P04-7 ID231

THE INFLUENCE OF THE HAMSTRING MYOFASCIAL RELEASE ON GROUND REACTION FORCE DURING GAIT

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The purpose of this study was to investigate the influence of the myofascial release on hamstring during gait in order to inform the clinical management of patients with muscular tightness of hamstring. Sixteen adult subjects with the muscle tightness of hamstring participated in this study. The peak of the vertical ground reaction force before treatment (1.114 body weight) in the stance phase is significantly higher than that (1.065 body weight) after treatment (P=0.007). The peak knee extension moment was significantly decreased across the intervention (0.48 vs. 0.33 Nm/kg, P = 0.019). The understanding of the efficacy of myofascial release on hamstring muscles is helpful to inform the clinical management of patients with muscular tightness of hamstring.

KEY WORDS: myofascial release, ground reaction force, hamstring.

INTRODUCTION: Ambulation is an important functional task for human locomotion and it requires complex interactions and coordination among the major joints of the body, particularly the lower extremities. The muscular tightness is a common clinical musculoskeletal problem and is regarded as a risk factor for the development of muscle injuries (Witvrouw et al. 2003). Muscle inflexibility could be as a consequence of a certain pathological conditions including chronic repetitive minor muscle strain, poor posture, systemic disease, or neuromusculoskeletal lesion. Fousekis et al. (2010) proposed that asymmetries in muscle strength, flexibility and proprioception could lead to hamstring strains and functional impairments. Radford et al. (2006) further reported that the lower leg muscle tightness and reduced joint range of motion were related to musculoskeletal disorders. The descriptions of typical body movements and of pathological conditions are critical for therapeutic interventions. The hamstring tightness is a common clinical musculoskeletal problem and the purpose of this study was to investigate the influence of the myofascial release on hamstring during gait in order to inform the clinical management of patients with muscular tightness of hamstring.

METHODS: Sixteen adult subjects (8 males and 8 females) with the muscle tightness of hamstring participated in this study. The patients were recruited if their range of motion of knee joint (popliteal angle) is less than 150 degrees. The ages of the sixteen participants were 25.4 ± 3.5 years. The body heights and weights were 167.6 ± 4.9 cm and 60.4 ± 8.2 kgw. Three-dimensional motions of body segments were measured by the five camera motion analysis system (Evart 5.0, Motion Analysis Corporation, Santa Rosa, CA, USA) operating at 60 Hz sample rate. Two AMTI forceplates (Advanced Mechanical Technology, Inc., Watertown, MA, USA) were used to measure the ground reaction forces with 1000 Hz sample rate. Data collection was simultaneously triggered and synchronized before each subject stepped onto the first forceplate. The subjects were instructed to walk along the walkway at two cadences. The metronome was set at 100 steps/min, and the subjects were encouraged to match the beeps of the metronome. The standard Helen Hayes marker set consisting of 15 reflexive markers were used to identify the lower body segments (Robon et al. 2000). The markers were on the right and left ASIS (anterior superior iliac spines), sacrum top in line with the spinal plane, right and left mid-thigh, cuff with marker on wand, right and left knee, lateral epicondyle, right and left mid-shank, cuff with marker on wand, right and left lateral malleolus, right and left foot between 2nd and 3rd metatarsal heads, and right and left heel. The computer software “Ortho Trak 5.2” (Motion Analysis Corporation Corp., CA, USA) was aided to analyze the kinematic and kinetic data. The ground reaction forces were selected for analysis.

Myofascial release was performed to stretch the cross-links and changing the viscosity of the ground substance of fascia (Barnes, 1997). The senior physical therapist used a cross-hand technique, slowly stretching out the elastic component of the hamstring fascia with relaxed hands, until the physical therapist reached a barrier. At that point, the physical therapist maintained sufficient pressure to hold the stretch at the barrier and waited 90 seconds or longer until the restriction or barrier released. The ground reaction forces and knee joint reaction forces during the walking trails were compared before and after 6-8 weeks myofascial release on hamstring.

Figure 1: The laboratory setup and experimental procedure for gait analysis.

RESULTS: The popliteal angle of knee joint before treatment was 124.5 ± 8.2 degree and 147.3 ± 7.4 degree after treatment ($P<0.001$). The peak of the vertical ground reaction force before treatment (1.114 times of the body weight) in the stance phase was significantly higher than that (1.065 times of the body weight) after treatment ($P=0.007$). The anterior and posterior direction ground reaction force was 0.174 times of the body weight before treatment, and 0.158 times of the body weight after treatment ($P=0.089$). The medial and lateral direction of ground reaction force was 0.058 times of the body weight before treatment, and 0.049 times of the body weight after treatment ($P=0.178$). The peak knee extension moment was significantly decreased across the intervention (0.48 ± 0.18 Nm/kg vs. 0.33 ± 0.15 Nm/kg, $P = 0.019$)

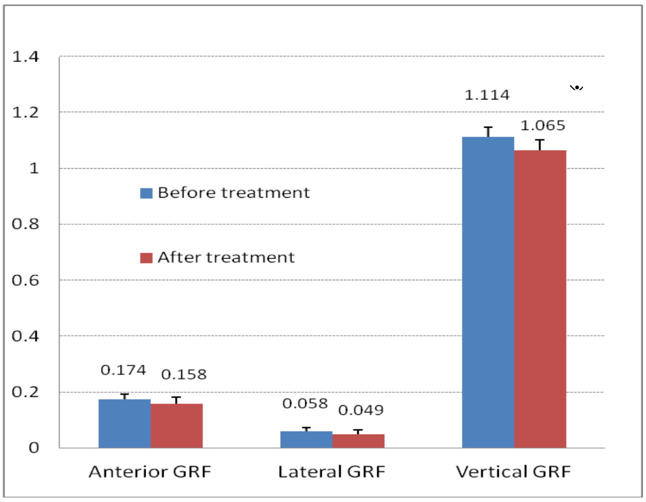

Figure 2: The different vectors of the ground reaction force (GRF) before and after intervention

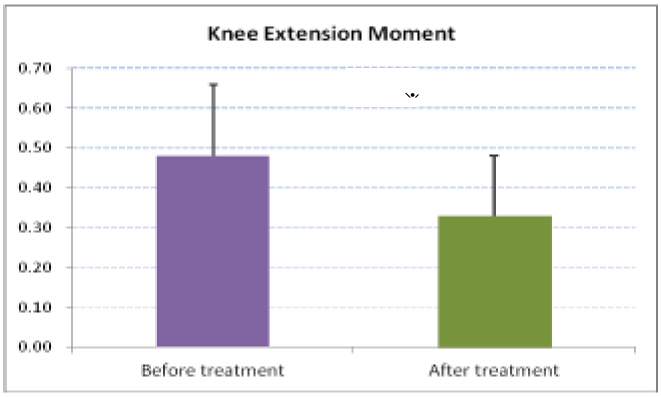

Figure 3: The knee extension moment in stance phase before and after intervention

DISCUSSION: The results of gait analysis indicated that the flexibility of hamstrings is improved after the myofascial release on hamstring. The adequate mobility of knee joint was necessary for normal attenuation of forces transmitted from the ground to the weight-bearing extremity. The quantitative gait analysis was valuable to clarify the influence of the muscle tightness on the ground reaction forces in the lower extremities and the effectiveness of myofascial treatments. The other limitation of the present study is the biomechanical considerations mainly on the primary motion of knee joint areas. Though this analysis method may easily identify the patient problems, future researches on analysis of the whole lower extremity and trunk may reveal more complicated compensatory strategies for the mobility impairment. The understanding of the efficacy of myofascial release on hamstring muscles is helpful to inform the clinical management of patients with muscular tightness of hamstring.

CONCLUSION: The quantitative gait analysis was valuable to clarify the influence of the muscle tightness on the ground reaction forces in the lower extremities. The understanding of the efficacy of myofascial release on hamstring muscles is helpful to inform the clinical management of patients with muscular tightness of hamstring.

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