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The Effect of Elastic and Non-Elastic Tape on Flat Foot

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Abstract

This study was performed to investigate the effect of elastic and non-elastic tape on flat foot. Fourteen able-body volunteers who had pes planus were recruited for this study. Subjects were measured navicular drop test to evaluate pronation of foot and navicular height and footprint during static standing with a bare foot state at pre-taping, elastic tape, and non-elastic tape. A one-way Repeated ANOVA analysis of variance design was used to examine the difference of navicular height and footprint. The results showed that the navicular height and a length (Smallest distance between medial and lateral border of footprint) were significantly decreased after non-elastic tape. The results suggest that non-elastic tape could be useful on flat foot.

Keywords: Elastic Tape, Flat Foot, Navicular Drop Test, Non-elastic Tape

1. Introduction

The structure of medial longitudinal and transverse arches designed to support the body weight gives human feet stability and resilience[1]. In standing, body weight tends to be transmitted via talocalcaneonavicular joint, pressing the lower part of talus bone and flattening the medial longitudinal arch[2]. It is called the flat foot where the arches are low or there are no arches at all[3]. The causes and consequences of the condition can be explained by complicated interactions among opposite ground reaction force, ligaments, the articular capsule, intrinsic muscles and the tendons of extrinsic muscles, and the surface of talus[4,5]. Though a wide range of clinical methods are attempted to see if a person has flat feet, the navicular drop test is the most widely used. It is intended to measure navicular drop height with or without the subject's body weight pushing down on the medial longitudinal arch. While>10mm difference is considered excessive foot pronation[6]. The lower medial longitudinal arch is associated with soft tissue damage and reduces the ability to support or distribute body weight. As a result, extrinsic muscles have to compensate for the reduced function, causing unbalanced condition in the body alignment and overuse syndrome, including patellar tendinitis and plantar fasciitis, and sore knee and sore lower back[1]. There have been many clinical interventions to treat foot pronation, including surgical correction, strengthened muscle, and stretch, the use of walking aid, manual therapy, and taping[7]. Among them, low-dye taping is a method so as to increase the height of longitudinal arch and navicular drop height[8]. The procedure involves taping along the bottom and sides of the foot, thus controlling the amount of rear foot pronation[9]. Intervention studies show the taping to relieve the pain of patients with plantar fasciitis and to decrease tibialis posterior muscle activation[8,10]. To identify the effect of antipronation taping on pronated foot, a recent study examines the degree of calcaneal eversion or navicular drop height[11]. As evidence, it evaluates the posture based on the height of arches or tibia rotation,

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or look into plantar pressure distribution and electromyography analysis[2,11,12]. The existing studies were focused on the measurement of lower muscle activity using non-elastic tape and looked into how much the application of arch support taping using non-elastic tape affect the plantar pressure and navicular drop height[8,13,14]. In fact, however, few studies have been carried out about the difference between elastic tapes and non-elastic ones in the application of low-dye taping and how much effect the taping have on navicular drop height and plantar contact area when applying the taping to subjects with flat foot. Therefore, this study is to identify the effect of elastic tapes and non-elastic tapes on navicular drop height and plantar contact area in the subjects with navicular drop tests.

2. Subjects and Methods

2.1 Subjects

A sample of convenience of 14 subjects volunteered for the study from S university in the Province of Chungcheongnam-do. All volunteers signed informed consent forms prior to participation, and the rights of all subjects were protected. All subjects were interviewed to ensure that they were without neurological history and no problems during static stance, and gait, and considered to be excessive pronation in the navicular drop. Also, their right foot was dominant than left. General characteristics are as shown in Table 1. This study was approved by the University of Sun Moon Institutional Review Board (IRB).

Table 1. The general characteristics of the study subjects (n=14)

Group	Value
Gender	Male (n=4/28.6 %)
	Female (n=10/71.4%)
Age	20.64 ± 1.28[a]
Height (cm)	163.64 ± 6.25
Weight (kg)	61.86 ± 7.47
foot size (mm)	246.43 ± 13.65

2.2 Navicular Drop Test

A modified test was employed in this study, as described by Brondy[2] and to ensure consistency, the same investigator carried out all procedures involved in the study. To perform it, a subject sits down on a chair with his or her knees bent at 90 degrees, and then keeps the knee and index toe of their dominant foot in a straight line. With talus bone in neutral position of subtalar joint, the investigator measured the distance between the navicular tubercle and the floor. Then, the subject stands with both feet parallel and 10 cm apart, and the investigator do the same as in sitting using a thin ruler. The test value is calculated from the gap in positions of sitting and standing and the test was done in bare feet.

2.3 Low-dye Taping

The subject's ankle was placed to neutral position and keeps his foot 90°. Longitudinal anchor strips to the the fifth metatrsal start in the bone attached to the head and along the lateral side of the head of the first metatarsal attached to the inside by pulling on the lateral. The transverse arch support strips are attached to the bow by pulling from the outside along the plantar surface and attached to the anterior surface of the calcaneous to the heads of the metatarsalsr. Then, the transverse arch support strips that the support strips help to stably apply additionally a fixed longitudinal anchor strips[15] (Figure 1).

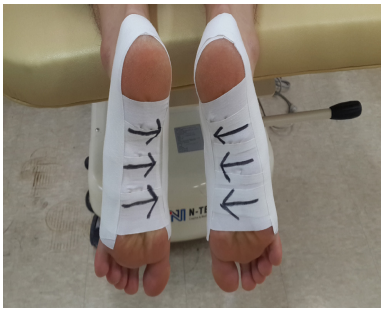

Figure 1. Low-dye taping

2.4 Navicular Height and Area

This study is a comparison of all three methods, when applied to a non-elastic tape to that of applying the elastic tape that is bare foot, the test sequence is a randomized. For subjects, after non-elastic tape and elastic tape using intervals keep the heel of the subjects in the standing position after applying the Low-dye taping was 10cm, with both feet side by side on one foot while supporting the amount of weight using a thin person, who checks to measure the distance to the lower portion of bone from the ground by navicular, was performed by one skilled observers to reduce the error. In addition, the practice prior to the experiment

was sufficient. To an area of the plantar foot surface area is measured by using a pressure Foot Scan to stand when the subject is static, the line draw along medial border of footprint (L) was measured in the smallest distance between medial and lateral border of footprint (A), 3 repeat time measured by the average value was used[10]. Statistical significance standard was set to α as 0.05.

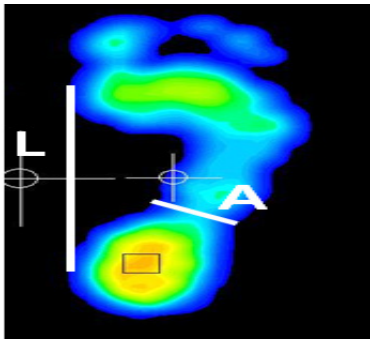

Figure 2. Footprint calculation.

2.5 Analysis

The collected data were treated statistically using the statistical program SPSS ver18.0. The general characteristics of the subjects used for the percentage and frequency analysis and the assay were performed in normality with Shapiro-Wilk so that such normality may be satisfied. Taping intervention before a repeated measures ANOVA was conducted to investigate the differences in elastic and non-elastic tape on the rear side of navicular height and foot area, corresponding comparisons were used Bonferroni, α =.05 level of significance was set.

3. Results

When applied to non-elastic tape, elastic tape for navicular, there was a significant difference in bone height Table 2. In post-hoc test, a significant difference in elastic and non-elastic tape was applied to the applicable value. Barefoot, elastic and non-elastic tape applied to the value was significantly difference(p<. 05) (Figure 3). Elastic and non-elastic tapes were dominant for the foot area value after the application did not show a significant difference in L Length (p<. 05) (Table 2) (Figure 3). A value of the length of the barefoot was for the elastic tape and a non-significant difference in elastic tape after their application (p<. 05) (Table 2). There was a significant difference in the response compared to that only applied to non-elastic tape before and after interventions (p<. 05) (Figure 3).

Table 2. Mean relative length (mm) and standard deviation (SD) of the different intervention during static standing with a barefoot state at pre-taping, elastic tape, and non-elastic tape

	Barefoot	Elastic tape	Non-elastic tape	*F*
Navicular height (mm)	34.29 ± 7.57	40.14 ± 7.00	46.07 ± 5.74	26.50*
L (mm)	141.90 ± 7.27	140.80 ± 6.08	140.49 ± 8.07	0.77
A (mm)	42.24 ± 8.52	43.72 ± 11.13	39.14 ± 8.53	14.50*

*ρ < .05, all values are mean ± standard deviation(SD). L(Line drawn along medial border of footprint), A(Smallest distance between medial and lateral border of footprint)

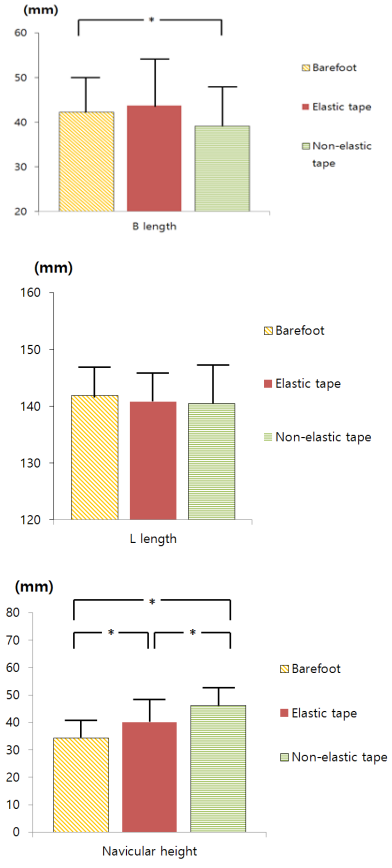

Figure 3. Comparison of length during static standing with a barefoot state at pre-taping, elastic tape, and non-elastic tape.

4. Discussion

This study examined the effects on a flat foot when applying the elastic and non-elastic tapes intended for flat feet. In the elastic tape rather than mediation before the navicular height in the non-elastic tape, elastic tape was significantly high in the length A was significantly reduced. Low-dye taping technique applied in the study is that the immediate effect of interventions to support the function of the foot inside the vertical bow initiative[16]. Lange et al[17]. 10mm or more subjects with navicular were to fall Low-dye taping when applied pronation initiative that generated much reduced[17]. In addition, O'Sullivan et al[7]. Low-dye taping was that caused the change in plantar pressure and pronation degree when applying for a support group not while walking, Low-dye taping after applying the existing research on the immediate effects navicular than other bones. It has been reported that the height of the elevated degree of 8-16%[2,7,14,18]. This result is in agreement with the result that a significant increase in the height of navicular taping applied when mediation is discussed in this study. In addition, the present study were compared during preliminary mediation effect of elastic and non-elastic tapes that are not covered in the study, the non-elastic taping mediation was applied to navicular because an increase in the bone shown great resilience when the flat foot tape applied to non-elastic tape is believed that the most effective at preventing weight-bearing bones when navicular descent. Robert et al. (2012) showed that 19.3% declines in the inside longitudinal anchor strips change during the stance phase when the biomechanical gait analysis was applied to the Low-dye taping subjects with arch strain. This study is significant in terms of being able to reduce the Low-dye taping and the foot of structural changes takes effect on the increasing height of the foot inside the longitudinal anchor strip with arch strain. Russo et al[16]. measured the foot during walking in the state in which pressing Low-dye taping techniques for the subject. The medial midfoot decreased to 18%, and increase to 26% on the lateral midfoot[19]. Lange et al[17]. is that 10mm on outside of navicular in medial midfoot has increased by 16% when applied to bone descent taping subjects. There are no changes in the mdial midfoot. Further, Vicenzino[11] etc. stated that subjects are excessively negative for pressure medial midfoot and its pronation is reduced to 29% and the lateral midfoot of 52% was reported to be increased. The results were measured in 2 feet long in area in the present study. A showed significance decreases in the length of the reduction in agreement with the results of the application of the tape[2]. There is no significant difference in the length L and length L is not subject to the length of the foot after taping intervention because it is a fixed length change as a line along the inner border of the foot area. The difference in the results is considered as a difference between the sole of the foot pressure to the area measured in the presence or absence of each type tape measure. Morrissey (2000) felt a unique sensation when he applied it to the subject with the shoulder girdle shoulder taping pathology and dysfunction to improve mobility and reduce the pain, it was reported to improve strength necessary to combine a variety of stability retraining, non-elastic tapes affect the length of the muscle fibers and muscle length-tension induces overlapping changes in the curve. Consequently, the actin and myosin filaments thereby increase the cross-link[1]. These results suggested that the change in the relative position of the next joint and made a direct effect on the direction of the muscle fibers. These studies showed no significant difference in the way of the non-elastic tape applied when a subjective is supported to the flat for the results. This study won't be a limit point of measured parameters such as movement locus of the center of gravity and the effect on the other part limited by the medial length and lateral length by measuring the change of the measured foot area. In addition, by directly measuring the foot area of the examiner, the limitations of the instruments used in this study and the lack of accuracy of the measurements for the subjects that might include small in the process. In a future study and consideration given to limited portions that through many subjects, including the walking behavior evaluation analysis, equilibrium analysis, electromyography assessment and research were found to bean effective intervention during the taping is applied to subjects by performing radiography, etc., if necessary.

5. Conclusion

This study was conducted to determine the effect of treatment by applying a Low-dye taping and non-elastic tape. Elastic tape is applied to the subject 14 people falling through the navicular scan through changes in bone height changes and to navicular area. For navicular, the application of non-elastic tape in bone height and length A were the most significant. This allows non-elastic tape

application is considered to be the most effective intervention for subjects with flat foot.

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