The Immediate Effects of External Kinesio-tape Wrapping for Inner Arch Support on the Lower Leg EMG for Gait in Stiletto Heels

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Purpose: The purpose of this study was to analyze the effects of using external kinesio-tape wrapping for inner arch support on the lower extremity EMG for gait in stiletto heels.

Methods: Subjects for this study were two female college students who had been wearing stiletto heels almost every day of the week for more than three years. The independent variable was the presence or absence of kinesio-tape wrap for inner arch support. Dependent variables were EMG readings for the four muscle groups: the medial and lateral gastrocnemius, the tibialis anterior, and the peroneus longus. EMG readings were taken using the NORAXON (USA). The Paired t-test within the subject repeated measure design for the presence and absence of inner arch support \( (p<0.05) \) was used via SPSS 18.0.

Results: With kinesio-tape wrap for inner arch support, there was a statistically significant decrease in the muscle force mean values for the peroneus longus and the medial and lateral gastrocnemius, in the maximum muscle forces of the peroneus longus and the lateral gastrocnemius.

Conclusion: External kinesio-tape wrapping for inner arch support in stiletto heels could have an effect to reduce peroneus longus, and medial/lateral gastrocnemius activities that could result in decreased fatigue and discomfort.

Keywords: Stiletto heel, Kinesio-tape wrapping, Inner arch support, EMG

I. INTRODUCTION

For humans, shoes have been an important and necessary item for almost as long as we have existed. There has been long standing evidence that humans have tried to provide some forms of protection for their feet. Throughout history, we can see that the shoe has developed beyond basic protection against the elements into a full-fledged fashion item and symbol of success (Kunzie, 2013; Wade, 2013).

With the evolution of the shoe as a form of fashion, creating more restrictions to natural movement, people have started to suffer consequences with pain (Dufour et al., 2009) and discomfort (Au & Goonetilleke, 2007) that can lead to misalignment, degeneration, osteoarthritis (Riskowski, Dufour, & Hannan, 2011) of the foot or toes (Stomp, Krabben, van der Helm-van, Mil, & Reijnierse, 2014; Daniel et al., 2014). High heels are the number one cause of shoe-related foot pain, and 71% of heel-wearers said their feet hurt when they wear them, according to a 2014 American Podiatric Medical Association survey of 1000 US adults (Edge Research, 2013).
This has raised concerns related to creating and designing shoes that can lessen the pain and discomfort suffered by the wearer. Podiatric medicine and the shoe industry have been working to mediate this problem. Many studies have been conducted on the relationship between the shoe and the foot (Stomp, Krabben, van der Helm-van Mil, & Reijnierse, 2014; Cronin, 2014; Miller, Whitcome, Lieberman, Norton, & Dyer, 2014) and the effects that certain shoe forms can have to the overall development of the foot.

Shoes classified as high heels are one of the most restrictive and damaging shoes that are designed for common use, which specifically targets the female population. Extensive wear of high heeled shoes has been linked to serious conditions relating to knee, ankle, metatarsal, phalanges pain or misalignment. Other related symptoms can be present in the lower back, hip joints, etc. With prolonged wear, permanent changes in posture (Silva, Siqueira, & Silva, 2013) and walking patterns can occur (Blanchette, Brault, & Powers, 2011; Simonsen et al., 2012; Chien, Lu, & Liu, 2013; Cronin, 2014). Frequent wears can experience a permanent shortening or decreased function of the Achilles tendon and gastrocnemius muscles (Csapo, Maganaris, Seynnes, & Narici, 2010). The contraction of these muscles can make it difficult for women to return to wearing flat shoes and performing basic motions such as squatting. Failure to be able to move into a squating position can lead to degeneration of their hip joints, which can cause serious issues later in life. In addition, high heel related problems such as ingrown toe-nails, bunions, severe pronation, hallux valgus, pain in the third and fourth metatarsals, and cuboid syndrome (Cronin, 2014).

Excessive use of high heels can also directly influence the underlying muscle structure of the foot and calf (Simonsen et al., 2012), as well as venous function (Tedeschi, Dezzotti, Joviliano, Moriya, & Piccinato, 2012).

Women are aware of a lot of these conditions; however, their immediate desire to wear heels outweighs their concern for what can happen in the long run. There is an increasing demand to create a high heeled shoe that eliminates most, if not all of these problems.

People usually thought that the important characteristics of comfortable shoes appear to be good fit, suitable heel height, no localized pressure under the ball of the foot, and attractive appearance. Meanwhile, shoes with poor fit in the forefoot region tend to be perceived as uncomfortable (Au & Goonetilleke, 2007).

When looking for shoes, it is recommended that you look for shoes that provide inner arch support and keep toes from crowding and bending (Miller, Whitcome, Lieberman, Norton, & Dyer, 2014).

The purpose of this study was to analyze the effects of inner arch support with external kinesio-tape wrapping on the lower extremity EMG for gait in stiletto heels.

II. METHODS

1. Subjects

Subjects for this study were two female college students who had been wearing stiletto heels almost every day of the week for more than three years. They had severe pes planus with a mean of -5 degrees according to RCSP (resting calcaneus standing position).

2. Variables

The independent variable for this study was the presence or absence of kinesio-tape wrap for inner arch support. The dependent variables were EMG of the peroneus longus, the tibialis anterior, and the medial and lateral gastrocnemius muscles (Figure 2).

3. Equipment

A force platform (9281B, Kistler) was used to analyze the effects of external kinesio-tape (Dowha Kinesiotape, Korea) wrapping for inner arch support on the lower extremity EMG (NORAXON, USA) during gait in stiletto heels. EMG values were recorded as subjects performed ten trial walks with and without kinesio-tape wrap for inner arch support at their natural pace on a 10 meter concrete laboratory walkway. Inner arch support was provided using kinesio-tape externally on the shoes. The kinesio-tape wrapped under the arches, around the top of the foot, provided arch support. Subjects used their own stiletto heels for this study. Heels were exactly 12 cm from the ground with a 9 cm drop from the heel to the forefoot (Figure 1).