VASTI MUSCLE INHIBITION TAPING DOES NOT ALTER LOWER LIMB BIOMECHANICS DURING LANDING

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SUMMARY
Patellofemoral pain syndrome (PFPS) is a common clinical problem with high prevalence rates. Previous research has focused on the effects of the muscular and osseo-ligamentous contributions to patellar tracking. Vastus lateralis inhibition (VLI) taping to reduce pain and muscle activity has become popular practice in the management of PFPS. We aimed to determine whether VLI taping may alter joint kinematics and muscle activation of the lower limb during single-leg drop landing.

Sixteen young healthy collegiate students were participated in the study. Lower limb kinematics and EMG were collected during no tape, tape and tape with force condition. Temporal and spatial variables of joint kinematics, vertical ground reaction force and temporal variables of EMG were used for the comparisons using Repeated Measures one-way ANOVA.

No significant differences were found in hip, knee and ankle joint kinematics among three conditions. In contrast, significant differences in onset time of muscle activation in lower limb muscles were found among three conditions (p < 0.01). Specifically, the reduced difference between VMO and VL onset time was significant in the tape with force condition, implying a delay in VL muscle activation. These findings confirm the concept of delayed vasti muscle activation with no detectable biomechanical effects.

INTRODUCTION
Patellofemoral pain syndrome (PFPS) is a common problem with reported prevalence rates of up to 25% [1]. The most commonly accepted hypothesis is abnormal lateral tracing of the patella [2]. Previous research has focused on the effects of the muscular and osseo-ligamentous contributions to patellar tracking. The studies have provided evidence of an imbalance in the activation of the timing of vastus medialis oblique (VMO) and vastus lateralis (VL) in people with PFPS [1]. The use of taping to reduce pain and modify muscle activity has become popular practice in sports medicine and rehabilitation. However, the underlying mechanism of action remains unclear. More importantly, whether VLI taping may change the joint kinematics and muscle activation is still controversial.

A vastus lateralis inhibition taping, which terms “VLI taping”, the use of rigid tape applied on the skin at right angles to the muscle fibers of an underlying muscle was initially in the management of patellofemoral pain developed by McConnell [2]. Recent research reported a significant decrease in VL EMG activity while applying VLI taping compared with no tape during a step down task [1]. However, there is little information whether VLI taping could alter timing of VL and joint kinematics in the lower limb during landing. The purpose of this study was to determine whether VLI taping may alter timing of electromyographic (EMG) activity of selected muscle groups in the lower limb, joint kinematics (hip, knee, ankle joints), and the amplitude of ground reaction force (GRF) during a single-leg drop landing.

METHODS
A total of 16 young healthy collegiate students (8 males and 8 females) were participated in this study, which involved individuals between 20-26 years of age (mean age 22.1 ± 1.6 SD years). Subjects were excluded when they had previous injury or pathology of the knee, quadriceps muscles, skin or connective tissues of the region and any systematic musculoskeletal diseases.

Subjects were attached eight sensors (Flocks of Bird, Ascension Crop, USA) on both lower limb and pelvis to construct a lower limb model (Motion Monitor, Innsport Inc., USA) to collect joint kinematics during a single-leg drop landing. Sagittal hip, knee and ankle joint kinematics were collected when the foot was placed on the forceplate (Kistler, 9286B, Switzerland) with the synchronization with ground reaction forces. The Bagnoli-8 EMG system (The Delsys Inc, Boston, MA, USA) was used to detect the onset timing of 

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was confirmed using a diagnostic ultrasound imaging system (LOGIQ Book XP, GE Co, USA). Raw data of joint kinematics, ground reaction forces were processed through commercial software (MotionMonitor, Innsport Inc. Chicago, USA). Custom-designed analysis program were used to detect the temporal and spatial variables of joint kinematics, vertical ground reaction force and EMG for further processing using Matlab 7.0 (Mathwork, Inc. USA). Specific variables of joint kinematics (amplitude and timing of initial contact, at maximal GRF and maximal angle at hip, knee and ankle joints, vertical ground reaction force (timing of initial contact, maximal vertical GRF, Figure 1) and onset timing of EMG were calculated to used for the comparison among the conditions (no tape vs. tape vs. tape with force) using Repeated Measures ANOVA. All statistical analysis were used commercial statistical analysis program (SPSS 14.0, SPSS Inc, USA) with $p$ value set at 0.05.

RESULTS AND DISCUSSION
There were no significant differences of temporal and spatial variables in hip, knee and ankle joint kinematics. In contrast, significant difference in EMG onset time of VMO, RF, BF, TA and GL were found among three different conditions ($p < 0.01$). Specifically, the difference between VMO onset time and VL onset time was significant reduced in the condition of tape and tape with force, implying a reduction in VL muscle activation during single-leg drop landing.

CONCLUSIONS
Vasti inhibition taping technique, such as vastus lateralis inhibition (VLI) taping, does not change in the joint kinematics of lower extremity during single-leg drop landing, implying no adverse effect with the VLI taping during dynamic activities. Meanwhile, the changes in motor coordination of lower limb muscles may result from the delayed VL muscle activation from VLI taping. These findings confirm the concept of modification of muscle activation in the lower limb with no detectable biomechanical effect in the lower limb.

![Figure 1: Variables of joint kinematics at hip (B), knee (C) and ankle (D) were determined by the initial contact of forceplate and maximal vertical GRF (A).](image-url)