DOES THE USE OF KNEE BRACE ANY IMPLICATIONS ON BIOMECHANICS' CHANGES INDUCED BY FATIGUE IN BADMINTON LUNGE TO THE NET?

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INTRODUCTION

Badminton requires players to move quickly in multiple directions to execute shots while maintaining good balance and motor control. The most common footwork in badminton are diagonal movements (Valldecabres et al., 2017) as lunges to the net (Kuntze, Mansfield, & Sellers, 2010). More than 70% of badminton injuries are to the lower limbs with nearly 50% of these being patellofemoral tendinopathy (Shariff, George, & Ramlan, 2009). Mechanisms of patellofemoral pain (PFP) include muscle imbalance, lower limb malalignment and knee joint laxity. The knee abduction moment has also been shown as an important contributor for PFP which may be treated with exercise, taping, foot orthosis or knee bracing.

The aim of the current study was to examine the effects of fatigue, with and without a knee brace on knee kinetics and kinematics during badminton lunge to the net and stability tests in badminton players.

METHODS

Sixteen right-handed badminton players (10 males and 6 females, 27.1±9.0 years, 172.1±8.9cm height and 74.0±16.5kg) were tested. All participants reported to be free from any pain or pathology affecting the lower limbs at the time of testing. Volunteers gave written informed consent prior to participation and all data collection conformed to the Declaration of Helsinki.

Kinematic data were collected with 10 cameras Oqus motion analysis (Qualisys medical, Gothenburg, Sweden) at 200Hz. Kinetic data were collected with an AMTI force platform at 2000Hz. Reflective markers were placed following Cappozzo et al., (1995) and the multisegment foot model described by Richards (2018).

Figure 1. Multisegment foot, knee brace and reflective markers position

PROCEDURE

Participants were required to visit laboratory twice in a randomized order to be tested with and without the knee brace (Reaction Brace, DJO Global Inc.). The protocol included: a standardized warm-up; 5 lunges for each side: forehand (FH) and backhand (BH) from a standardized position 45° to the net, with the final step being made with dominant limb on the force plate; clinical stability tests (Y balance, one leg hop distance and ankle dorsiflexion tests) and induced fatigue following Pincivero et al., (2000). After fatigue protocol, participants were reassessed.

Figure 2. Lunge to the net execution

STATISTICAL ANALYSIS

Three factor repeated measures ANOVAs were performed (lunge direction-fatigue-brace) with post-hoc comparisons for the lunge tests, and two factor repeated measures ANOVA tests (fatigue-brace) for stability tests.

RESULTS & DISCUSSION

Significant main effects between pre and post fatigue were observed at heel strike (HS) during lunge in knee flexion angular velocity and knee abduction moment, decreasing post fatigue. Comparing Forehand (FH) and Backhand (BH) tasks at HS, significant main effects in knee flexion angle, knee extension moment and transverse plane knee angular velocity, with greater flexion, lower extension moment and lower internal rotation velocity during the FH lunge. When comparing braced and no braced conditions, significant main effects were observed in knee adduction moment, greater in the no braced condition. In addition, no significant differences were found for any stability test.

	Mean difference		p-value	CI of the Difference	Effect Size η_p^2
Pre versus Post	Pre	Post			
Flexion at HS	192.2	138	0.003	21.9 to 86.3	0.46
Range of Velocity Coronal Plane	331.8	296	0.011	9.6 to 62.1	0.36
Peak Varus Moment	-21.2	-16.9	0.004	-7.0 to -1.6	0.435
Coronal Plane Moment Range	93.1	85.2	0.034	0.673 to 15.1	0.266
Right Stance Time	0.247	0.234	0.012	0.003 to 0.023	0.352
BH versus FH	BH	FH			
Flexion at HS	17.4	18.2	0.047	-2.27 to -0.015	0.240
Transverse Plane Velocity at HS	28.1	-9.5	0.012	9.5 to 65.8	0.35
Peak Extension Moment	-55.4	-50.4	0.019	-9.11 to -0.97	0.317
No Brace versus Brace	No Brace	Brace			
Peak Adduction Moment	-23	-15	0.028	-14.95 to -0.99	0.283

CONCLUSIONS

This study showed that post fatigue lunge is performed with no significant differences in approach velocity and loading rate but greater knee stiffness. In addition, there appears to be greater risk factors when performing BH lunge to the net compared to FH. Final proprioceptive bracing appears to improve the loading patterns at the knee. These factors should be considered for coaches, in particular for return to sport after an injury.

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