

Effect of ankle taping on the ankle muscle strength in young healthy women

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ABSTRACT

Of the various approaches to manage or prevent injuries on the ankle joint, Kinesio taping improves static posture stability, stimulating the neuromuscular control system. This study aims to investigate of ankle taping on the peak torque and average power of ankle muscle in young healthy women. Taping was applied to the extensor digitorum, tibialis anterior, gastrocnemius, soleus of the ankle in 16 healthy women. Isokinetic measurement of the dorsiflexion and plantarflexion patterns were recorded before and after taping. As a result of this study, the pre-post isokinetic parameters improved significantly for plantarflexion ($p < 0.05$) while those for dorsiflexion did not. Through this study, it was found out that ankle taping improved the muscle power of the plantarflexor of young healthy women, and it is expected that applying ankle taping would help young healthy women. **Keywords:** Ankle taping; Muscle power; Young women.

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INTRODUCTION

The ankle joint is the closest lower extremity joint to the base of support (BoS) (Blackburn et al., 2000), while, foot and ankle alignment plays an important role in standing posture, gait, and weight bearing in gait (Kim & Lee, 2013; Lee et al., 2013). If this alignment is compromised, abnormal alignment may result in stress or fatigue on muscles and supportive connective tissues leading to excessive kinematic compensatory movements with the possibility of causing spasm or pain (Donald, 2013). Foot and ankle muscles can correct abnormal alignment, control the specific action of the relevant joint and its stability, and absorb the shocks necessary for movement (Donald, 2013). Therefore, strengthening the muscle near the ankle is essential for injury prevention (Gao et al., 2011), while their weakening may lead to various ankle injuries and deterioration in the performance of sports activities.

The most common injury associated with the ankle is sprain which usually occurs due to excessive inward inversion (Garrick & Schelkun, 1997; Mohammadi, 2007). Causes of sprain or factors affecting it include excessive stretch or weight, the relaxation of the ankle joint, anatomical misalignment, and reduction in muscle power, muscle reaction time, and posture fluctuation (Beynon et al., 2002). In addition, it has been known that the relaxation of the ankle joint differs depending on sex, and according to previous studies the relaxation of lateral ankle ligament was higher in women than in men (Wilkerson & Mason, 2000) and that estrogen produced during the menstrual cycle relaxes the muscles and joints (Lee & Yim, 2016). Moreover, women have less ability to control dynamic motion than men do, so it may be likely that they have a higher risk of musculoskeletal injury (Lee & Yim, 2016).

Of the various approaches to manage or prevent injuries on the ankle joint, Kinesio taping, an affordable and simple to apply device, which allegedly improves static posture stability, stimulate the nerve root control system has a positive effect on muscle power and increases the stability of the ankle in everyday activities (Iris et al., 2000). In addition, it was reported that taping was effective for controlling muscle tone, increasing muscle power as well as reducing pain and increasing the range of motion (Mostafavifar et al., 2012). According to another study, the application of taping to healthy male college student significantly changed ankle muscle power and proprioception sense (Ozer et al., 2009).

Like this, there are many studies that applied taping to men and athletes and reported its effects, but as mentioned above, despite a higher prevalence of ankle injury in women (Wilkerson & Mason, 2000) only a few studies focused on the effect of taping on the ankle in women. Therefore, this study would investigate the effects of Kinesio taping on the peak torque and average power of ankle muscle in young healthy women.

MATERIAL AND METHODS

Participants

Sixteen healthy women: age - 22.0 (0.52) y; stature - 159.7 (4.03) cm and weight - 55.0 (8.34) kg, were recruited through social media at K University. The recruited subjects were selected according to the following criteria: no musculoskeletal or nervous system disorder; no ankle joint injury in the past year; no limitations in the range of motion of the ankle ; allergy to tape. The research purpose and methods were explained to all the subjects who signed the consent form. This study was approved by the Institutional Review Board of Kyungnam University.

Experimental procedures

We used an MYO tape (Rehabilitation Medicine Product, Seoul, Korea) size 5cm*5m with an elasticity of

160-180% which was attached to the extensor digitorum, tibialis anterior, gastrocnemius, and soleus as Kinesio taping. The tape was placed at a tension of 120-130%, the effective range for muscle strengthening according to the origin and insertion (Lemos et al., 2018). As for the order of the attachment of taping, dorsiflexion taping was applied to the extensor digitorum and tibialis anterior, while plantarflexor taping was applied to the gastrocnemius and soleus. For the dorsiflexor, Kinesio tape was attached to the extensor digitorum and tibialis anterior (Fig 1,2,3), and taking a 30-minute break after the application of the tape, measurements were made in the same method as that of measurements before the attachment of taping. Taking a 30-minute break after dorsiflexor taping was removed, a 30-minute break was taken, applying plantarflexor taping. For plantarflexor taping, Kinesio taping was attached to the gastrocnemius and soleus (Fig 4,5,6). Likewise, taking a 30-minute break after the application of the tape, measurements were made with the same method as the measurements before taping.



Fig 1. Extensor digitorum

Fig 2. Tibialis anterior

Fig 3. Dorsiflexor



Fig 4. Gastrocnemius

Fig 5. Soleus

Fig 6. Plantarflexor

Peak torque and average power were measured with an isokinetic test device, and in the measurement before taping, these were measured by the isokinetic test device after the subjects' dominant foot was checked through a kicking test (Cramer et al., 2007). To control the compensation movement by the subjects' movement, straps were applied to the trunk and thigh on both sides. Three sets of measurements were made by starting from dorsiflexion through plantarflexion to dorsiflexion as one set five times at a measurement load speed of 60°/sec. The break time between sets was set to 60 seconds, and the measurer gave certain

verbal instructions to exhibit muscle power sufficiently (Carregaro et al., 2011).

Outcome measurements

As for a measurement tool, to measure isokinetic muscle power, Biodex System 4 Pro (Biodex Medical Systems, New York, USA) was employed. Muscle power test using BIODEX has very high reliability. It had an error range of less than 1% also in re-measurement (Van Driessche et al., 2018) and showed higher reliability than Goniometer in PROM measurement (Jung et al., 2015). In addition, it is often used in that it has high accuracy in measuring ROM and proprioception and can draw results in many categories in a short time.

Statistical analysis

In this study, for statistical analysis, the general characteristics of the subjects were analysed with the average and standard deviation or frequency, using SPSS 18.0. The muscle power of the ankle flexor and extensor of the subjects before and after taping was compared and analysed with a paired t-test, and all statistical significance levels were $p < .05$.

RESULTS

The changes in the peak moment following taping are outlined in Table 1. There was a significant increase in peak moment and power during plantarflexor before and after taping ($p < 0.05$). No differences were noted for dorsiflexion.

Table 1. Comparison of pre- and post-taping

		Pre Taping	Post Taping	p
Peak torque	Dorsiflexor	15.52 (10.07)	10.76 (4.18)	.080
	Plantarflexor	52.12 (23.84)	60.47 (25.14)	.000*
Average power	Dorsiflexor	9.37 (8.72)	5.45 (2.83)	.072
	Plantarflexor	26.95 (14.31)	32.10 (14.24)	.002*

Values were presented as mean (standard deviation).

DISCUSSION

This study would explore the impact of ankle joint taping on ankle muscle strength and power in young healthy women. Its main finding relates to positive effect on plantarflexion and related performance. A previous study had reported that there were significant improvements in plantarflexion performance after the application of taping to the ankle of 11 healthy women basketball players (Quackenbush et al., 2008). It was noted that since the cross-sectional area of the dorsiflexors had a smaller and relatively the dorsiflexors were more easily exposed to muscle fatigue than the plantarflexors, and accordingly, taping was more efficient for improvement of plantarflexion power. In addition, it was indicated that the application of elastic tape to the patients with ankle sprain improved their muscle power (Karlsson & Andreasson, 1992), also, support the results of this study, and in the study that examined the effects of the application of elastic tape to the ankle joint of healthy subjects on their gait, balance ability, and muscle power, too, the elastic tape attached to the skin stimulated various sensory receptors to improve muscle contraction ability and accordingly increases the functions of muscles and joints and helps improve gait and muscle power (Kim & Cha, 2015), which supports the results of this study.

However, this study has several limitations. The number of subjects participating in the study was not enough, and the time of the application of taping was short. Also, the mechanisms of the effects of taping proposed through the previous studies are still theories or hypotheses, and there are not enough grounds or research that can support them. Therefore, it is judged that it would be necessary to investigate the effects of taping through more studies in the future.

CONCLUSION

This study investigated the effects of the application of ankle joint taping with young healthy women, and as a result, there was a significant difference in the peak torque and average power of the plantarflexor before and after taping. This study could find out the possibility of the effect of the application of taping on the improvement of the muscle power of young healthy women.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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