TRUNK PROPRIOCEPTION PREDICTS KNEE INJURIES: A PROSPECTIVE STUDY

INTRODUCTION:
In sports involving pivoting and landing that challenge core (trunk) control, female athletes suffer anterior cruciate ligament (ACL) injury at a 4 to 6-fold greater rate than males. Proprioceptive deficits in control of the body’s core may affect dynamic stability of the knee. Our objective was to determine whether objective measures of core proprioception were predictive of knee injuries in female and male athletes. Our hypothesis was that female, but not male, athletes who suffered knee injury during the 3 year injury tracking period would demonstrate decreased core proprioception at baseline testing as compared to uninjured athletes.

METHODS:
277 collegiate varsity athletes were prospectively tested for core proprioception by PPR (passive proprioceptive repositioning) and APR (active proprioceptive repositioning), then tracked for injury for 3 years. The subject participants included 140 females (age 19.4 yrs ± 0.8, mean height 1.7m ± 0.1, mean body mass 65.6 kg ± 8.7, mean body mass index 22.6 ± 2.2 kg/m²) and 137 males (age 19.3 yrs ± 1.8, mean height 1.8 ± 0.1 m, mean body mass 79.9 ± 11.9 kg, mean body mass index 23.8 ± 2.8 kg/m²). Knee ligament/meniscal injuries were initially rotated 20 degrees away from the neutral spine posture (at 2º/sec) and briefly held in that position for 3 seconds. In the passive test, the subject was slowly rotated towards the original position by the apparatus at a steady, slow rate to minimize tactile cueing. In both tests, the subjects were required for adequate power.

RESULTS:
There were 25 knee injuries (11 F, 14 M), 14 ligament and/or meniscal injuries (6 F, 8 M) and 6 MRI confirmed ACL ruptures (4 F, 2 M). There was no difference in PPR between injured and uninjured athletes. Athletes with knee injuries demonstrated greater average error in APR of the core (1.9º vs. 1.6º, p < 0.01). Deficits in APR were observed in females with knee (2.2º) and ligament/meniscal injuries (2.4º) compared to uninjured females (1.5º, p ≤ 0.05) (Figure 1). There was no difference in average APR error between injured males compared to uninjured males (p ≥ 0.05). Uninjured females demonstrated significantly less average error in APR than uninjured male athletes (1.5º vs. 1.7º, p ≤ 0.01). For each degree increase in average APR error, a 2.9-fold increase in the odds ratio of knee injury, and a 3.3-fold increase in odds ratio of ligament/meniscal injury was observed. APR predicted knee injury status with 90% sensitivity and 56% specificity in female athletes (p ≤ 0.01).

DISCUSSION:
Decreased active core proprioception, measured by APR of the trunk, predicted knee injury risk in female, but not male, athletes. Athletes may be evaluated for proprioceptive deficits prior to competition and targeted for specific active neuromuscular training. The implementation of interventions that incorporate core neuromuscular training, including proprioceptive exercise may significantly reduce knee injury risk in this athletic population.

REFERENCES:

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