Effects of Wearing a Tight Skirt on the VMO, VL, and TFL Muscles during Walking

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Abstract. [Purpose] The purpose of this study was to show the effects of wearing a tight skirt on the VMO, VL, and TFL muscles during walking. [Subjects] Twelve female subjects were recruited. [Methods] The muscle activities of the VMO, VL, and TFL muscles were measured using a surface EMG system during walking while wearing a typical skirt and tight skirt. [Results] The VL and TFL muscle activities significantly increased, and VMO muscle activity significantly decreased when wearing a tight skirt. [Conclusion] We thought that a tight skirt might limit the normal gait. The abnormal gait movements resulting from wearing a tight skirt could cause imbalance of the VMO and VL.

Key words: Gait, Patellofemoral pain, Tight skirt

INTRODUCTION

Tight garments could influence intestinal transit time and increase urinary excretion1, 2). They also contribute to the rising rate of esophageal cancer and digestive problem3). Previous studies have shown the effect of tight garments on the human body, and most of these have included physiological investigations; a tight garment can irritate nerves as well as restrict blood circulation and lymph fluid1, 2). Yoo et al.4) were the first to suggest requirements of study associated with the relationship between musculoskeletal disorders and wearing of tight garments. Some studies have examined the risks associated with tight clothes. They reported that tight clothes such as tight belts, ties, and jeans, which are becoming increasingly popular, have a constraining influence on the abdomen, which in turn might promote reflux4, 5). Recently, wearing tight skirts has become fashionable. However, the influence of the tight skirt on the musculoskeletal system has yet to be investigated. Wearing a tight skirt has a direct factor on musculoskeletal order. Therefore, clinical studies are required to investigate the effects of wearing a tight skirt on the musculoskeletal system. The purpose of this study was to clarify the effects of wearing a tight skirt on the vastus medialis oblique, vastus lateralis, and tensor fasciae latae muscles during walking.

SUBJECTS AND METHODS

The subjects of this study were 12 healthy female students aged 20–23 years (22.0 ± 1.2 years, mean ± SD) with an average height and weight of 159.5 ± 6.7 cm and 62.0 ± 5.0 kg, respectively. Subjects with conditions that might affect the gait, such as injury or neurologic deficits of the hip and lower extremities during the previous year, were excluded. The muscle activity of each muscle was measured with an MP100 system, and DE-3.1 Double Differential Electrodes were used. The electromyogram electrodes were attached to the vastus medialis oblique (VMO), vastus lateralis (VL), and tensor fasciae latae (TFL) muscles. The EMG signals were normalized to the percentage of maximal voluntary contraction (%MVC). The EMG data were sampled at 1000 Hz using the Acqknowledge 3.9.1 software (BIOPAC Systems). We used a typical skirt and tight skirt from J Company. They were knee skirts made from a nonelastic material, polyester. The typical skirt was tightened to 110–120% of the subject’s waist and below the waist (measuring down under the waist 5 inches then circumference) and the hips widest and below the hips widest. All subjects performed treadmill walking at 2 m/sec in the typical and tight skirt. The paired t-test was conducted to test for differences in muscle activities. Significance was accepted for value of p<0.05, and SPSS version 12.0 was used for the statistical analyses.

RESULTS

The muscle activities of the VL and TFL muscles significantly increased when wearing a tight skirt compared with wearing a typical skirt. The muscle activities of the VL and TFL when wearing a typical skirt were 20.6 ± 9.7% and 19.2 ± 13.0%, respectively. The muscle activities of the VL and TFL when wearing a tight skirt were 27.0 ± 11.4% and 26.9 ± 16.5%, respectively. The muscle activities of the VMO muscles significantly decreased when wearing a tight
skirt (19.2 ± 8.9%) compared with when wearing a typical skirt (22.7 ± 10.4%).

DISCUSSION

A previous study that used a tight back belt compared with a typical back belt reported that the intramuscular pressure on the erector spinae influenced spinal stiffness separately from muscle activation. Yoo et al. reported limitation of cervical joint motion, restricted by a tight necktie, resulting in an increase in shortening of collagen tissue and muscles of the neck and shoulder. The present study investigated the effects of wearing a tight skirt on the VMO, VL, and TFL muscles during walking. Recently, tight skirts have become very fashionable. However, we suggest that a tight skirt might limit the normal gait. The muscle activities of the VL, and TFL muscles significantly increased when wearing a tight skirt compared with when wearing a typical skirt. Patellofemoral pain syndrome can be caused by weakening of the vastus medialis oblique muscle, increasing of the knee valgus angle, and shortening of the knee lateral muscles, such as the VL or TFL. Previous studies reported that when the knee valgus angle increases to an abnormal proportion, it affects the distance between the origin and insertion of the vastus lateralis muscle. As it shortens the traction line of the vastus lateralis muscles, the muscles must be pulled in a contracted condition. We thought that a tight skirt places outward force on the patella by increasing the knee valgus angle during walking. When the patella is pushed outward from the patella surface between the femoral condyles, patellofemoral pain syndrome is caused, which involves serious pain around the knee. If this occurs repetitively, an individual may develop degenerative arthritis due to the abrasion of the articular surface. Many studies have demonstrated that the patellae of patients with patellofemoral pain syndrome are excessively dragged outward. The muscle activities of VMO muscles significantly decreased when wearing a tight skirt compared with when wearing a typical skirt. Imbalance in the onset of activities of the VL and VMO leads to patella maltracking. Patients with patellofemoral pain usually have weakness of the VMO, so the activities of the VL and VMO are often compared. Wearing a tight skirt daily may cause an abnormal gait, and it may cause imbalance of femur muscles, such as the VL, VMO, and TFL. Finally, continuous muscle imbalance of femur muscles may cause patellofemoral pain syndrome.

ACKNOWLEDGEMENTS

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (no. 2012001058).

REFERENCES