

## ANKLE-JOINT INSTABILITY IN BASKETBALL: A COMPLEX BIOMECHANICAL, CLINICAL AND RADIOLOGICAL INVESTIGATION

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**KEY WORDS:** ankle joint instability, functional instability, risk factors, stress x-ray

**INTRODUCTION:** More than 50 % of injuries in basketball are ankle sprains (5,14,15). More than 90 % of players suffer from ankle injuries during their careers (10). The most unpleasant consequences for players after recurrent ankle sprains are mechanical, functional and chronic instability problems (4,12,16,17,20). In the USA the costs for rehabilitation after ankle injuries are more than \$2 billion a year (2). In times of lower budgets prevention of injuries is becoming more and more important. In this study biomechanical, clinical and radiological parameters at the lower extremity were investigated with regard to their importance as a risk factor for ankle sprains in basketball. The relation of all these results should allow a special individual forecast for a higher risk of ankle injury. Those players who belong to a high risk injury group should be advised to wear an external support such as an orthosis for adequate ankle sprain prophylaxis.

### **METHODS:**

#### Research group:

For this study 36 German second division basketball players with at least one recent ankle sprain in their history were examined. The summary of demographic data for the investigation group is presented in Table 1.

(Table 1 demographic data, research group (n=36)):

n=36	Age (years)	height (cm)	weight (kg)
Mean	25.9	191.7	88.4
S.D.	± 5.5	± 5.7	± 9.8
Min.	18.1	183	63.5
Max.	40.8	204	113.0

Players' positions divided the group into 15 center and post-players (short distance play under the baskets), 14 forwards (mid-, long distance play at the wings), and 7 guards (long distance play at the 3 point line).

After a detailed anamnestic evaluation of players' previous injuries we calculated an injury score for each foot which allows a separation into two groups for further analysis.

The groups' dividing line was at a value of 1.5 (group 0 = 0-1.49, low-risk and group 1 = 1.5 > , high-risk).

It was a quotient of the severity of injury from grade 0-3 and duration passed from injury date to the investigation period.

Clinical, radiological and biomechanical investigations:

Three torsional parameters were measured by the same experienced investigator for both sides:

1. Femoral anteversion - using ultrasound for measurement (19)
2. Tibial torsion - visually evaluated measurement (7)
3. Malleolar detorsion - measured by the method of Lerat (11) using a podogram  
A Naviculare-Index modified by Debrunner (3) as a quotient of height of tuberositas osis navicularis and foot length in percentages was calculated.

The evaluation of ankle instability for both sides consisted of three parts:

1. clinical instability:  
One experienced orthopedic surgeon evaluated talar tilt and anterior drawer test in four grades (0-3) (8).
2. radiological instability:  
Radiological talar tilt was examined by an stress x-ray using the apparatus of Prof. Scheuba (Telos©-Hungen)
3. functional instability:  
The players marked their subjective feeling of ankle instability from 0 mm (totally stable) to 10mm (totally unstable) on a visual analogic scale (VAS).

In the biomechanical examinations EMG activity of the m. peroneus was measured during a sudden combined inversion-plantarflexion movement on a specially constructed tilt platform with and without orthosis (1).

**RESULTS:** Our injury score divided the data into two groups, with a low-risk group 0 (n=59) and a high-risk group 1 (n=13).  
The Naviculare-Index for both groups was similar (18.3%,S.D.  $\pm$  2.7% group 0, 17.6%,S.D.  $\pm$  1.4% group 1).  
The value for clinical instability did not differ for both groups. Radiological talar tilt for group 0 was 3.0° (S.D.  $\pm$  3.0°), 3.2° (S.D.  $\pm$  4.2°) group 1.  
VAS-Mean values for players' subjective feeling of instability were 38.8mm, S.D.  $\pm$  21.7mm (group 0) and 62.2mm, S.D.  $\pm$  16.1mm (group 1).  
(Table2: Mean and standard deviation for the three torsional parameters, n=72 lower extremities)

n=72	group 0	group 1
<b>Femoral anteversion</b>	26.58° (S.D. $\pm$ 4.39°)	26.31°(S.D. $\pm$ 5.01°)
<b>Tibial torsion</b>	6.02° (S.D. $\pm$ 8.45°)	4.62° (S.D. $\pm$ 6.60°)
<b>Malleolar detorsion</b>	13.39°(S.D. $\pm$ 4.48°)	12.38°(S.D. $\pm$ 4.74°)

Using ANOVA in the analysis of variance, the subjective feeling of instability (p=0.000) and players' position (p=0.037) showed a significant difference with players' injury score. Players' subjective feeling of functional ankle instability did not correlate with clinical or radiological instability parameters.

The integrated EMG during the tilt movement was reduced significantly by an average of 20% with wearing an orthosis.

The amplitude and velocity of the inversion movement was decreased by an average of 30% compared to the baseline value without orthosis.

**DISCUSSION:** In the last decade the prevention of ankle injuries has received more attention in medical research. Many studies have tried to evaluate risk factors for ankle sprains in the players' history in different fields (2,4,6,15,17,18,20).

In a literature analysis, no concrete data about people's subjective feeling of ankle instability as a risk factor for an ankle sprain could be found. It is often used only as one of many factors to calculate a score in follow-up studies about long-term results after surgical ankle ligament reconstruction (9).

In our study we could evaluate players' subjective feelings of ankle instability as a highly significant risk factor for ankle injury. Like other authors we found no correlation between the subjective feeling of instability and clinical or radiological instability (12,16). Anatomical parameters like the modified Naviculare-Index and the torsional parameters did not correlate with a higher injury risk and were likewise insufficient to explain players' subjective feeling of functional instability.

Further research, especially on psychological and physical aspects, is needed to detect parameters for subjective instability measurement.

The second parameter evaluated in our investigation as a risk factor was players' position. Center players play under the basket, with limited space on the court and more physical contact with other players than forwards or guards. Normally their body constitution is bigger and taller, so that a contact with a following inversion moment could have more serious consequences than for smaller players. These conclusions agree with those of other studies (13,14,15,17).

#### **CONCLUSIONS:**

- 1.) Players who have a high subjective feeling of ankle instability have a higher risk and are predisposed to ankle sprains.
- 2.) Center players run greater risks of ankle sprains than do forwards and guards.
- 3.) Center players with a high subjective feeling of ankle instability should perform proprioceptive training or should use an external ankle support such as tape or orthosis for ankle sprain prophylaxis.

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