



Original Contribution

A METHOD FOR MEASURING THE RANGE OF MOTIONS OF STERNOCLAVICULAR AND ACROMIOCLAVICULAR JOINTS BY USING INCLINOMETER

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ABSTRACT

The clinical and experimental searches are relatively less on sternoclavicular and acromioclavicular joints. The data found in literature are incompatible. Usually sternoclavicular and acromioclavicular joints considered in total movements of shoulder girdle, because it is difficult to be measured separately by traditional methods. The electronic digital inclinometer (EDI 320) improved by Cybex Co is a very precise and portable device and it can be used easily. Its reality and reliability at measurements of range of motion (ROM) of limbs was proved, but it was not applied on sternoclavicular and acromioclavicular joints. Therefore we searched the practicability of the inclinometer on these joints. 40 volunteer university students (20 men and 20 women) participated in our study. Protraction-retraction and elevation-depression movements of sternoclavicular joints and scapular abduction-adduction movements of acromioclavicular joints were measured on both right and left joints. The most suitable position for subject and researcher and location of device's probe was determined for the measurement of each movement. The first results found in this preliminary study which are proposed to form a method were like this: average value for protraction + retraction is 45° , for elevation + depression is 40° , for scapular abduction + adduction is 55° .

Key words: *Biomechanics, range of motion, sternoclavicular and acromioclavicular joints, inclinometer*

INTRODUCTION

The joints placed bilaterally to the clavicles help total movements of upper limbs. They are included in shoulder girdle anatomically and functionally. Although three morphological units with articular cavity and articular capsule (sternoclavicular, acromioclavicular and glenohumeral) exist in the shoulder complex, some researchers add fourth component "scapulothoracic gliding mechanism" (1, 2). Furthermore "subacromial joint" is described as fifth component (3). These joints which form the shoulder complex work precisely in a coordinated and synchronized manner (4). The clavicular joints influence the ROM and the contribution of the scapula to total

arm movement. The scapulothoracic component of upper limb movement is the product of sternoclavicular and acromioclavicular joint mobility (1). But it is always difficult to measure the ROM degrees of clavicular joints of the human separately. Clinical and experimental researches are inadequate on this subject. Laboratory measurements and geometrical models are done on isolated cadaver preparations but these do not cover the needs of clinical applications (5, 6).

The electronic digital inclinometer (EDI 320) improved by Cybex Co is a very precise and portable device and it can be used easily. It is devised by the American Academy of Orthopaedics Surgeons (AAOS) (7). It is applied successfully on measurements of spinal motions which classic goniometric methods are insufficient (8). Wide measurements are made on the big joints of upper and lower limbs by inclinometer and they compared with goniometric measurements (9, 10). As a result, reality and reliability of inclinometer

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is proved (11). For this reason, we decided to search the practicability of inclinometer on evaluation of movements of sternoclavicular and acromioclavicular joints.

MATERIALS AND METHODS

40 volunteer university students (20 men and 20 women) participated in our study. The person who has an illness or trauma anamnesis about shoulder girdle and upper limbs were not taken to this study. The heat of measurement room was 20-24 °C. The measurements were made by the same researcher and measured at 10-12 a.m. The movements were demonstrated to volunteers and the data were noted on forms by assistant researcher.

"Continue mode" method was chosen. The probe located at the end of elastic cable was contacted to the reference points of volunteers and kept in this position by the researcher. The point was to fix the probe to the reference points without much pressure.

NOMENCLATURE OF MOVEMENTS

Two movements were tested on sternoclavicular joint: 1-"elevation-depression" motion in frontal plane; 2-"protraction-retraction" motion in horizontal plane. Some researchers claim that clavicle rotates around its axis while arm is in maximum anteflexion and

retroflexion position. But this kind of motion (1, 3, 4) is not defined by many authors. For this reason we left measurement of clavicular rotation for our future work.

Only one movement was tested on acromioclavicular joint: "scapular abduction-adduction". As the obligation of making oscillation of scapula on the thorax's exterior face in a curved plane, we measured this movement in "reference plane" which was called "Johnston's scapular plane" (12).

DESCRIPTION OF THE PREFERENTIAL POSITIONS

In order to compare and repeat the experimental measurement results, which were done on different volunteers, three elements were studied a) subject's position b) researcher position c) location of device's probe.

For measurement of "elevation-depression" on sternoclavicular joint the subject was in erect position and both clavicle in horizontal line. This "0" (zero) position is pointed out by dermatographic bodymarker, maximum elevation and maximum depression motions are done around this reference point. Researcher stood on measurement side. Probe placed in frontal plane, on lateral part of clavicle with a slight pressure from up to down (**Figure 1**).



Figure 1. Measurement of elevation-depression on sternoclavicular joint: A- elevation. B- depression.

Measurement of "protraction-retraction" motion on sternoclavicular joint needed many trials. Because this motion is defined according to the forward-backward movement of clavicular lateral end. The digital electronic inclinometer detects the

variations of gravitation force in angular value.

For this reason, motions which are parallel to earth's surface can not be measured. Supine position was given to the volunteer for "protraction-retraction" motion.

However not to stop movements of scapula space between nape and lumbal spine was left without any support. To be more exact, the volunteer's body projected from the medical examination table and head-neck area was supported at the same level.

Researcher stood on the measurement side of head-level of subject. Probe is placed on lateral part of clavacula with a slight pressure from up to down (**Figure 2**).

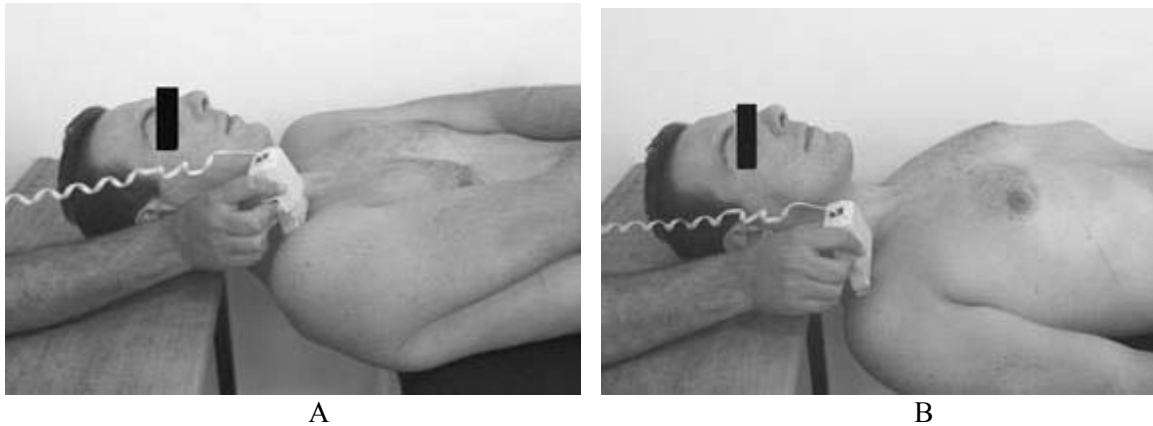


Figure 2. Measurement of protraction-retraction on sternoclavicular joint: A-protraction. B-retraction

To measure the angular value of "scapular abduction-adduction" motion on acromioclavicular joint, "spina scapulae" was accepted as reference point. "Spina scapulae" of the subject is marked while he is in erect position. Researcher stood on the posterolateral side of the subject. The probe is

placed on the skin of the middle part of spina scapulae by a slight pressure from up to down. Subjects were asked to lift the arm maximum over the head and bring near the elbows maximum on the back in retroflexion (**Figure 3**).

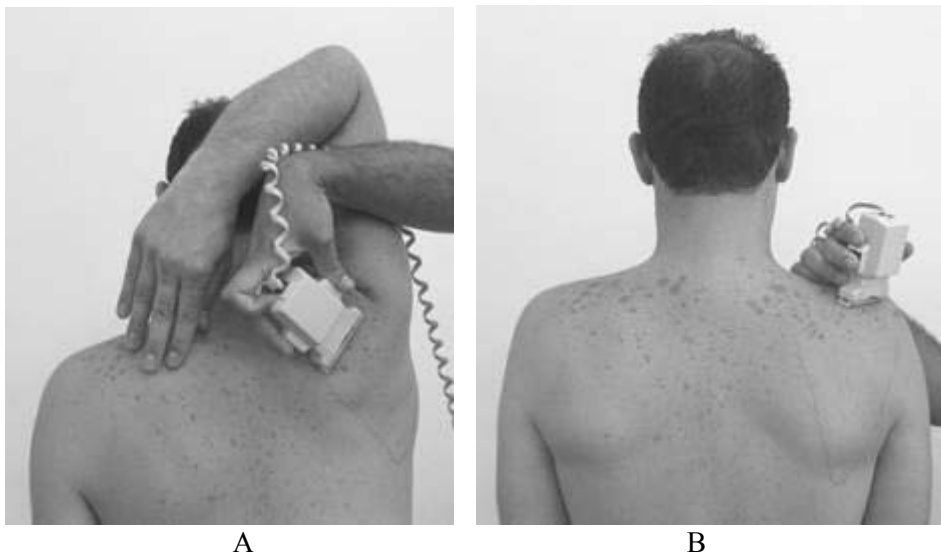


Figure 3. Measurement of scapular abduction-adduction on acromioclavicular joint: A-abduction. B- adduction

RESULTS

Movements were measured bilaterally on men and women. Every measurement was repeated three times and the highest value was taken as maximal ROM. The results were well adjusted with the data of literature (4, 7, 13, 14).

On sternoclavicular joint, the mean values were measured 40 degrees for "elevation -depression" (min. 30 degrees,

max. 56 degrees) and 45 degrees for "protraction-retraction" (min. 30 degrees, max. 58 degrees). The mean value for "scapular abduction-adduction" on acromioclavicular joint was measured 55 degrees (min. 49 degrees, max. 67 degrees).

CONCLUSION

According to our measurement results and experiments, we believed that, the movement

degrees of clavicular joints can be measured easily on live people.

Electronic digital inclinometer was a very easy and practical device for measuring of these joints. It can be suggested for diagnosis, treatment and rehabilitation. It can be used in doctor's offices, because it is fairly small and transportable.

For scientific researches it is needed to continue the measurements on multitude groups in different ages and sexuality, as well as on dominant and non-dominant sides.

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