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Biomechanical Difference in Forward Lunges and Lateral Lunges and Changes in Knee Joint Moment and Functional Measurement

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Introduction

Lunge training is a well-known therapeutic exercise in sports conditioning and rehabilitation. Lunges require minimal instrument for strengthening quadriceps muscles, which improves various knee pathologies. Forward lunges and lateral lunges are two common variations of lunges, with different knee joint loading. Functional Movement Screen (FMS) is an assessment developed for screening subjects in terms of functional readiness in pre-participation or return-to-play assessment. It is scored on a 0 to 3 ordinal scale, However the biomechanical properties of motions are under investigated.

Objectives

This project objective aimed to 1) investigate the biomechanical difference between Forward Lunges and Lateral Lunges , and 2) measure the difference in knee joint moment and its association with Functional Movement Screen (FMS)

Methodology

Fifteen physically active healthy male adults were recruited. All of them were asked to perform 3 different motions, namely FMS in-line lunge, forward lunge and lateral lunge in a randomized order. While subjects were performing the motions, 3-dimensional biomechanical parameters of knee joint motion was measured using real-time VICON motion capture system while functional performance was evaluated using FMS . Each testing condition was repeated for 3 trials . One-way ANOVA was used to compare the between group difference with subjects act as self-control. Spearman correlation was conducted to evaluate the relationships between biomechanical measurement and functional performance.

Result

All 3-dimensional moment showed significant between-group difference [Flexion/Extension moment: $(F(2,28) = 40.5, p < .001, \text{partial eta-squared} = .74)$. Varus/ Valgus moment $(F(2,28) = 6.20, p = .006, \text{partial eta-squared} = .31)$. Internal/

External Rotation moment: ($F(2,28) = 6.87, p = .004, \text{partial } \eta\text{-squared} = .33$)]. Also, a moderate positive correlation between FMS score and Knee Flexion/Extension moment was established ($r_s(45) = .57, p < .001$). Other correlations between factors are not significant.

From biomechanical point of view, among all the 3 lunges testing motions, lateral lunge is the most desirable movement for lower limbs strengthening training as it created least knee valgus moment which may be a significant risk factor for knee osteoarthritis. However, lateral lunge also resulted in a higher knee Flexion/Extension moment comparatively which may not be suitable for those people with persisting knee pain. Rather, forward lunge may be a good alternative in this target group of clientele. The present study also demonstrated that FMS can be a potential clinical tool to reflect knee kinematics as it positively correlated with the knee Flexion/Extension moment as measured by the expensive sophisticated VICON system. It has significant clinical impact as it is low in cost and easy to use. However, further refinement of FMS is warranted to better reflect knee biomechanics in tool of outcome measure.