

Effects of Applying Low-Dye Taping in Performing Double-Leg Squat on Electromyographic Activity of Lower Extremity Muscles for Collegiate Basketball Players with Excessive Foot Pronation

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Abstract : Low-dye taping (LDT) is commonly used for treating foot problems, such as plantar fasciitis, and supporting foot arch for runners and non-athletes patients with pes planus. The potential negative impact of pronated feet leading to tibial and femoral internal rotation via the entire kinetic chain reaction was postulated and identified. The changed lower limb biomechanics potentially leading to poor activation of hip and knee stabilizers, such as gluteus maximus and medius, may associate with higher risk of knee injuries including patellofemoral pain syndrome and ligamentous sprain in many team sports players. It is therefore speculated that foot arch correction with LDT might enhance the use of gluteal muscles. The purpose of this study was to investigate the effect of applying LDT on surface electromyographic (sEMG) activity of superior gluteus maximus (SGMax), inferior gluteus maximus (IGMax), gluteus medius (GMed) and tibialis anterior (TA) during double-leg squat. 12 male collegiate basketball players (age: 21.7 \pm 2.5 years; body fat: 12.4 \pm 3.6%; navicular drop: 13.7 \pm 2.7mm) with at least three years regular basketball training experience participated in this study. Participants were excluded if they had recent history of lower limb injuries, over 16.6% body fat and lesser than 10mm drop in navicular drop (ND) test. Recruited subjects visited the laboratory once for the within-subject crossover study. Maximum voluntary isometric contraction (MVIC) tests on all selected muscles were performed in randomized order followed by sEMG test on double-leg squat during LDT and non-LDT conditions in counterbalanced order. SGMax, IGMax, GMed and TA activities during the entire 2-second concentric and 2-second eccentric phases were normalized and interpreted as %MVIC. The magnitude of the difference between taped and non-taped conditions of each muscle was further assessed via standardized effect \pm 90% confidence intervals (CI) with non-clinical magnitude-based inference. Paired samples T-test showed a significant decrease (4.7 \pm 1.4mm) in ND (95% CI: 3.8, 5.6; $p < 0.05$) while no significant difference was observed between taped and non-taped conditions in sEMG tests for all muscles and contractions ($p > 0.05$). On top of traditional significant testing, magnitude-based inference showed possibly increase in IGMax activity (small standardized effect: 0.27 \pm 0.44), likely increase in GMed activity (small standardized effect: 0.34 \pm 0.34) and possibly increase in TA activity (small standardized effect: 0.22 \pm 0.29) during eccentric phase. It is speculated that the decrease of navicular drop supported by LDT application could potentially enhance the use of inferior gluteus maximus and gluteus medius especially during eccentric phase in this study. As the eccentric phase of double-leg squat is an important component of landing activities in basketball, further studies on the onset and amount of gluteal activation during jumping and landing activities with LDT are recommended. Since both hip and knee kinematics were not measured in this study, the underlying cause of the observed increase in gluteal activation during squat after LDT is inconclusive. In this regard, the investigation of relationships between LDT application, ND, hip and knee kinematics, and gluteal muscle activity during sports specific jumping and landing tasks should be focused in the future.

Keywords : flat foot, gluteus maximus, gluteus medius, injury prevention

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