

The effects of the application of low-dye taping on paretic side plantar pressure among patients with plantar fasciitis

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Abstract. [Purpose] This study aimed to examine the effects of low-dye taping on paretic side plantar pressure in patients with plantar fasciitis. [Subjects] The 30 patients in this study were randomly allocated to a low-dye taping group (n = 15) or a conservative treatment group (n = 15). [Methods] Both groups received treatment thrice a week for six weeks. BioRescue was used to measure the weight distribution of the patients' paretic side. [Results] Within-group comparison showed that the posterior weight distribution significantly increased among patients in both groups. However, comparison between the two groups showed that the low-dye taping group's posterior weight distribution was significantly higher than that of the conservative treatment group. [Conclusion] These findings show that the application of low-dye taping is an effective intervention for paretic-side plantar pressure among patients with plantar fasciitis.

Key words: Plantar fasciitis, Low-dye taping, Plantar pressure

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INTRODUCTION

The plantar fascia is a hard membrane that connects the heel bone and the toes, and has a thick structure with bonding strength. It plays a complex role in the protection and support of the foot itself, but is also important for support of body weight by the foot¹⁾. Plantar fasciitis is a condition caused by repetitive and excessive tensile stress applied to the plantar fascia, which leads to fibrosis and inflammatory and degenerative changes. It can develop in those who perform excessive exercise all of a sudden. In fact, there are several well-characterized causes of plantar fasciitis: a flat foot, a supinated foot, a tight Achilles tendon, and other conditions that reduce the shock-absorbing power of the feet^{2, 3)}.

Conservative treatment methods for plantar fasciitis include nonsteroidal anti-inflammatory analgesics, local steroid injections, plantar heel cushions, injections with botulinum toxin, insoles, heel cushions, and assistive devices^{3, 4)}. However, such treatment methods have limitations. They

cannot correct the posture of the foot area or apply plantar pressure that is suitable for an individual patient's condition. For such patients, low-dye taping is a conservative treatment method, first devised by Dr. Ralph Dye, which can be used for plantar fasciitis patients who have excessive pronation⁵⁾. Low-dye taping reduces excessive pronation by fixing the subtalar joint axis, which corrects the aforementioned associated problems of plantar fasciitis. Numerous papers have demonstrated the short-term use of low-dye taping for an excessively pronated foot⁶⁾; however, studies describing longer-term application of low-dye taping are lacking. Accordingly, this study was conducted to examine the effects of the long-term application of low-dye taping on plantar pressure among patients with plantar fasciitis.

SUBJECTS AND METHODS

The 30 patients included in this study were those who visited the foot clinic of B Hospital located in Daegu Metropolitan City and were diagnosed as having plantar fasciitis in one foot, after examination by an orthopedist. Patients with inflammatory arthritis, neurological abnormalities, hypersensitivity response to taping therapy, or another disease that triggered gait disorder, were excluded.

The average age, height, and weight of the patients was 38.6 ± 4.1 years, 166.2 ± 6.5 cm, and 65.3 ± 5.1 kg, respectively, in the low-dye taping group (LTG, n = 15), and 37.4

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± 4.5 years, 168.3 ± 6.2 cm, and 66.5 ± 4.8 kg, respectively, in the conservative treatment group (CTG, $n = 15$). All subjects read and signed consent forms, in accordance with the ethical standards of the Declaration of Helsinki. Ethical approval for the study was granted by the Youngdong University institutional review board.

Patients in the LTG received transcutaneous electrical nerve stimulation (TENS, 15 min) and infrared therapy (5 min) for thirty minutes per session before undergoing modified low-dye taping. The method of applying modified low-dye taping was based on the procedure used by Schulthies and Draper⁷). The ordinary low-dye taping method was adapted into a modified method that covered adipose tissues of the heels and could replace fatty pads. This modified method was designed to reduce heel pain during the first few steps taken in the morning, and to decrease shock from the ground to the heel during the stance phase of gait. Ordinary low-dye taping was attached by pulling it from the lateral side to the medial side of the foot three to five times, with each line of tape overlapping, in order to support the medial longitudinal arch. It was then wound around the head of the metatarsal bone across the sole. In addition, the tape was wound along the side of the foot, from the lateral to the medial part of the foot. In order to support the medial longitudinal arch, taping was applied three to five times along the plantar fascia, with taping overlapping slightly from the lateral to the medial part. Then, with the plantar heel as the center, taping was wound from the lateral side back to the center of the sole, and then, from the center of the medial sole, taping was wound to the lateral side and then returned to the center. This procedure was repeated four times. In order to prevent detachment of the tape, it was applied across the center of the sole twice. Once applied, the tape remained on the foot for 12 hours. Patients in the CTG received treatment with TENS (15 minutes) and infrared (five minutes) for 30 minutes per session. Both groups received treatment three times a week for six weeks. For TENS, low frequency (3 pps) and high intensity (100 pps) were alternately applied, and infrared treatment was used between 700 and 2,000 nm and 10 W/cm^2 to the area of the foot that was described as painful by the patients.

BioRescue (RM Ingénierie's, France) was used to examine the anterior weight distribution (AWD) and the posterior weight distribution (PWD) of plantar pressure of the affected foot. BioRescue's baropodometric platform has 1,600 pressure sensors that can evaluate weight load on both feet. Measurement was initiated by having the patient step onto the BioRescue equipment, putting their heels together so that their second toes were situated on the diagonal line of the foot pad, and then maintaining the anterior parts of their feet at 30 degrees. Patients stood in their most comfortable posture on the measurement equipment, with both arms held relaxed beside their trunk. The pressure sensor at the platform measures both AWD and PWD. Measurements were taken when taping was removed, thereby eliminating the emotional placebo effect of taping for the patients.

For the statistical analysis of this study, paired t-tests and independent sample t-tests were conducted for comparison within groups and between groups, respectively. For statistical processing, SPSS 12.0 for Windows was used, and the

Table 1. Comparison of the AWD and PWD between each group

	Group	Pre	Post
AWD (%)	LTG	20.9 \pm 2.2	19.3 \pm 1.2
	CTG	22.4 \pm 1.6	21.7 \pm 1.1
PWD (%)	LTG*	22.2 \pm 1.9	24.6 \pm 1.2 [†]
	CTG*	19.6 \pm 1.2	21.1 \pm 1.0

AWD: anterior weight distribution of the affected foot, PWD: posterior weight distribution of the affected foot, LTG: low-dye taping group, CTG: conservative treatment group, [†]independent t-test, * pair t-test, * $p < 0.05$, [†] $p < 0.05$

significance level was set at $\alpha = 0.05$.

RESULTS

According to the results of this study, the PWD of the LGT and CTG significantly increased in the within-group comparison of PWD, and the LTG's PWD was significantly higher than the CTG's in comparison between the groups after treatment ($p < 0.05$) (Table 1).

DISCUSSION

In this study, we examined the effects of 6 weeks of treatment with modified low-dye taping on the plantar pressure of patients with plantar fasciitis. Radford et al.⁶) reported that the application of low-dye taping led to immediate increase in the height of tuberosity of the navicular bone. Smith et al.⁸) reported that inelastic taping to prevent pronation supported the medial part of the foot, which affected both the middle and the rear foot. Another study showed that application of low-dye taping during the stance phase of gait was associated with significant variation in the degree of changes in angles of eversion and inversion⁹). It has also been reported that the leg joint angle is affected by low-dye taping, with significantly increased flexion angle and adduction angles of the ankle joints¹⁰). Kim et al.¹¹) observed that an excessively pronated foot, which may be the cause of plantar fasciitis, had wide weight distribution in the medial foot, but after application of low-dye taping over 6 weeks, the weight distribution of the medial sole decreased and the height of the navicular bone was elevated. In a study of basketball players who had functional ankle instability during basketball games, inelastic taping was shown to be effective for improving joint range of motion, proprioception, and functional performance ability¹²). According to the results of the present study, PWD significantly increased among patients of both the LTG and CTG. These findings suggest that patients with plantar fasciitis move their weight onto the front of the parietic side due to abnormal posture and pain, but that six weeks of modified low-dye taping and conservative physical therapy resulted in them shifting their weight onto the back side of the foot. In addition, after treatment the LTG's PWD was significantly higher than that of the CTG. This result shows that a 6-week regimen of modified low-dye taping was associated with greater outcomes for plantar fasciitis, including improved correction of the feet

and reduced pain, than was conservative physical therapy. Modified low-dye taping also resulted in shifting of the body weight onto the foot on the paretic side, suggesting that it is effective in normalizing a balanced weight load. Vicenzino et al.¹³⁾ showed that plantar pressure decreased when low-dye taping was applied before walking and jogging. In particular, such a result signifies a decrease in plantar pressure of the medial middle part and medial cochlear of the feet, and that low-dye taping effectively corrected the feet and normalized weight distribution. On a long-term basis, pain and the failure to achieve a proper weight distribution on the lower limbs lead to the recurrence of plantar fasciitis for many patients. Therefore, simultaneous application of conservative physical therapy and low-dye taping at home may be more effective than physical therapy alone. The use of modified low-dye taping is conducive to treating patients with diseases of the neurological system and those with musculoskeletal system disorders.

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