSS ver. 11 software.

RESUTLS

Twenty subjects were 20 years old or younger (range, 15 to 20), 65 between 21 and 50 and the remaining 15 patients were between 51 and 58 years. The mean (±SD) age in all groups was 34 ±14. There was no significant difference between mean ages of men and women (32±14 vs. 34±13, $P < 0.6$). Normal ranges of motion of peripheral and axial joints as a whole are shown in table 1 . In peripheral joints, the range of joint motions was significantly greater in males ($P < 0.05$), except for the elbow flexion, shoulder adduction and inward rotation, and inward and outward hip rotation (Table 1).

Table 1. Range of peripheral and axial joints motions (degree) in two sexes

Kind of motion	All patients			Males	Females	*P* value
	Minimum	Maximum	Mean±SD	Mean±SD	Mean±SD	
Peripheral joints						
Wrist flexion	55	72	65±4	69±2	64±5	0.0001
Wrist extension	46	63	56±8	59±3	51±7	0.0001
Elbow flexion	138	152	146±3	146±2	145±3	0.5
Shoulder flexion	145	175	164±3	165±2	162±7	0.0001
Shoulder extension	42	60	52±3	53±2	51±4	0.0001
Shoulder abduction	160	175	170±3	169±3	168±4	0.001
Shoulder adduction	61	73	70±4	70±3	69±5	0.12
Shoulder internal rotation	63	70	68±2	68±1	68±2	0.2
Shoulder external rotation	58	74	65±3	67±2	65±4	0.0001
Knee flexion	128	150	133±3	133±2	132±4	0.002
Hip flexion	120	130	124±2	124±2	123±3	0.0001
Hip extension	5	15	12±4	11±3	10±5	0.0001
Hip abduction	43	50	47±2	48±2	47±3	0.0001
Hip adduction	15	30	25±5	27±4	23±7	0.0001
Hip internal rotation	42	48	45±1	45±1	45±1	0.2
Hip external rotation	42	48	45±1	45±1	45±1	0.2
Vertebral column						
Lumbar flexion	75	90	83±1	83±3	82±4	0.2
Lumbar extension	3	10	9±1	9±1	8±2	0.2
Lumbar right bending	25	35	30±2	30±2	29±3	0.0001
Lumbar left bending	25	35	30±2	30±2	29±3	0.001
Thoracic right rotation	40	46	42±1	44±1	43±2	0.001
Thoracic left rotation	40	46	43±2	44±1	43±2	0.0001
Chest expansion	5	9	7±1	8±1	7±1	0.004
Cervical flexion	34	45	40±3	40±2	39±3	0.0001
Cervical extension	34	45	40±3	40±2	39±3	0.0001
Cervical right bending	40	48	45±1	45±1	44±2	0.003
Cervical left bending	40	48	45±1	45±1	44±2	0.009
Cervical right rotation	40	55	45±3	49±2	47±4	0.0001
Cervical left rotation	40	55	48±3	49±2	47±4	0.0001

Abbreviation: SD, standard deviation.

In axial joints, only the averages of lumbar flexion and back extension were not significantly different between the men and women (Table 1).

Table 2 show the average range of peripheral and axial joint motions in relation to age. As is shown, there is a significant fall in the average range of all joint motions with increasing age ($P < 0.05$).

Table 3. Range of peripheral and axial joint motions (degree) in different age groups*

	Age					
Kind of motion	**≤ 20 years**	**21-30 years**	**31-40 years**	**41-50 years**	**≥ 50 years**	***P* value**
Peripheral joints						
Wrist flexion	69±2	68±2	65±4	62±4	60±5	0.0001
Wrist extension	60±2	58±2	51±8	51±8	48±10	0.0001
Elbow flexion	149±2	146±2	144±2	143±2	143±1	0.0001
Shoulder flexion	167±3	164±2	160±5	159±7	159±4	0.0001
Shoulder extension	55±1	53±2	49±3	49±3	49±2	0.0001
Shoulder abduction	172±2	171±2	165±3	166±2	166±2	0.0001
Shoulder adduction	72±2	70±1	65±1	64±5	64±7	0.001
Shoulder internal rotation	70±1	68±1	66±2	67±1	57±1	0.0001
Shoulder external rotation	69±2	68±2	64±2	63±3	63±3	0.0001
Knee flexion	136±3	134±1	131±2	130±2	130±1	0.0001
Hip flexion	126±2	124±1	122±2	122±2	122±2	0.0001
Hip extension	13±2	13±2	7±3	8±3	8±3	0.0001
Hip abduction	50±1	50±1	45±1	45±2	45±2	0.0001
Hip adduction	32±2	31±2	22±4	23±4	22±4	0.0001
Hip internal rotation	46±1	45±1	44±1	44±1	44±1	0.0001
Hip external rotation	46±1	45±1	44±1	44±1	44±1	0.0001
Vertebral column						
Lumbar flexion	86±2	83±3	80±3	80±2	80±3	0.0001
Lumbar extension	10±1	10±1	7±3	7±1	8±1	0.0001
Lumbar right bending	32±1	31±2	28±2	28±1	28±2	0.0001
Lumbar left bending	32±1	31±2	28±2	28±1	28±2	0.0001
Thoracic right rotation	44±1	44±1	42±1	43±2	42±1	0.0001
Thoracic left rotation	45±1	44±1	42±1	43±1	42±1	0.001
Chest expansion	8±1	8±1	6±1	6±1	6±1	0.0001
Cervical flexion	42±1	41±2	38±2	38±2	37±2	0.0001
Cervical extension	42±1	41±2	38±2	38±2	37±2	0.0001
Cervical right bending	46±1	45±1	43±1	43±1	43±1	0.0001
Cervical left bending	46±1	45±1	43±1	43±1	43±1	0.0001
Cervical right rotation	52±2	50±1	45±2	45±2	45±2	0.0001
Cervical left rotation	52±2	50±1	45±2	45±2	45±2	0.0001

*Data are given as mean ± SD.

DISCUSSION

Previous studies of normal range of joint motion report on a large group of patients with diverse socioeconomic and ethnic background (1-3), methodology and despite of varying degree of routine daily activities (4,5).

To help clarify the discrepancy reported in the literature (2-5), the present study was designed to investigate the normal range of joint motions in a group of healthy Iranian adults to provide a set of guideline for future reference. The results of the present study are consistent with some previously reported studies (5) but are in conflict with other reports (2-4).

Our observations, as well as those of other investigators (5) demonstrate a linear decrease in joint motions with increasing age (Table 2). The inverse relationship between the increased age and decreased joint motion, is mostly related to the vertebral columns (3,6-8). In peripheral joints, the reduced joint motility was most obvious in wrist, elbow, shoulder and knees joints.

Previous studies have shown that the range of motion of neck vertebra is higher in women than men (3, 9) and that of the lumbar flexion and extension in men is higher than women (7). In the present study, on the contrary, except for elbows flexion, shoulders adduction and inward rotations and inward and outward rotations of hips, the range of joint motions in women was significantly less than men. Considering peripheral joint motions, one study showed that the range of hip joint motions in women was higher than men (11); however, in another study, no difference was observed (2,12). In our study, except for lumbar flexion and extension, in other motions, the average of motion range in men was more than women.

Considering our results, it seems that the normal range of axial and peripheral joint motions in this study were similar to the values (10).

In conclusion, the results of the present study indicate that the normal range of motion for peripheral and axial joints in healthy Iranian adults are similar to those reported previously in other populations. In addition there was an inverse relationship between the range of joint motions and the increasing age in both men and women.

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