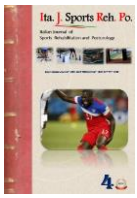

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Kibler's Test as a Functional Pre-Physical Examination Asymmetries of the Scapula in Overhead Game Athletes. A Field Test.

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Abstract

Analysis and study of the posture of athlete is one of the most important aspects of evaluation during pre-season. In overhead athletes, assessing the functionality of the scapula is one of the most important and interesting observations in postural manner. Postural asymmetries frequently remains as dysfunctional abnormalities that correlate with increase in risk factors for disease in the shoulder of athletes who involve in overhead sports. These asymmetries scapular posture are more pronounced in the upper limbs dominant for their repetitiveness gestural in game play. Test of static and dynamic evaluation have been presented in the literature to classify the presence of dyskinesia's scapular between the Kibler's test (lateral scapular slide test, LSST) that evaluates the postural modulation of the scapula in static positions clinically. Through this test, asymmetries side to side above the measurement of 1.5 cm may be classifiable as scapular dyskinesia after fifteen minutes of assessment on the field. We therefore recommend LSST to overhead game (volleyball) athletes' technical teams as a functional assessment field test for scapula. It is simple within 15 seconds, repeatable and capable of detecting any scapular dysfunction in asymptomatic volleyball athletes.

Key word: *Field test, Scapular dyskinesia, Scapular, Volleyball injury, Kibler test, Shoulder*

Introduction

Volleyball is one of the most popular sports in the world, and their incidence of injury is between 1.7 and 4.2 per 1,000 hours of play, making it the fourth most common source of sports injuries[1]. Volleyball has received, in recent years, significant attention from many authors in relation to the study of traumatic injuries most of which are related to the repetitiveness gestural. [1] Most studies reported ankle joint, knee shoulder and hand as the most affected parts.[2,3,] Studies shown the rate of injuries in volleyball to be lower than other team sports such as football and basketball [4,5] while fits injury are frequently connected with two non-contact which occurs during the landing. [5,8,10] Women showed a higher incidence than men because of a lower strength levels associated with a poor proprioception during the kinematics of landing[12] and lesions remain most frequently incurred during races compared to training sessions[11]. This applies in particular to traumatic distorting inversion which make ankle joint to be prone to acute injuries (Photo 1) in volleyball. [5,9,30]

Photo 1. Ankle sprains in Italy Women's National Volleyball Player

International studies on the epidemiology of trauma in sports showed that in volleyball trauma to the shoulder are still rising (15.0–20.0%). During the last 10 years the percentage of disease overuse, in men's volleyball elite, increased from 16% to 47% with a significant increase in the incidence of injury from 0.5 to 1.8 per athlete, for 1000 hours played . ($p<0.001$) [12,13]

Spiking in volleyball(Photo 2) have been studied [9.14.15] and different muscle activation patterns[16,19] with the dominant shoulder in the game can cause lateralization of the scapula and a shortening of muscles than non-dominant [20] and decrease in internal rotation with increase of the external one. [28,29]

Photo 2. The "volleyball attacker"

Despite the essential role played by the scapula in the function of the shoulder, there is a tendency to overlook both training and rehabilitation during sports competition. Its specific involvement in volleyball becomes interesting to the admiration of what international language defined as an abnormal scapular.
Overhead athletes (Volleyball, Basketball, and Handball) presented scapula humeral rhythm asymmetry between dominant and non-dominant shoulder in 90° and 135° humeral abduction as dominant shoulders have less scapulahumeral rhythm ratio than non-dominant shoulders.
Furthermore, overhead athletes dominant shoulders have more scapular downward rotation in scapular rest position, more scapular upward rotation in 90° and 135° humeral abduction and less scapulahumeral rhythm ratio in 45°, 90° and 135° humeral abduction than non-dominant shoulders athletes. [21] Scapular dyskinesia is a modification of the normal scapular, kinematics, shown to be a predisposing factor for shoulder disorders. [21]

In an article on clinical implications of scapular dyskinesia in shoulder injury, Kibler [13] points out that : 1) scapular dyskinesia are present in a high percentage of most shoulder injuries ; 2) the exact role of dyskinesia in creating a pathology of the shoulder is not clearly defined; 3) the clinical symptoms in shoulder impingement symptoms are particularly severe in the scapular dyskinesia; and 4) the rehabilitative treatment of pathologies of the shoulder can have a greater efficacy if they are identified early scapular dyskinesia.

Thus patients with dyskinesia and sub -acromial impingement syndrome have reduced external rotation and scapular increased activity of the upper trapezius muscle, along with a greater loss of shoulder functions than those without dyskinesia. Indeed, the alteration of the scapular stabilization, muscle coordination, the decrease in the flexibility of the complex muscular and capsule - ligamentous shoulder can deconstruct the normal physiology of the scapula.

This implies, yet further research and studies which correlate asymmetries scapulars induced muscle fatigue relatable to specific gestures .Different methods of evaluation of scapular positioning are grouped by the literature, which shows non-homogeneity of objectives and results, as to leave, to the operators, a large choice of use among the diverse tests proposed to "intercept" asymmetries scapulars (Table1).

Pattern	Definition
Inferior angle (type I)	At rest, the inferior medial scapular border may be prominent dorsally. During arm motion, the inferior angle tilts dorsally and the acromion tilts ventrally over the top of the thorax. The axis of the rotation is in the horizontal plane.
Medial border (type II)	At rest, the entire medial border may be prominent dorsally. During arm motion, the medial scapular border tilts dorsally off the thorax. The axis of the rotation is vertical in the frontal plane.
Superior border (type III)	At rest, the superior border of the scapula may be elevated and the scapula can also be anteriorly displaced. During arm motion, a shoulder shrug initiates movement without significant winging of the scapula occurring. The axis of motion is in the sagittal plane.
Symmetric scapulohumeral (type IV)	At rest, the position of both scapulae are relatively symmetric, taking into account that the dominant arm may be slightly lower. During arm motion, the scapulae rotate symmetrically upward such that the inferior angles translate laterally away from the midline and the scapular medial border remains flush against the thoracic wall. The reverse occurs during lowering of the arm.

Table 1. Scapular Dyskinesia System Used to describe Abnormal Scapular Motion.
(From Kibler et al, 2002) [22]

On the basis of possibility, as a reasonable and probable scapular disorder, sports such as volleyball categorized as overhead has fundamental preventive screening that may be embedded in the stages of pre-season. In the screening strategy, pre-season is essential, therefore, a functional assessment, before starting training workouts specific technical / athletic, of the upper limb whose restriction of mobility, has both reflected adaptive descendants, who ascending the posture of the segment head / neck with reflections on the articulation temporal - mandibular as shown by several studies in the literature. [14,17]
In this article we want to propose, to the technical staff of various overhead game teams, a functional assessment field of the scapula, simple and repeatable, capable of detecting any scapular dysfunction in asymptomatic athletes. If identified early, this might be a clear functional factor, predictive of a future pathology of the shoulder.[23] We , therefore, propose its specificity and ease to administer lateral slide scapular test (LSST) of Kibler as detector of mobility scapular dysfunction. The LSST was introduced, primarily, in an attempt to objectively measure the scapular stabilizing force.

The role of the scapula in relation to the functionality of the Shoulder

In summarizing the complex multidimensional biomechanics of the upper limb, we can say that during normal movement, on the chest wall, the scapula provides a support, functional, for the humerus (Figure 1) such as to maintain constant, through its mobility, the report "length – tension" muscle scapularhumeral. In most overuse injuries, occur, later, precisely to an alteration biomechanical / functional. These are often likened to a change, the balance muscle stabilizers, and the scapula – Humeral . [24]

When there is a "weak" or an imbalance of tensions, as with immediate reflection, a decrease of the neuromuscular performance and an increase, an important risk of injury, amplified by a repetitive gestural abnormal, which will lead, certainly with time, to pathological findings[2]. Conversely, a hypomobility or a bad positioning of the scapula, disturbs the rhythm joint (Figure 2) and generates a functional dysfunction of the shoulder.[3,4]

Functional deficiencies of the scapula, can influence, the instantaneous center of rotation of the shoulder, which goes to alter, significantly, the potential of the force generated and normal joint fluid.A considerable proportion of "impingement" can be corrected by a re-education and a scapular muscle activity reconditioning. Rehabilitation restoring the organization's normal movement and the right balance of the game of pairs of muscle strength, can improve the position and function of the scapular and efficiency of the rotator cuff.

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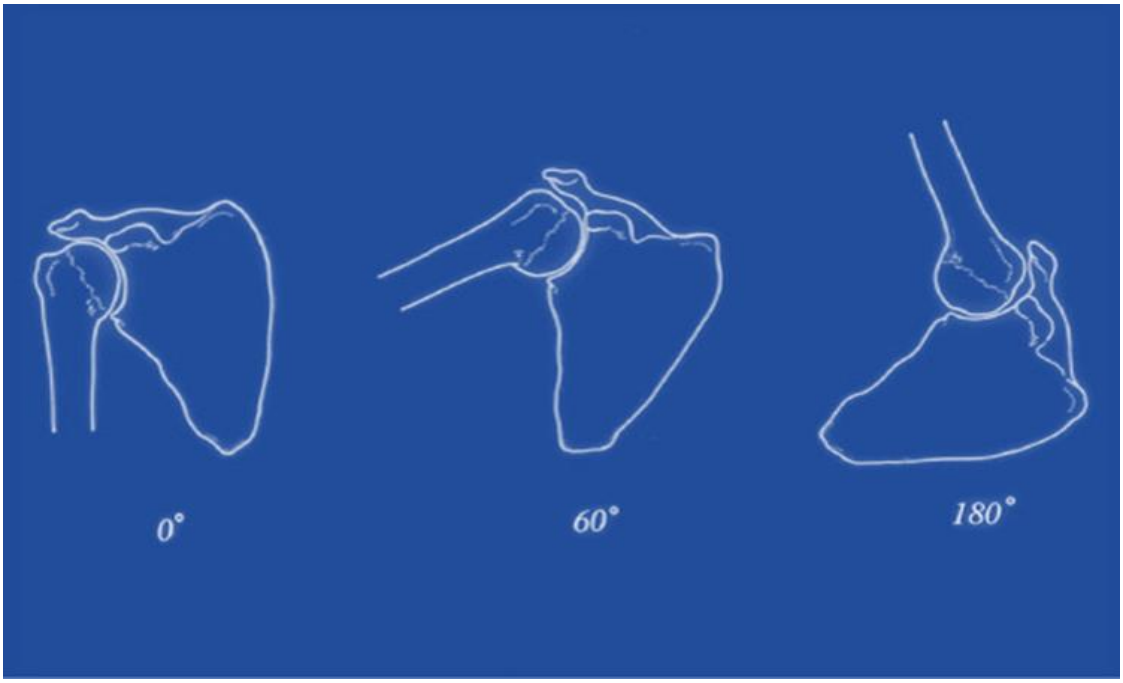

Figure 1. The movement of the scapula during abduction of the arm. (From Magee,2002) [25]

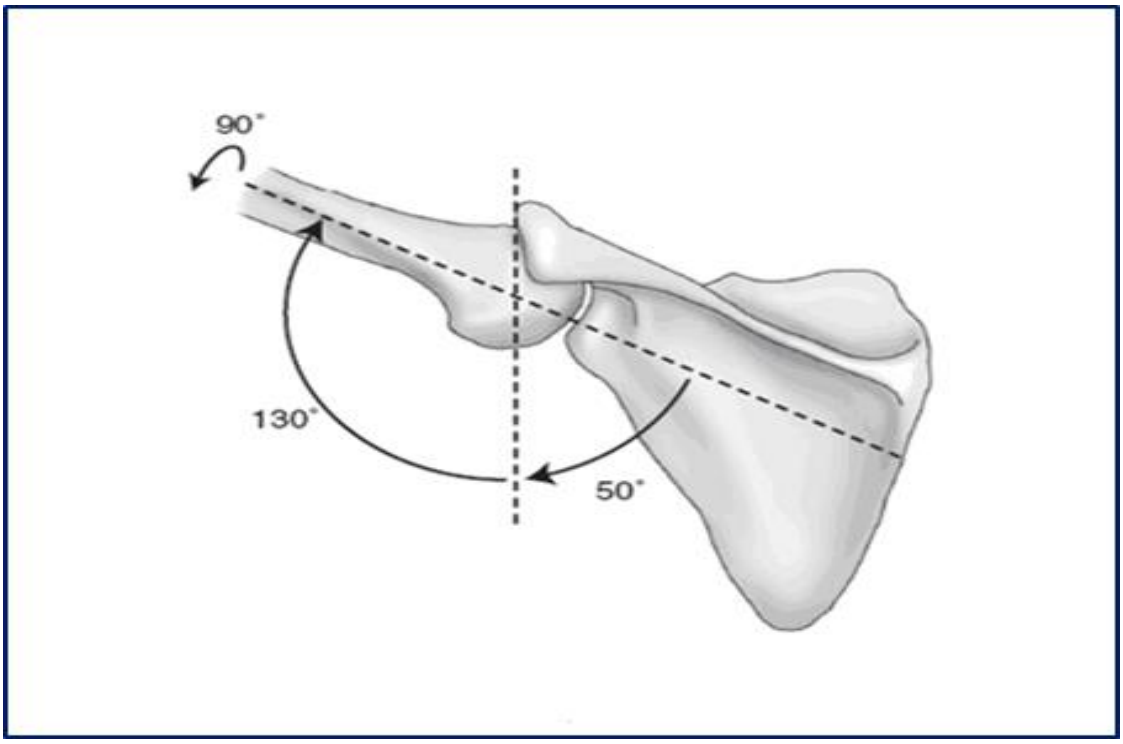

Figure 2. The pace bachelor – humeral.

The Functional assessment of the shoulder blade

The first step in the evaluation process of the therapist is to observe the scapula, both in static and dynamic expression. The position of the shoulder blade can be observed, for active movement in orthostatic position from the back of the athlete (movement of abduction, adduction, elevation, etc.) while the prone position is used for an auscultation of passive mobility.
The examiner should look for asymmetry, deformity, atrophy or hypertrophy, the possible oedema, weakness, crackle, colour and skin temperature, which can help to research and / or to confirm the possibility of any shoulder injury. Static positional abnormalities can be emphasized to further stimulate isometric contractions, interesting muscles that stabilize the shoulder blade. Further, analysis of the functional activity of joints can be carried out through manual tests. In these tests muscle activity is then classified with an ordinal grading scale from 0 to 5. [27,28] The next step should be directed towards a correlation evaluation of the segment column basin - the lower limbs. The degree of lumbar lordosis, cervical dysfunction of the basin, and some rotational abnormalities and hip must eventually research and annotated. Remember that a thoracic kyphosis or scoliosis have a direct relationship with the expressiveness functional, of the scapula.

The Kibler's Test /Lateral Scapular Slide Test (LSST)

Kibler [9] described the first manual test as the trial evaluation of the scapular muscle strength. The athlete is asked to perform an isometric contraction of the shoulder blade and hold for 15-20 seconds. A possible weakness of the scapular muscle gives rise to a "burning pain" in less than 15 seconds. [10] However, this first test can be used to validate or properly objectify muscle weakness in scapulars as a specific evaluation of the functional behaviour of the scapula.
This test involves measuring the distance from the inferior angle of the scapula to the nearest vertebral spinous process using a tape measure or goniometer in three positions:
shoulder in neutral, shoulder at 40-45 degrees of coronal plane abduction with hands resting on hips, and the shoulder at 90 degrees abduction with the arms in full internal rotation.
Kibler [10] contends that injured or deficient side would exhibit a greater scapular distance than the uninjured or normal side and asserted that a bilateral difference of 1.5 cm (15 mm) should be the threshold for deciding whether scapular asymmetry is present.
Curtis et al [29] also suggested that LSST may be used to monitor the scapular stabilizer muscles in any rehabilitative program that involves shoulder strengthening exercises.
This can definitely be used for its practicality as a field test in that it a) easy applicability for coaches; b) reproduces easy movements of scapulars desired and the intended measurements; c) appears to be, a reliable test, in terms of reproducibility; and d) examines the stabilizing muscle of the scapula. In this test, the measurements between the inferior angle of the scapula and the spinous process corresponding are recorded in three different positions. This test begins with establishing by the operator of the precise point of reference or a reference point which is to topographically on the spinous process of the corresponding lower corner of the scapula. (Figure 3: A, B, C) [9]

Figure 3A

Figure 3B

Figure 3C

Figure 3A, 3B, 3C. First Positional Measurements with arms at side.

In the first of the three different positions, the first position (fig. 3A) is the related photographic projections of Kibler's test. Measurement of the distance between the lower corner of the scapula and the thorny correspondent is the fig 3B. This is measured in a comparison with the athlete arms outstretched at sides. On a landmark between the distance from the bottom of the scapula and the thorny parallel is in figure 3C. The reference points are visible in figure 4.

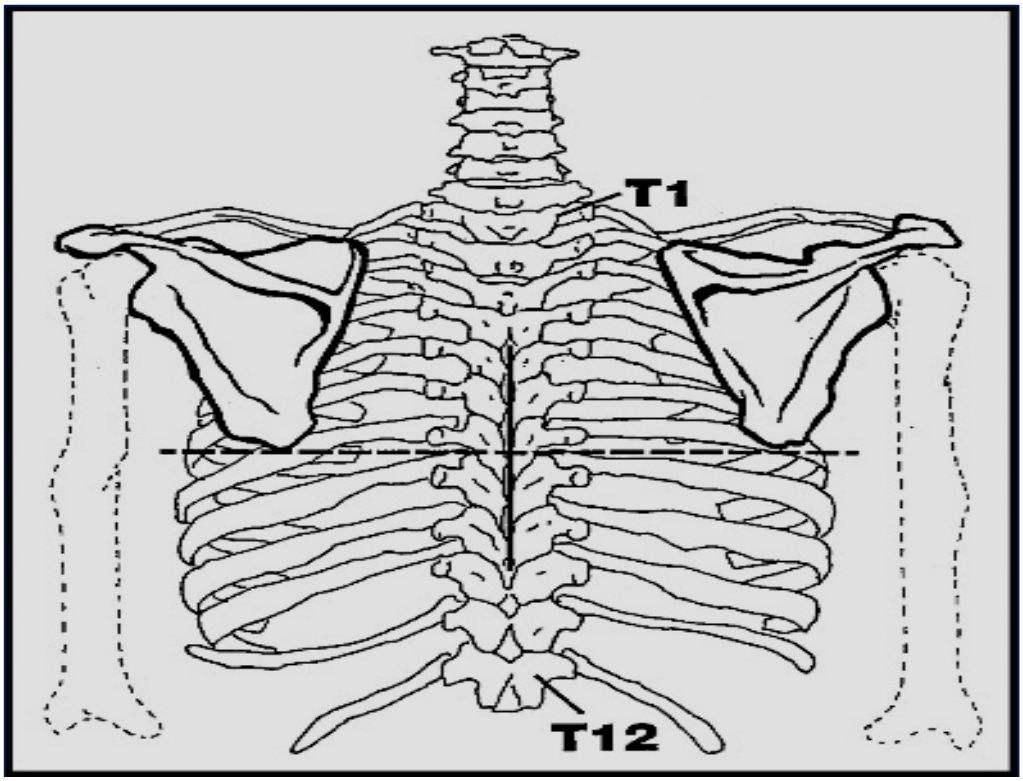

Figure 4. Reference points and parallelism to the Lateral Slide Scapular (LSS). [Kibler[10]]

The second position in the proposed test of Kibler use language simplistic with the athlete's hands positioned on the iliac crest, fingers effectively forward and the thumb on the back. It puts the humerus at approximately 45^0 of abduction and always measured from the lower and the thorny, socket, initially as a landmark (Figure 5A, B, C).

Figure 5A

Figure 5B

Figure 5C

Figure 5A, 5B, 5C . Second position and relative photographic projections of the Kibler's test: the second position, with hands on hips.

The third position, proposed as a progression, teaching, is an assessment of mobility, in a position much more functional. In this position, upper limb is abduction of $90^0$and involves glenohumeral internal rotation. The measurement is always the same having a landmark on thorny and inferior angle of the scapula. (Figure 6, A,B,C .)

Figure 6A

Figure 6B

Figure 6C

Figure 6A, 6B, 6C. Third position of the test of Kibler and related photographic projections

Kibler [9] initially recognized that a difference of 1-cm represented a significant signal of clinical interest. Subsequently, the same author brought this threshold of clinical abnormalities to 1.5 cm. The side-to-side in athletes with asymmetrical scapular dysfunction is represented graphically constantly in a range between 0.83 and 1.75 cm. When the disease is present, it is not unusual to have finding also 3 cm. At the end of this evaluation, the clinician must determine the exact cause of a possible dysfunction and establish intervention strategies through a program called "Preventing and Rehabilitation Training Exercises". [15,30]

Discussion

The normal function of the shoulder blade and the muscles surrounding it is vital to define the index of the normal shoulder function. Restriction of mobility of the scapula decreases the normal shoulder function, correlating with a clinical picture at least initially in asymptomatic and with a deflection of the receptor. The weakness, as well as a decrease in the flexibility of muscles scapulars, can lead to an alteration biomechanics of the glenohumeral joint, with excessive stress on the rotator cuff and the anterior capsule. However, this set of movements and positions of the scapula is not physiological but has been described as scapulothoracic (ST) dyskinesia or floating scapula [21] and lateral scapular slide. [31]

Koslow [34] discovered an asymmetrical scapular position in sporting subjects asymptomatic. The lateral scapular slide test (LSST) was performed on 38 female and 33 male collegiate athletes who participated in throwing sports. [32] All subjects had no past or present history of scoliosis, dysfunction of the shoulder or elbow. Fifty-two of the 71 subjects presented at screening a difference of at least 1.5 cm in one or more of the three positions. Other studies have been conducted to determine the reliability and validity of the test LSS in which the authors have verified the accuracy of "search and / or mark" the inferior angle of the scapula in different positions of abduction, in comparison with examination of radiographic. [24,25] The radiographic appearance for the validity of the lateral scapular glide measured was found to have a greater coefficient of 0.90.[10] .The reliability was established at between 0.80 and 0.88 and between 0.77 and 0.85 for measurements inter-tester and intra-tester. [9,23,29]

It also shows the importance of proprioceptive modulators of the functional activity of the rotator cuff during sports activities gestural upper limb. An alteration, a power failure, the control receptor, neuromuscular, alters the regulatory mechanism of dynamic tension of the ligamentous apparatus and muscles and tendons, with postural adaptations, compensatory, immediate cervical spine and TMJ. [33,34] The proprioceptive abnormalities were demonstrated and highlighted even in patients with recurrent dislocation of the shoulder and in patients with scapular dysfunction.

Lateral muscle inhibition is often the result of a scapular instability. This seems to be an answer not specific to a painful condition in the shoulder but rather than a response to a situation of glenohumeral pathology. This state of inhibition is considered as a decrease of the ability to modulate the expression of the force gestures during athletic techniques. It has been suggested, that the muscles bachelor chest, may be banned from painful conditions around the shoulder. The serratus anterior and the lower trapezius muscle are the most susceptible inhibitive effect with significant decreases in strength. [20.22]
First of the lumbar spine and pelvis as illustrated by Thomson [33] suggests that a deficiency of strength - fatigue-induced - the muscles of the shoulder can have an effect, against the scapular positioning, allowing the blade to glide more laterally during functional activity. It is clear that a perfect synchronism, a synergistic coordination, of the muscle-tendon unit,

stabilize the humeral head and computerized controlled, during these activities, by a perfect receptor activity, in -out, which expresses from the biomechanical point of view, a perfect functional stability. This functional stability depends on a) from muscular ability to center the humeral head on the glenoid; b) the contribution of the dynamic stress, capsuloligamentous tendons, thanks to the contribution informational receptor; and c) the completeness of either active or passive joint range.

After completing a thorough functional diagnosis and control passes to step instructional, the next is the drafting of a training manual for rehabilitation techniques and exercises functional recovery. [18,35,38] Restoring the normal mechanical scapulars through protocol regarded as exercise therapy, it is possible to restore the long joint and a proper stabilization and shoulder function. Exercise therapists will be defined the teaching progression and the rhythm of the exercises with goals of transition from one phase to the other until a complete return to integrum. Muscle strengthening exercises and stretching are an integral important part of rehabilitation protocols which must be customized and designed in relation to the clinical evaluation and functional. [39]

Conclusion

The scapula has a very important role for the normal function of the shoulder. Its movement and its location create the right parameters to allow a normal functional physiology and biomechanics of the shoulder. An asymmetry of the position of the scapula assessed through Kibler's tests makes it possible to read in advance possible shoulder disorders. All these are evidence in the literature for the sake of completeness and also a not homogenous view regarding the test in question of reliability. Common in this balance of non-homogeneity of studies for and against Kibler's test is characterized by the simplicity and specificity fitness camp designed to determine, within a Pre-Functional Physical Examination [31] a possible asymmetry scapular, in an athlete completely asymptomatic.
The identification, through this simple field tests, of a dysfunction of the shoulder blade in an asymptomatic athlete, will encourage clinician/technical / athletic teams, in their work to decrease the risk factors of injury. Restoring the organization of normal joint movement and the game stress, through a therapeutic strategic ethical / functional to improve scapular position and decrease subsequent pathologies from overuse of the shoulder extremely disabling for the expressiveness of technical / athletic teams in overhead games.

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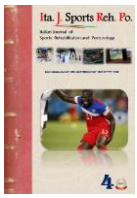

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