

RELATIONSHIP BETWEEN ISOKINETIC LEG STRENGTH AND KNEE FRONTAL PLANE PROJECTION ANGLE DURING SINGLE LEG SQUAT AMONG MALE JUNIOR ATHLETES

Mail MSZ¹, Mohd Azhar N¹, Affandi NF¹, Shaharudin S¹, Agrawal S², and Chee LM³.

¹ Exercise & Sports Science Programme, School of Health Sciences, Universiti Sains Malaysia, 16150 Kota Bharu, Kelantan, Malaysia

² Department of Mechanical Engineering, Columbia University 10027 New York, USA

³ National Sports Institute, Bukit Jalil, 57000 Kuala Lumpur, Malaysia

Correspondence:

Shazlin Shaharudin

Exercise & Sports Science Programme,

School of Health Sciences,

Universiti Sains Malaysia,

16150 Kota Bharu, Kelantan, Malaysia

Email: shazlin@usm.my

Abstract

Background: Those with increased dynamic knee valgus are vulnerable to increased risk of non-contact knee injuries. However, studies on the top down kinetic chain of lower limb mechanics during dynamic motions such as single leg squat (SLS) among trained males were scarce.

Objective: The objective of the study was to evaluate the relationship between isokinetic hip and knee strength and frontal plane projection angle (FPPA) of the knee joint during SLS.

Methods: Thirty-two male junior athletes (twelve cyclists, ten runners and ten squash players) were screened for excessive dynamic knee valgus (DKV) prior to participation. Only those within the normal value of DKV were included. Their hip and knee isokinetic strength in sagittal plane were evaluated at 60°/s of angular velocity for both legs using dynamometer. Two dimensional knee FPPA was evaluated during SLS at 60° of knee flexion. Pearson correlation was evaluated between knee FPPA during SLS and isokinetic leg strength.

Results: Correlations between knee FPPA and hip and knee isokinetic strength were not statistically significant except between knee flexion peak torque/body weight ($r = -0.35, p = 0.05$) and hamstring to quadriceps ratio ($r = -0.39, p = 0.03$) of non-dominant leg.

Conclusions: Isokinetic hip and knee strength and knee FPPA during SLS was correlated only for non-dominant leg during SLS among male junior athletes. DKV during SLS may be reduced through strengthening the muscles around hip and knee joints.

Keywords: *Dynamic Knee Valgus, Kinematics, Muscular Strength, Top Down Kinetic Chain, Youth Athletes*

Introduction

Weakness of thigh and hip muscles is thought to be an underlying mechanism for excessive knee valgus motion during dynamic movements (1). Dynamic knee valgus (DKV) is a dynamic alignment consisting of hip adduction, hip internal rotation, knee abduction and ankle eversion (2, 3). Those with increased DKV is vulnerable to increased risk of knee injuries including patellofemoral pain syndrome (PFPS) and anterior cruciate ligament (ACL) strain (4). DKV can be evaluated through functional tasks such as single

leg squat (SLS) and drop landing. It was shown that knee frontal plane projection angle (FPPA) measured during SLS is associated with three-dimensional (3D) knee kinematics during dynamic motions comprising mostly sagittal plane such as running (5). Additionally, SLS is a common clinical test used to examine lower extremity alignment and identify faulty movement patterns of trunk, pelvis, and lower extremity (6). Moreover, SLS resembles common motions in sports such as running, soccer and hockey (7).