THE ANATOMY AND MOVEMENTS OF THE SHOULDER

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SUMMARY

The anatomy of, and movements occurring at, the glenohumeral, sternoclavicular and acromioclavicular joints, are discussed. Muscles acting on the shoulder girdle and glenohumeral joints are tabulated.

OPSOMMING

Die anatomie van, en bewegings wat plaasvind by, die glenohumerale, sternoklavikulêre en akromioklavikulêre gewrigte, word bespreek. Spiere wat om die skouergordel en glenohumerale gewrigte beweging meebring, word getabuleer.

The shoulder can be described as the articulation between the head of the humerus and the glenoid cavity of the scapula. However, functionally it is far more complicated as the shoulder includes all the structures which join the upper limb to the thorax (Matsen, 1980).

ANATOMY

The joints involved in the shoulder include the glenohumeral, sternoclavicular and acromioclavicular joints (Fig. 1).

THE GLENOHUMERAL JOINT

This is a synovial multi-axial ball and socket joint between the head of the humerus, which is slightly less than a hemisphere, and the small shallow pear-shaped glenoid cavity of the scapula. The concave glenoid cavity is deepened by a rim of fibro-cartilage, the glenoidal labrum. The articular surfaces are covered by a layer of articular cartilage and are held together by a very loose fibrous capsule. The size and shape of the articular surfaces and the laxity of the capsule make this the most mobile joint in the body. However, this mobility makes the glenohumeral joint extremely unstable. The capsule is slightly strengthened by ligaments. Above is the coraeohumeral ligament (Hollingshead and Jenkins, 1981) and anteriorly three thickened bands, the glenohumeral ligaments, can be seen on the inner aspect of the capsule. A synovial membrane lines the inner surface of the capsule, the intracapsular bone and ensheathes the long head of biceps which passes through the joint. The synovial cavity communicates through the capsule with bursae which lie deep to adjacent muscles. Nerves that supply the joint are mainly from the posterior cord of the brachial plexus (C 5, 6, 7, 8, T1)(Williams and Warwick, 1980).

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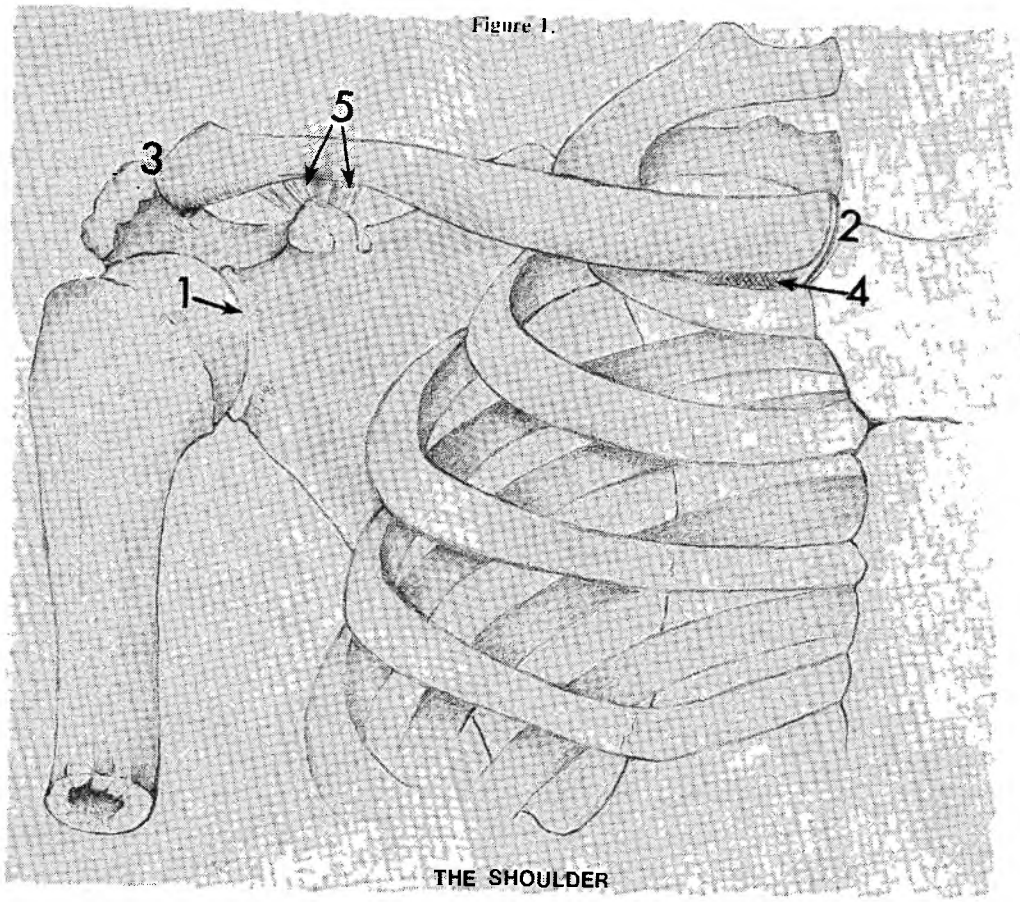
THE STERNOCLAVICULAR JOINT

This is a stable synovial joint between the medial articular facet on the clavicle and the first costal cartilage and clavicular notch of the manubrium sterni. The articular surfaces are not congruent and the joint cavity is divided into two chambers by a fibrocartilaginous articular disc. The joint is enclosed in a fibrous capsule which is strengthened on all surfaces by ligaments, the most powerful and most important of these being the inferiorly placed costoclavicular ligament. This is bilaminar, connecting the first rib and costal cartilage to the under surface of the clavicle.

THE ACROMIOCLAVICULAR JOINT

This is a plane synovial joint between the articular facets on the lateral end of the clavicle and the medial rim of the acromion process of the scapula. The articular surfaces are covered with fibrocartilage and connected by a synovial lined fibrous capsule. The cavity thus formed can be partially divided above by a fibrocartilaginous disc. The capsule is supported above by the acromioclavicular ligament and below by the strong important coracoclavicular ligament. The coracoclavicular ligament is divided into conoid and trapezoid parts which connect the coracoid process of the scapula with the adjacent under surface of the clavicle, maintaining the correct relationship between the scapula and

Figure 1.



1. Glenohumeral joint.
2. Sternoclavicular joint.
3. Acromioclavicular joint.
4. Costoclavicular ligament.
5. Coracoclavicular ligament.

clavicle at all times, thus supporting the acromioclavicular joint.

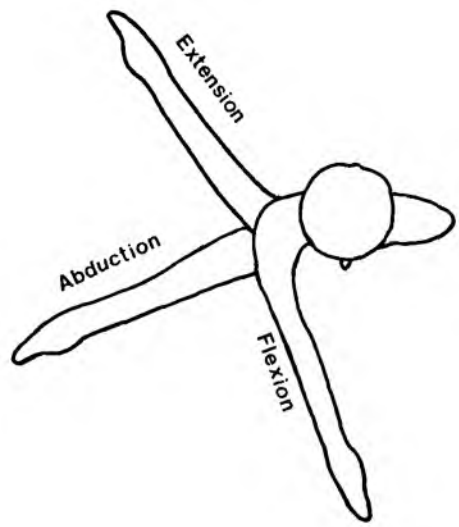
MOVEMENT

Movement at the glenohumeral joint is rarely isolated in normal shoulder function. However, the movement is easier to understand if it is analysed by examining each joint separately.

Distinction must be made between true physiological movement and exercise therapy. Movement at the glenohumeral joint occurs in the plane of the scapula, thus flexion carries the arm medially across the front on the chest (Williams and Warwick, 1980), the plane of movement being oblique, not sagittal (Fig. 2).

Abduction and adduction occurs in a vertical plane at right angles to the plane of flexion and extension (Williams and Warwick, 1980) the arm moving forwards and laterally away from the body in abduction, returning in the same plane in adduction. Medial and lateral rotation occur around the long axis of the humerus and circumduction is the sequential combination of all the above movements.

Movement of the shoulder displays constant humero-scapular rhythm. This includes movement at the sterno-clavicular and acromioclavicular joints simultaneously.



Movement of the arm
(Viewed from above)

Figure 2.

TABLE I
MUSCLES ACTING ON THE SHOULDER GIRDLE

	Protractors	*Retractors*	*Lateral Rotators (inferior scapular angle)*	*Medial Rotators (inferior scapular angle)*	*Elevators*	*Depressors*
Trapezius		*	*		*	
Levator Scapulae				*	*	
Rhomboids		*		*		
Latissimus Dorsi		*		*		*
Serratus Anterior	*		*			
Pectoralis Major	*			*		*
Pectoralis Minor	*			*		*

TABLE II
MUSCLES ACTING ON THE GLENOHUMERAL JOINT

	Flexors	**Extensors**	**Abductors**	**Adductors**	**Medial Rotators**	**Lateral Rotators**
Pectoralis Major	*			*	*	
Deltoid	*	*	*		*	*
▲ Supraspinatus			*			
▲ Infraspinatus			(*)			*
▲ Teres Minor			(*)			*
▲ Subscapularis			(*)		*	
Teres Major		*		*	*	
Latissimus Dorsi		*		*	*	
Coracobrachialis	*			*		

▲ Rotator cuff muscles (*) Synergist

The range of movement at these joints is negligible in comparison with that at the glenohumeral joint, and can be related to movement of the scapula.

As the scapula moves forwards (protraction) the acromion glides forwards on the clavicle (acromioclavicular joint, A-C jt) and the medial end of the clavicle moves backwards (sternoclavicular joint, S-C jt). Backward movement (retraction) of the scapula causes the reverse movements to occur, the acromion slides backwards (A-C jt) and the medial end of the clavicle moves forwards. Lateral rotation of the inferior scapular angle causes the lateral end of the clavicle to lift (A-C jt), while its medial end is depressed (S-C jt) then rotation of the clavicle at the sternoclavicular joint occurs as the scapula reaches its final position of rotation and the glenoid cavity faces upwards. Medial rotation of the inferior scapular angle returns the bones to their resting position with corrective rotation of the clavicle, while its lateral end drops down (A-C jt) and its medial end is elevated (S-C jt).

Movement at the glenohumeral joint can be easily isolated but functionally the humerus and scapula usually work in concert, the scapula moving to place the glenoid cavity in the best possible position for functional use of the glenohumeral joint and thus of the arm itself. Many investigations have been attempted to measure exactly when the scapula moves during glenohumeral movement. It has proved impossible to generalise because of the many complex variations that exist in an individual, let alone in a total population. Most authorities agree, however, that if the humerus is elevated through 180 degrees in relation to the thorax, approximately two-thirds of the movement occurs in the glenohumeral joint and one third occurs with rotation of the scapula (Matsen, 1980). The most obvious interplay of muscles and joints is seen during elevation of the arm through abduction. The middle fibres of deltoid and supraspinatus are responsible for abduction of the humerus. Simultaneously the remaining rotator cuff muscles contract, putting a downward and medial force on the head of the humerus, allowing the humerus to be lifted outwards, not vertically upwards (the natural direction of pull of the middle fibres of deltoid).

As the arm is lifted laterally, so the scapula starts to rotate. The muscles responsible for this rotation are the upper and the lower fibres of trapezius and the lower fibres of the serratus anterior muscle. With scapular rotation the clavicle will move at both sterno- and acromioclavicular joints. To reach 180 degrees of elevation the humerus is rotated laterally, moving its greater tuberosity backwards. In the reverse movement of adduction from full elevation, the scapula returns to its normal position partly through the pull of gravity, assisted by levator scapulae, the middle fibres of trapezius and the rhomboids, while the middle fibres of deltoid play out to the pull of gravity, returning the arm to its relaxed dependent position, and the rotator cuff muscles control the relationship between the humeral head and the glenoid cavity at all times during the manoeuvre.

DISCUSSION

Movement of the shoulder is complicated and it is wise to understand how each component functions before viewing the whole in action. Although a muscle can be simply described as the prime mover of a specific action, further analysis of the movements of the shoulder as a whole demonstrate that the muscles act continuously in concert.

References

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