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EVALUATION OF THE KNEE LAXITIES OF WRESTLERS

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Abstract: Anterior tibial displacements of 78 elite wrestlers (20.7±3.1 years of age), 49 of them wrestling in Greco-Roman and 29 in free style, having no history of serious knee injury were measured by KT1000 (MEDmetric, San Diego, California) arthrometer. The "support leg" was defined to be the lower extremity used for lifting up the opponent wrestler. All the tests revealed higher displacement values in support legs of all the wrestlers ($p<0.001$), while no significant differences were found between the support legs and the other legs of the wrestlers of two different styles ($p>0.05$). The increased laxity of the support legs ie., the knees sustaining chronic overloading, may have been indicating that there are degenerative changes of the ligamentous structures, especially of the anterior cruciate ligaments. Since many studies revealed the proofs of proprioceptive deficits in anterior cruciate deficient knees, possibly there may be an impairment of these functions in uninjured but looser knees. Although there is lack of certain information concerning this issue yet, it will be better to add proprioceptive exercises to the training programs to reduce the incidence of injuries. ***(Biol.Sport :25:361-369, 2008)***

Key words: Knee laxity - Arthrometer - Wrestling

Introduction

Along with the advances in sports medicine in the past two decades, the ability to assess knee laxity objectively has improved dramatically. To improve noninvasive diagnostic accuracy and to quantify laxity, instrumented knee testing devices have been designed.

Extensive testing of various knee arthrometers has generated baseline laxity data for the normal and injured adult knee [4,8,18]. KT 1000 arthrometer is one of the most sensitive instruments to detect the knee laxity levels and compared with

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other commercially available arthrometers, it has been shown to most closely approximate the findings of the clinical examination [2,10].

In clinical examination, the anterior displacement of the tibia on femur is based on a subjective evaluation of anterior cruciate ligament (ACL) disruption or anterior instability. KT 1000 arthrometer quantifies the Lachman test and is more accurate than manual testing and more reliable from examiner to examiner than the other techniques [7].

Nearly all reports examining musculoskeletal problems in sports, injury rates in wrestling are significantly high and occasionally the highest among all sports [8,13,15]. The knee is most commonly injured anatomical region in wrestling and is involved in an even larger proportion of injuries causing relatively longer time losses [8].

As of yet, researchers have been unable to establish a relationship between excessive ligament laxity and frequency or type of joint ligament injury [17].

Proprioceptive deficits resulting in motor reflex insufficiencies, possibly secondary to excessive joint laxity, may render a joint unable to sense and response to joint stress, thereby resulting in connective tissue and ligament injury [17].

There are several studies indicating increased knee laxities after different exercise bouts [21,22]. However, there are no studies investigating the laxity differences between the extremities of athletes in resting situation.

We have signified the extremities of the wrestlers which were under higher stress and pressure due to the requirements of this sport and tried to show the resulting effects of this overloading on the anterior cruciate ligaments by measuring the laxity levels.

Materials and Methods

Seventy-eight healthy, national level wrestlers, 49 wrestling in free, 29 in Greco-Roman style were participated in this study. The athletes enrolled in the study had no significant history of a ligament trauma to their knee joints. The characteristics of the athletes are summarized in Table 1.

Determination of the support leg: Dominant leg was determined by requirement of hitting a ball. The selected leg was noted as dominant side. For determination of "support leg" all the wrestlers matched with another to make the most frequently used sport-specific activity in wrestling, hemming stitch play, which means lifting and spinning the opponent over himself. The pivot leg in this activity was noted as the "support leg".

Table 1
Athletes' characteristics

Group	Age	Height	Weight	Sports participation (years)
Free style (n=49)	21.2±2.6	167.4±8.9	76.9±11.9	9.3±2.4
Greco-Roman style (n=29)	19.7±3.3	164.3±7.6	74.5±9.4	8.2±2.9

Testing procedure: To determine the knee joint laxities, anterior tibial displacements of both extremities were tested by KT-1000 instrumented knee arthrometer. (MEDmetric, San Diego, California). The measurements were done by application of 15, 20 and 30 pounds of anterior displacement forces and by manual maximum test which were resembling the Lachman test and active quadriceps test revealing the anterior displacement during the active contraction of quadriceps muscle

One researcher performed all KT-1000 tests to exclude any potential examiner related variability who had studied the written and videotaped instructional material and followed the recommended protocol. To assure consistent tibial rotation and pressure on the patellar pad to reduce the potential source of error, all the measurements have been performed with maximum care. Every measurement has been done three times and the mean values were taken into consideration.

The study was approved by the ethics committee of the Ankara University Faculty of Medicine.

We made the normality test for the variables by using Kolmogorov-Smirnov test (Lilliefors Significance Correction). We found out that all of the analyzed variables were not normally distributed. For this reason, we preferred non-parametric tests.

Differences between the arthrometric measurements of support legs and other legs were compared by using Wilcoxon Signed Ranks test.

Differences between the arthrometric measurements of free style and Greco-Roman wrestlers were compared by using Mann-Whitney U test.

Results

The anterior tibial displacement values of support legs at 15, 20, 30 libres of force, manual maximum tests and active quadriceps tests were significantly greater than the measurements of other legs of all the wrestlers ($p<0.001$) (Table 2, Fig. 1).

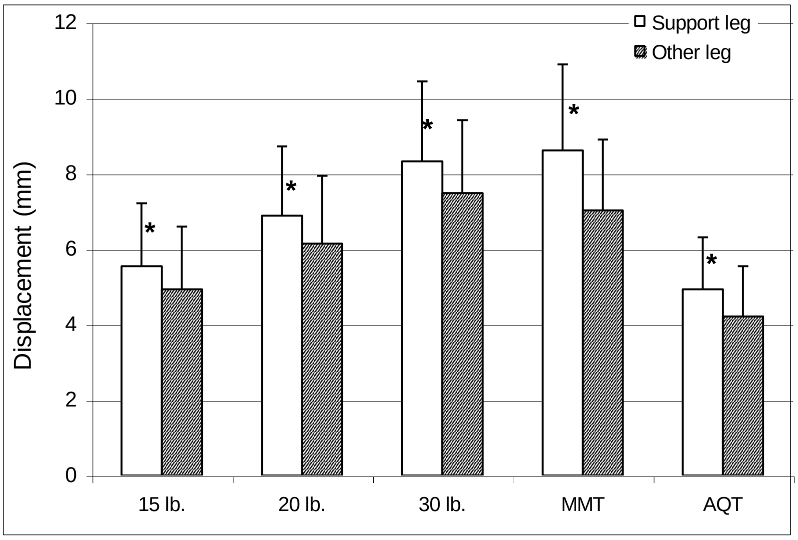

Fig. 1
Results of KT 1000 arthrometer testing of all the wrestlers at each force and active quadriceps tests
MMT: manual maximum test; AQT: active quadriceps test; *$p<0.001$

When the results of free style and Greco-Roman wrestlers were evaluated separately, all the tests of the support legs revealed significantly greater anterior tibial displacements. However, the significancy of the results at 15 libres of force and active quadriceps tests were lower in free style compared to Greco-Roman wrestlers ($p<0.01$) (Table 3, Fig. 2).

The comparisons of the support legs of free style and Greco-Roman wrestlers revealed no significant differences. There were no significant differences between the other legs also (Table 3).

Table 2
Results of KT 1000 (MEDmetric, San Diego, California) arthrometer testing of all the wrestlers at each force and active quadriceps tests

	Wrestlers	
Subjects (N)	78	
Age (years)	20.7(±3.1)	
Extremities	Support leg	Other leg
Displacement at 15 lb. (mm)	5.65(±1.76)*	4.97(±1.65)
Displacement at 20 lb. (mm)	7.11(±2.06)*	6.24(±1.76)
Displacement at 30 lb. (mm)	8.65(±2.42)*	7.61(±2.01)
Displacement at MMT (mm)	8.63(±2.29)*	7.10(±1.82)
Active qudriceps test	4.91(±1.37)*	4.24(±1.25)

MMT: manual maximum test; *p<0.001

Table 3
Results of KT 1000 arthrometer testing of free style and Greco-Roman wrestlers at each force and active quadriceps tests

	Free style wrestlers		Greco-Roman wrestlers	
Subjects (N)	29		49	
Age (years)	21.5(±3.64)		20.2(±2.62)	
Extremities	Support leg	Other leg	Support leg	Other leg
Displacement at 15 lb. (mm)	5.84 (±1.93)§	5.05 (±1.63)	5.54 (±1.67)*	4.93 (±1.66)
Displacement at 20 lb. (mm)	7.51 (±2.36)*	6.41 (±1.75)	6.88 (±1.84)*	6.14 (±1.80)
Displacement at 30 lb. (mm)	9.21 (±2.81)*	7.83 (±2.16)	8.32 (±2.12)*	7.48 (±1.93)
Displacement at MMT (mm)	8.65 (±2.33)*	7.22 (±1.75)	8.61 (±2.28)*	7.02 (±1.88)
Active quadriceps test	4.88 (±1.38)§	4.29 (±1.14)	4.93 (±1.38)*	4.21 (±1.33)

MMT: manual maximum test; §p<0 01; *p<0.001

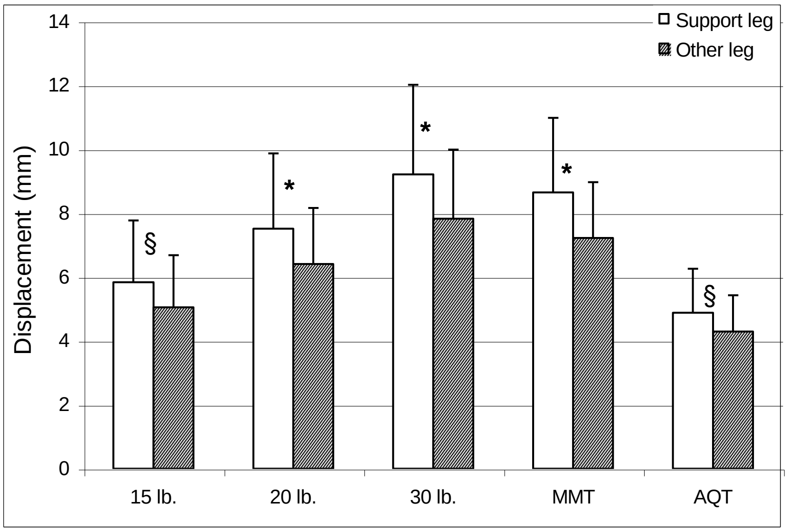

Fig. 2
Results of KT 1000 arthrometer testing of free style and Greco-Roman wrestlers at each force and active quadriceps tests
MMT: manual maximum test; AQT: active quadriceps test; §p<0 01; *p<0.001

Discussion

The effects of laxity on orthopedic disorders and injuries have been the subject of several studies. Laxity is thought to play an important role in certain joint disorders, including recurrent dislocation of the shoulder and patella and developmental dysplasia of the hip [5].

Although three reports showed that knee laxity increases after exercise, studies specifically investigating the role of laxity as a factor in sports injuries have reached conflicting conclusions [19,20,22].

Nicholas found that 72% of the loose professional football players sustained a knee ligament injury [14], while Grana and Moretz using the Nicholas' tests on high school athletes detected no relationship between looseness and injury rate [6].

The lack of a reproducible, objective measure of joint laxity may be partially responsible for the contradictory conclusions of those studies. Likewise, it is unclear how well tests of upper extremity laxity correlate with laxity in the knee, which is the most often, involved in sports injuries.

The development of knee arthrometers has greatly improved the ability to measure knee laxity objectively and reproducibly. KT 1000 arthrometer compared with other commercially available arthrometers, has been shown to most closely approximate the findings of the clinical examinations [2].

This study has been designed to measure knee laxity of the wrestlers of two different styles objectively and to have data for further comparisons with the knee injury rates of these specific groups.

For the definition of the lower extremity which is preferred for lifting up the opponent wrestler, "support leg" term has been used. Anterior tibial displacement levels obtained by the arthrometric tests revealed that support legs' knee joints of both style wrestlers were found to be looser than the other knees.

It has been thought that the joints under more pressure and stress eventually had degenerative changes not only of menisci and cartilagenous tissues, but also of the ligamentous tissues. Degeneration process also thought to involve the proprioceptors present at the ligaments, especially the anterior cruciate ligament which is mainly responsible for the mechanical stability of knee joint.

There are some studies indicating higher incidence rates of knee injuries in female athletes [3,9,12,16]. Various causative factors have been presented and investigated to explain this discrepancy. Knee joint laxity was one of these accused factors.

Rozzi *et al.* suggested and then demonstrated that female athletes participating in the collegiate sports of soccer and basketball inherently possess excessive knee joint laxity and proprioceptive deficits that may predispose them to ligament injury [17]. The excessive joint laxity of the women appears to contribute to diminished joint proprioception, rendering their knees less sensitive to potentially damaging forces and possibly at increased risk for ligament injury.

Jarret *et al.* reported that wrestling was one of the highest injury rate sports [11]. Putting forward the possible risk factors for injury, such as knee laxity, would help us to be able to render the preventive measures.

Allegrucci *et al.* investigated joint kinesthesia in healthy athletes participating in upper extremity sports and suggested that excessive joint laxity may result in decreased joint motion sensibility because of the lack of stimulation of these lax tissues [1].

Although there were no pathological and clinical findings accompanying the increased laxity at the support legs of our subjects, due to the possible proprioceptive deficits, there might be an increased acute injury risk to their knee joints.

The results of this study directed us to investigate the proprioceptive situation of the knee joints of this group and collect the data regarding the possible knee injuries that would have been experienced during the sport specific activities. The future researches must continue to focus on joint laxity and neuromuscular characteristics of athletes participating in sports in which a disproportionate number of ACL injuries occur and to find out practical methods to enhance the proprioceptive joint functions to compete the increasing injury rates parallel to increasing sports participation.

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