

Preventive Assessments and Training for Shoulder Joint Injury

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Abstract. Shoulder joint injury often affects athletes' performance, training, and daily life, and it costs more money and time to treat, so it is very important to prevent shoulder joint injury. This paper mainly provides assessment and training ideas for preventing shoulder injury to make athletes achieve better results and reduce injuries. Many shoulder joint examinations such as Jobe, Neer, the Hawkins Kennedy, the pain arc, and the Allen tests can simultaneously be used for preventive evaluation. At present, there are few preventive assessments. This paper gives some ideas from the assessment's breadth, content, timing, and modernization perspective. Preventive assessment is mainly to screen out risk factors for high-risk people who do not suffer from shoulder joint disease or those who recover from shoulder joint injury to provide better plans for follow-up daily life and training and improve the quality of life and sports. Preventive evaluation provides a good reference for preventive training. The main purpose of preventive training is to prevent potential upward risks and improve athletes' sports levels. Functional training is mainly aimed at strengthening the weak chain so that the muscle group can reach a more stable and balanced state, so better cooperation with the completing Fascia is easily ignored in ordinary training. Fascia training can better play the function of muscles, increase the proprioception of muscles, and improve the quality of action completion.

Keywords: Preventive Assessments, Preventive Training, Shoulder Joint Injury.

1. Introduction

The shoulder joint is the most flexible in the human body and plays a very important role in daily activities. However, it is also one of the most vulnerable joints, with the highest proportion of all sports injuries, reaching 26%, mainly concentrated in tendinopathies, joint injuries, and muscle injuries [1]. Some studies have shown that the shoulder joint needs a lot of time to recover after injury, which could cause time loss and sports performance reduction for athletes. Especially the excessive use of discus, hammer, or javelin throwing could greatly increase the injury risk of the shoulder joint [2].

Although there are many treatment methods for shoulder joint injury in modern times, the degree of injury before and when the damage occurs is unpredictable. The injury often affects the athletes' later training effect, psychology, and future quality of life to varying degrees. Therefore, athletes should not stop at strengthening the relevant sports muscles but also carry out appropriate training for their weak links to reduce the potential risk of shoulder joint damage. This article mainly provides a clinical evaluation idea from the perspective of evaluation and provides some training methods to help athletes achieve better training effects and prevent injuries.

2. Anatomy

The shoulder joint comprises the sternum, clavicle, scapula, humerus, and surrounding soft tissues. There are four main joints in it: The sternoclavicular joint which is the only joint connecting the upper limb and trunk, the scapulothoracic joint plays an important role in the stability of the shoulder joint, the glenohumeral joint, and the acromioclavicular joint. Composed of the head of the humeral and hard to cover with the deeper concavity of the glenoid fossa, the shoulder's main joint is glenohumeral. It contains the glenoid labrum and is surrounded by a thin, relaxed joint capsule and several muscles. In addition, because the glenoid is shallow and can only accommodate 1 / 4 of the humeral head, it has a large range of motion, poor stability, and is prone to injury.

The static stability of the shoulder joint is mainly maintained by capsular ligaments, the articular components, negative intra-articular pressure and the glenoid labrum. If this component is damaged, it could easily cause instability of the shoulder joint. The shoulder joint muscles mainly maintain the shoulder joint's dynamic stability. For example, the rotator cuff is composed of the supraspinatus, infraspinatus, and teres minor and subscapular, which mainly maintain the stability of the glenohumeral joint. The deltoid is divided into three bundles: anterior, middle, and posterior, which mainly maintain the stability of the scapula.

The damage to the dynamic stability mechanism also affects the static stability mechanism of the shoulder joint. For example, the destruction of the rotator interval surrounded by the upper border which belongs to the subscapularis tendon, and the supraspinatus tendon's anterior border may lead to the destruction of the joint capsule, thus making the shoulder joint unstable. The nerve innervation of shoulder joint activity and sensation mainly comes from the C5 to T1 nerve roots and several major peripheral nerves of the upper limb, the brachial plexus. The branches of the brachial plexus merge to synthesize the main nerves innervating the upper limbs, such as the axillary, ulnar, radial, median.

3. Diagnosis

There are six domains to consider as part of the RTS decision-making process: the power, endurance and strength of the shoulder's muscle, active shoulder joint ROM, the pain, the kinetic chain of the body, the psychology of the people who suffer from shoulder problems and back to sport-specific activities [3]. The current evaluation is mainly based on the functional examination of musculoskeletal and nervous systems with bare hands. The routine inspection of the shoulder joint is similar to other body parts, such as palpation (including nerves), joint active and passive mobility, joint accessory movement, muscle strength, length, and control force tests. The following will introduce several commonly used special examinations for the shoulder joint.

3.1. Neer Test

This test is one of the clinic's most specifically used symptom aggravating tests. The subject is seated. The examiner is located behind the patient, fixes the scapula with one hand, and raises the testing arm substantially. If pain is induced, it is positive. This action will cause pain at all stages of impact injury, and its specificity is not high.

3.2. The Hawkins-Kennedy test

The subject can sit or stand up, then put the shoulder joint adduction of 90 degrees and elbow joint flexion of 90 degrees, in an "L" shape. Keep your forearms horizontal. The examiner forced the subject's forearm downward to cause the shoulder joint rotation inward, and the pain was a positive test, which suggested that the rotator cuff tendon hit the coracoacromial arch, the pain in the front of the shoulder suggested impact syndrome, and the pain in the back of the shoulder suggested tension in the back of the joint capsule. Like the neer test, as an experiment to examine acromion impingement syndrome, Cool's meta-analysis compared the specificity and the sensitivity between the Hawkins test and Neer Test and found that the sensitivity of Hawkins will is higher than that of the neer test [4], but the overall poor specificity [5].

3.3. The pain arc test

To do the pain arc test, make the patient stand or sit. Before abduction to 60°, the patient has no pain or less pain. Resistance is applied when abduction to 60° - 120°, and the pain is heavier. However, when shoulder abduction exceeds 120°, the pain is alleviated, and the lifting can be continued automatically. The range of shoulder abduction 60° - 120° is the pain arc. The positive pain arc test indicates the possibility of rotator cuff injury or subacromial impingement syndrome. It can be inspected in cooperation with the neer and Hawkins Kennedy tests.

3.4. Allen Test

This test is used to detect the blood supply of the upper limbs, which is helpful for the diagnosis of thoracic outlet syndrome. The method is to make the other subject sit in a sitting position so that his arm was induced to 90 °, and the inspector horizontally extended and laterally rotated the arm. If the radial pulse on contralateral cervical rotation indicative of thoracic is positive.

3.5. Jobe Test

The Jobe test is also called the empty can test. The subject is sitting or standing, and the examiner rotates the subject's shoulder joint inwards and the arm abducts to 90 degrees at the same time. After completion, the examiner applies downward pressure on the arm of the tester. If there is pain, it indicates that the supraspinatus muscle is weak or injured. Jobe test showed the highest sensitivity (0.81) for the deficiency of supraspinatus muscle [6].

4. Preventive assessment

The assessment is essential in the training of athletes. Generally, the assessment is focused on the athletes who have been injured rather than those who have not. Few studies on preventive assessment focus on injury prevention for athletes. It could reflect the condition and function of athletes, adjust the training program of athletes in time, maintain a better training state, and maximize the development of athletes' potential and prevent injuries. So this paper discusses the scope, content, and timing of the assessment in order to provide suggestions for the design of preventive assessment.

4.1. Assessment scope

From the perspective of assessment scope, it is necessary to understand the basic information of athletes, such as age, occupation, name, and gender, and also to evaluate the risk factors that this basic information may bring. One example is that men are easy to get scapular dyskinesia during an abduction with the high risk. Another with the same method is that insufficient internal and external rotational strength of the equal-length shoulder is only associated with the risk of injury in women [7]. In addition, therapists should observe the high risks that may exist in the training part and pay attention to the risks that the untrained parts may bring during the assessment. For example, the main part of throwing is the shoulder joint, which mainly includes six movements, the first step is windup. In the end stage of windup, the hip power is transferred to the throwing arm, and the lumbopelvic muscle could be activated in this process. However, the lumbopelvic control is related to the shoulder joint torque, and the poor control force of the lumbopelvic might increase the risk of injury and reduce movement performance [8]. It means that the preventive assessment of lumbopelvic help the prevention of shoulder joints.

4.2. Assessment content

In terms of the assessment content, it is suggested to be detailed and appropriate. Although the evaluation effect of an overly complex evaluation is better and more comprehensive, it might take too much time. If it is used for monitoring and observation in ordinary training, the time and money costs are too high. Although simple assessment is convenient, it is relatively rough and can not fully stimulate the greatest potential of athletes. With the refinement of training and the improvement of athletes' levels, the evaluation content should be richer and more factors that may cause damage should be considered, such as excessive use, weight exceeding the bearing capacity, and long-term repetitive movements that may harm athletes.

4.3. Assessment timing

In assessment timing, there is a certain gap between athletes due to different individual differences and training methods. Especially near the early stage of the competition, athletes would have a certain pressure. Some athletes may be overtrained due to emotional problems during preparation. Therefore,

the psychology and physical function of athletes are particularly important. The evaluators should pay more attention to the athletes at ordinary times, find out problems in advance, intervene, and adjust the training according to the different training periods of athletes.

4.4. Assessment ideas

Regarding assessment ideas, although the muscles are not independent, like a train. However, there will still be weak links in the muscle chain. Even if the main muscle groups with specific functions are more developed, the existence of weak chain is more likely to cause damage. The discovery of weak chains can be judged by the combination method, such as confirms muscles that mainly control movements during abduction and forward flexion combination and confirming muscles that do not participate or participate too little. At the same time, some risk factors should be considered in combination. Currently, the popular main problems are overhead, heavy workload, improved position, psychological pressure, repeated motion, improved tools, and the motion with the arm raised more than 90 degrees or hands moving above shoulder height are the significant causes of a shoulder injury [9].

4.5. Combining modern science and technology

By combining modern science and technology, it reasonably uses big data to screen out possible risk factors and formulate a reasonable evaluation scheme for the corresponding risk factors to better screen out athletes with potential damage. At the same time, it can share data with athletes from other countries, analyze their advantages and disadvantages using data, and analyze the reasons for better use in prevention.

5. Preventive training

Overhead movement, repetitive movements and incorrect posture are the main factors leading to shoulder joints. Not only older athletes, but also healthy young athletes are extremely vulnerable. [10]. During the preparation and training of athletes, especially when approaching large-scale events such as the Olympic Games, injuries are more likely to occur during the training period. If the injury occurs at this time, it will miss an excellent opportunity for the athletes and is not conducive to later training. For older athletes, the damage would be easier and more serious. Therefore, preventive training is essential for athletes.

Ann et al. proposed that adherence to prevention is the primary condition for success, and it is possible for accidents to prevent accidents [11]. Prevention strategies can be adjusted for specific sports or injuries, mainly focusing on modifiable risk factors, such as rules, equipment and physical health. Sports training includes learning appropriate sports techniques, such as understanding each joint's range of motion limitations and avoiding joint positions that put joint anatomy at risk of injury [12]. Preventive training is mainly aimed at the appropriate intervention of physical muscle function, connective tissue, and psychology, significantly improving sports performance and reducing injury risk factors.

5.1. Functional training

In the ordinary training of athletes, because of the special movement requirements of sports events, athletes often strengthen the training of special movements. In the long run, the main muscles mobilized by special movements will be more strengthened, but the muscles with less training will be less developed, and the body will be asymmetric and unbalanced, resulting in weak chains. The generation of weak chains can easily increase the risk of injury, but it can be supplemented by functional training. Functional training is mainly aimed at the weak chain of muscles. It integrates daily physical activities and competitive sports. Through comprehensive training, the sports skills of athletes can be improved as a whole, and their sports ability can be optimized. The main methods are balance, stability, and core and dynamic sports training [13]. Niu Zhenjun's group used FMS to

functionally test the shoulder joints of flying saucer shooters of the national team and found that their flexibility, push-ups, and rotational stability scores were low. If long-term special training is easy to cause injury to the shoulder joint and affects the waist simultaneously, it is very important to train the shoulder joint's flexibility and the core area's strength [14].

5.2. Fascial training

Traditional sports training emphasizes the full exercise of muscle fibers, cardiovascular regulation, and neuromuscular coordination. However, most sports-related overload injuries occur in elements of the body-wide fascial net [15]. Therefore, when an athlete's shoulder joint is injured, it is not necessarily a muscle or bone problem but also a fascia problem.

The fascia's structural characteristics and sensory ability may cause sensory discomfort after exercise, which is often caused by strenuous and unaccustomed exercise [16]. Fascia is a three-dimensional continuation of connecting tissue surrounding the bones, muscles, nerves, and blood vessels throughout our body [17]. It can be summarized in three characteristics [18], interconnecting sheets and layers of body-swathing membranes; an inconstant range of ostensibly distinct parts (fasciae and fibrous structures); a body-wide soft connective tissue system with several forms of connective tissue. Recent studies have shown that fasciae contain proprioceptors and nociceptors [19], so fascia training can not only effectively improve joint mobility, core strength, balance, and muscle performance but also enhance proprioception input and effectively prevent injury [20]. Fascia training mainly includes foam roller training, utilization of elastic recoil, preparatory counter movement, slow and dynamic stretching, rehydration practices, and proprioceptive refinement [15, 20].

6. Conclusion

This article mainly shares the evaluation and training ideas related to prevention to enable athletes to prevent injuries in regular exercise and to provide further play to their training effects.

The general examination of the shoulder joint mainly focuses on musculoskeletal and nerves, similar to other body parts. There are also some special examinations and diagnoses of the shoulder joint. This article mainly introduces the Jobe Test for supraspinatus injury, the Neer Test, the Hawkins Kennedy test, the Pain Arc Test for acromion impingement syndrome, and the Allen test for thoracic outlet syndrome.

Preventive assessment is mainly to screen out risk factors for high-risk people who do not suffer from shoulder joint disease or those who recover from shoulder joint injury to provide better plans for follow-up daily life and training and improve the quality of life and sports. Regarding the scope of assessment, we should have divergent thinking and judge potential risk factors from general information. The evaluation content should be detailed and appropriate, and the evaluation methods should be effectively combined in regular training to improve efficiency and achieve better results. In terms of the actual situation at ordinary times, it is suggested to pay special attention to the state of athletes and intervene appropriately according to individual circumstances. From the perspective of modern informatization, we should properly combine modern new technology to make preventive assessment play a greater role.

Preventive training is mainly to supplement the possible weak links after the completion of preventive assessment to minimize the damage of weak links. This paper mainly introduces functional training and fascia training. Practical training is mainly aimed at strengthening the weak chain so that the muscle group can reach a more stable and balanced state, to better cooperate with completing the action. Fascia is easy to be ignored in ordinary training. Fascia training can better play the function of muscles, increase the proprioception of muscles, and improve the quality of action completion.

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