Rehabilitation of the Athlete's Shoulder

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KEYWORDS

• Shoulder • Rehabilitation • Scapula • Kinetic chain

Rehabilitation is sometimes difficult in the shoulder, where complex function involves not only local anatomic and biomechanical integrity, but also biomechanical and physiologic contributions from distant body segments. The distant segment contributions are key components of the sequential activation of body segments that is necessary to accomplish any athletic activity. This sequential activation is known as the ''kinetic chain.'' The shoulder does not function in isolation, but functions as a link in kinetic chain activity that optimizes shoulder function. Alterations in any of the other links of the kinetic chain can affect the shoulder, and alterations in the shoulder can affect other links in the kinetic chain. The existence of this interaction has 2 implications for shoulder rehabilitation. First, the evaluation and identification process preceding shoulder treatment and rehabilitation should include more than just local shoulder structures. The evaluation process should result in a complete and accurate diagnosis of all altered structures throughout the kinetic chain. Second, optimum restoration of shoulder function requires activation of all kinetic chain segments to re-establish the interactions that existed before injury.

The biomechanical model for striking and throwing sports is an open-ended kinetic chain of segments that work in a proximal-to-distal sequence.[1–3] The goal of the kinetic chain activation sequence is to impart maximum velocity or force through the distal segment to the ball, racquet, or other implement. The ultimate velocity of the distal segment is highly dependent on the velocity of the proximal segments. The proximal segments accelerate the entire chain and sequentially transfer force and energy to the next distal segement.[1–5] Because of their large relative mass, the proximal segments are responsible for the majority of force and kinetic energy that is generated in the kinetic chain.[2] As a result, lower extremity force production is more highly correlated with ball velocity than is upper extremity force production.[6]

The physiologic model for throwing and striking sports is a motor program that activates muscles in co-ordinated sequences to create joint movements that simplify and perform movement tasks.[7] There are 2 types of these programs—length-dependent

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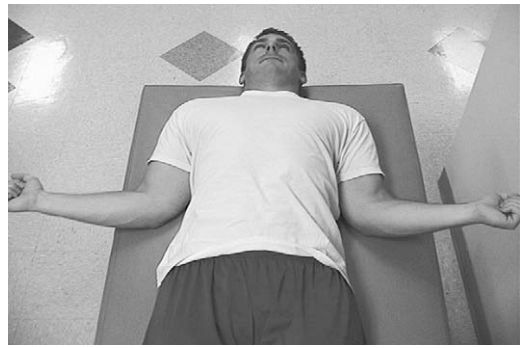

Fig. 1. Open-book stretch.

motor programs and force-dependent motor programs. Length-dependent motor patterns operate locally at one joint, are responsible for resisting joint perturbations, and result in co-contraction force couple activation as seen in deltoid-supraspinatus activation to control the humeral head in the glenoid fossa. Force-dependent patterns harmonize motions of several joints, create co-ordinated joint motions, and use agonist-antagonist force couple activation to generate force. An example would be latissimus dorsi-lower trapezius activation to simultaneously retract/stabilize the scapula and internally rotate the arm. In combination, these result in motor programs for voluntary upper extremity movements that are task oriented and include lower extremity and trunk muscle activation before and during arm motion.[8] In addition to generating and transferring force to the distal segments, these programs create a stable proximal base for voluntary arm movements, so that the rapid arm movements will not disturb body equilibrium during throwing or striking.[8,9]

Rehabilitation protocols should be position specific, motion specific, and function specific, and they must include gravity resistance and joint integration to stimulate the proprioceptive feedback that will cue the appropriate functional patterns.[10]

ALTERATIONS LEADING TO INJURY

Glenohumeral internal rotation deficit (GIRD) is the most commonly associated alteration in flexibility.[11–13] This alteration creates an anterior/superior humeral translation with arm forward flexion[11] and is associated with external impingement based rotator

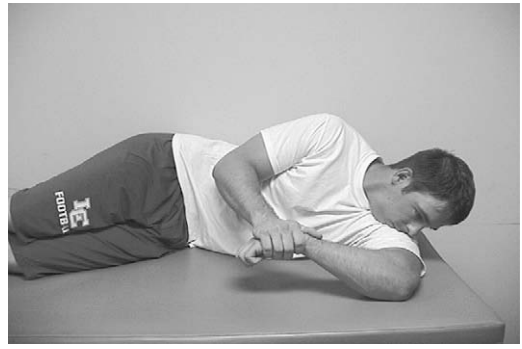

Fig. 2. Sleeper stretch.