

# Effects of the application of Low-Dye taping on the pain and stability of patients with plantar fasciitis

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**Abstract.** [Purpose] This study examined how the application of Low-Dye (LD) taping affected the pain and stability of patients with plantar fasciitis. [Subjects] The subjects were 30 patients with plantar fasciitis who were divided into two groups: a Low-Dye taping group (LTG, n=15) and a conservative treatment group (CTG, n=15). [Methods] The treatments were performed three times a week for six weeks in both groups. A visual analog scale (VAS) was used to evaluate the pain and stability of patients with plantar fasciitis, and the transfer area of the center of gravity (TAOCOG) was measured to evaluate stability using a BioRescue device. [Results] In the within-group comparison of the VAS, the LTG and CTG values significantly decreased. In the post-test between-group comparison, the VAS pain decreased more significantly in LTG than in CTG. In the within-group comparison of the TAOCOG, the LTG value significantly increased. In the post-test between-group comparison, the TAOCOG value increased more significantly than in LTG than in CTG. [Conclusion] Utilizing Low-Dye taping for patients with plantar fasciitis appears to be an effective intervention method for reducing pain and enhancing stability.

**Key words:** Plantar fasciitis, Low-Dye taping, Stability

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## INTRODUCTION

The number of patients with plantar fasciitis has increased by approximately three times over the last five years, due to the hard roads found in urban areas, the use of high-heeled shoes, occupational environments, and increasing numbers of obese individuals. Plantar fasciitis, which is also called heel pain syndrome, widely covers painful diseases of the foot and is mainly observed among middle-aged patients<sup>1)</sup>.

Regarding the causes of plantar fasciitis, repetitive excessive tensile stress on the plantar fascia causes fibrosis, inflammatory change, and degenerative changes, which can subsequently develop into plantar fasciitis. It can also occur with the sudden initiation of intensive exercise. Known factors that cause plantar fascia injuries include flatfoot, talipes cavus, taut Achilles tendons, and factors that decrease the

impact force of the foot<sup>3, 4)</sup>.

Conservative treatment methods for plantar fasciitis include frames, heel cushions, Botox injections, plantar heel cushions, inner sole treatments, topical steroid injections, and non-steroid anti-inflammatory analgesic drugs<sup>4, 5)</sup>. However, these treatment methods have limitations: they cannot correct the posture of the feet or modify plantar pressure according to patients' conditions. Low-Dye (LD) taping is a conservative treatment method for patients with plantar fasciitis. It was first developed by Dr. Ralph Dye and is now being used for treating patients with plantar fasciitis who have excessive pronation<sup>6)</sup>. The principle behind LD taping is to fix the subtalar joint axis, which consequently reduces excessive pronation correcting patients' foot disorders.

Radford et al.<sup>7)</sup> reported that patients with plantar fasciitis experienced decreased pain in the first step taken after LD taping. Most previous studies have either investigated the instant effects of semi-pronation taping, such as 10–20 minutes after the application, or measured the effects of the tape-applied to the foot in comparison with bare foot<sup>6–9)</sup>. In contrast to these studies assessing the immediate effects, the present study examined the long-term effects of LD taping on the pain and stability of patients with plantar fasciitis.

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## SUBJECTS AND METHODS

Among those who visited the foot clinic of Hospital B located in Daegu, Korea, patients who were diagnosed by an orthopedist with plantar fasciitis in one foot were selected as research subjects for this study. Those with inflammatory arthritis, preceding trauma, neurological anomalies, surgical history of the lower limbs, hyper-sensitive reactions to taping therapy, or a disease that causes gait disturbances were excluded from the sample.

The research subjects were divided into two groups: a Low-Dye taping group (LTG,  $n=15$ ) with an average age of  $35.4\pm 5.03$  years, height of  $169.1\pm 5.7$  cm, and weight of  $64.8\pm 6.0$  kg, and a conservative treatment group (CTG,  $n=15$ ) with an average age of  $35.9\pm 4.0$  years, height of  $170.3\pm 5.6$  cm, and weight of  $64.2\pm 5.4$  kg. Ethical approval for this study was granted by the Institutional Review Board of Youngdong University. All subjects read and voluntarily signed consent forms in accordance with the ethical principles of the Declaration of Helsinki.

LTG received conservative treatment using transcutaneous electrical nerve stimulation (TENS, 15 minutes) and infra-red (5 minutes) in 30-minute sessions, after which modified Low-Dye (LD) tape was applied. To reduce pain that occurred during the first step out of bed in the morning or to decrease the impact felt by the heel during the stance phase of walking, regular LD taping was modified so that the tape could replace the fat pad covering the heel and fat tissue. To support the internal medial arch, LD taping was applied inward from the outside 3–5 times depending on the foot size by slightly overlapping the tape each time. The head part of the metatarsus was wrapped with tape that crossed the sole once. Tape was applied from the external part of the foot toward the internal side along the sidelines. To support the internal longitudinal arch, tape was applied 3–5 times starting inward from the outside sole with a slight overlap. Then, centered at the plantar heel, the tape covered the foot from the external lateral side and then returned to the center of the sole. The tape wrapped the foot again starting from the inner center of the sole toward the outside and then returning back to the center of the sole. This was repeated four times. To prevent the central tape from detaching, the tape was used to cross the sole twice. Wearing time was a minimum of 12 hours. The CTG received TENS (15 minutes) and infra-red (5 minutes) in 30-minute sessions. Alternative stimulation with low frequency (3 pps) and high intensity (100 pps) using TENS was applied. Infra-red was 700–2,000 nm, 10 W/cm<sup>2</sup>; it was applied to the area of the feet where the patient complained of pain. Both groups received these treatments three times per week for six weeks.

To evaluate the intensity of the pain, a visual analog scale (VAS) was used. To examine stability, the transfer area of the center of gravity (TAOCOG) was measured using a BioRescue device (RM Ingénierie, France). The BioRescue device has 1,600 pressure sensors attached to a baropodometric platform. It can assess weight loading, body movement, and left-right balance of the lower limbs using the pressure sensors under both feet. Instead of assessing the extent of the movement by moving the trunk of the body, the TAOCOG measures the maximum weight capable of being moved in a

**Table 1.** Comparison of the VAS and TAOCOG between each group

	Group	Pre-test	Post-test
VAS (point)	LTG**	9.3±0.2	3.8±0.3††
	CTG**	9.2±0.4	7.3±0.3
TAOCOG (mm <sup>2</sup> )	LTG*	3,942.7±286.4	4,197.9±281.3†
	CTG	3,357.3±118.3	3,389.5±184.8

VAS: visual analog scale, TAOCOG: transfer area of center of gravity, LTG: low-Dye taping group, CTG: conservative treatment group, †: independent t-test, \*: pair t-test, ††:  $p < 0.01$ , \*\*:  $p < 0.01$

maximal range when an individual moves the body using the ankles and without losing balance.

For the statistical analysis of the results, the pain and stability of patients with plantar fasciitis were examined using the paired and independent sample t-tests within-group comparisons and between-group comparisons, respectively. SPSS 12.0 for Windows was used for statistical analyses in this study with a significance level,  $\alpha$ , of 0.05.

## RESULTS

The within-group comparison of the VAS showed the LTG and CTG values significantly decreased after the intervention, and the LTG value decreased more significantly than the CTG value as shown by the post-test between-group comparison ( $p < 0.05$ ). within-group comparison of the TAOCOG, the TAOCOG value significantly increased after the intervention, and it increased more significantly in LTG than in the CTG as shown by the post-test between-group comparison ( $p < 0.05$ ) (Table 1).

## DISCUSSION

This study examined how applying modified LD taping for patients with plantar fasciitis for six weeks affected their pain and stability.

Smith et al.<sup>10</sup> reported that inelastic anti-pronation taping positively affects the midfoot and hindfoot because it buttresses the interior. O'Sullivan et al.<sup>11</sup> measured changes in ankle pronation and ankle supination in the stance phase of gait after applying LD taping and observed significant differences. Franettovich et al.<sup>12</sup> examined changes in leg joint ankles and reported significant increases in the flexion angle and the adduction of the ankle joints after applying LD taping.

In the present study, the within-group comparison of the VAS showed the LTG and CTG values significantly decreased, and the LTG value showed a more significant decrease than the CTG value according to the post-test between-group comparison. Considering that the research subjects were patients who experienced severe pain from plantar fasciitis, the results indicate that modified LD taping can be an effective treatment for those who complain of pain due to plantar fasciitis. Radford et al.<sup>7</sup> reported that the short-term application of both LD taping and ultrasonic waves for patients with plantar fasciitis was effective at

reducing pain. These results are consistent with those of the present study. However, since LD taping was only applied for a short period of time in that previous study, no differences in foot correction or function were observed after its application. Moreover, it can be speculated that the application of modified LD taping heightened the fat pad of the plantar heel, which is a major site of complaint in plantar fasciitis. This was effective at reducing pain in the heel, similar to our present study. Hence, the present study's results indicate that conducting conservative physiotherapy and modified LD taping for patients with plantar fasciitis elicits greater amelioration of plantar fasciitis pain than performing conservative physiotherapy alone.

Moreover, the within-group comparison of the TAOCOG showed the LTG value significantly increased, and the post-test between-group comparison showed the LTG value increased more significantly than the CTG value. Before the application of the modified LD taping, weight support and the stability of the affected side of the foot were measured as being low due to pain and foot instability. It appears that the stability of the feet increased due to pain reduction, foot correction, and desirable weight distribution after applying the modified LD taping. Radford et al.<sup>7)</sup> reported that the height of the navicular tuberosity immediately increased after the application of LD taping. Kim et al.<sup>13)</sup> reported that feet with excessive pronation, which can cause plantar fasciitis, showed more weight distribution toward the interior side. The application of LD taping over six weeks resulted in a greater spread of weight distribution on the inner sole along with an increase in navicular height. Moreover, Won<sup>14)</sup> reported that an inelastic taping aid during basketball play was effective at enhancing the range of motion, proprioceptive sense, and functional performance of a basketball player who had functional ankle instability. Hence, this present study's results imply that applying modified LD taping is more effective for reducing foot pain, correcting weight distribution, and improving stability due to foot correction than performing conservative physiotherapy only. Treatment by applying modified LD taping can cause long-term effects

as well as temporary relief from symptoms before using a foot frame for foot correction and pain reduction.

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