Effect of Low-dye taping and Anti pronation Spiral Taping Techniques on Ankle Strength, Gait Performance, and Balance in Adult Females with Flexible Flat Feet.

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로우다이 테이핑과 내전 방지 나선형 테이핑 기법이 유연한 평발을 가진 성인 여성의 발목 근력, 보행 성능 및 균형에 미치는 영향

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Abstract

BACKGROUND: Taping, being more immediate in its effects compared to exercise and relatively cost-effective compared to orthotic devices, and has been utilized as a rational tool for alleviating symptoms of flexible flat feet.

OBJECTIVE: This study aims to investigate the impact of applying low-dye taping and anti-pronation taping on gait and balance in adult women with flexible flat feet

METHODS: The experiment was conducted on 29 female participants with intervals of three days for three different conditions: non-taping, low-dye taping, elastic anti-pronation taping, and inelastic anti-pronation taping methods. Balance, muscle strength, step length, and stride length were utilized as variables among the participants. Repeated Measure Analysis of Variance (ANOVA) was employed.

RESULTS: A significant increase was observed in the case of elastic taping ($p<0.05$). The value of step length was significantly increased when elastic and inelastic taping was applied ($p<0.05$). Stride length showed a significant increase only with elastic taping ($p<0.05$). In the results of measuring the Limits of Stability, it was observed that there was a significant decrease after applying all types of taping compared to before taping application ($p < 0.05$)

CONCLUSIONS: Application of taping can reduce excessive pronation of the foot, have a positive impact on functional foot movements, and enhance dorsiflexion muscle strength, step length, and stride length abilities in women with flexible flat feet.

1. Introduction

The medial longitudinal arch (MLA) plays a role in shock absorption and propulsion during activities like walking or running [1]. Flexible flat feet, where the entire sole of the foot touches the ground when weight is applied, is a common issue associated with the MLA [3, 4]. This condition can lead to excessive foot pronation and negatively impact the windlass mechanism, which is crucial for gait [5, 6, 7].

Flexible flat feet can also affect balance control as the increased ground contact area influences proprioception [8]. Various taping techniques, such as low-dye taping and Anti-pronation Spiral Taping, have been used to alleviate symptoms by preventing foot pronation and providing necessary tension [11~15, 13~17, 16, 17, 16, 18, 19, 20, 21]. This study aims to compare the effectiveness of these taping techniques on gait and balance in adult women with flexible flat feet.

2. Method

This section outlines the methodology used in the study, detailing participant selection, experimental procedures, measurement techniques, and statistical analysis. Participants were 29 female students from Sunmoon University, South Korea, chosen based on the Navicular drop test indicating a pattern of inward vertical arch descent. The study involved four conditions: non-taping, Low-Dye taping, elastic anti-pronation taping, and inelastic anti-pronation taping, conducted over intervals of three days. The Navicular Drop Test assessed flexible flat feet criteria, measuring navicular bone descent in non-weight-bearing and weight-bearing postures. Low-Dye and Anti-pronation Spiral Taping techniques were applied to address medial longitudinal arch support and foot stability. The Dartfish Software and BioRescue program were utilized for gait analysis and balance

measurement, respectively, including the Limits of Stability and the Romberg test. Muscle strength was measured using a hand-held dynamometer. Statistical analysis was performed using SPSS 23.0, employing Repeated Measure ANOVA to evaluate the impact of different taping methods on the participants' gait and balance, with results presented as mean ± standard deviation.

3. Result

The study's results revealed distinct outcomes across different taping techniques applied to adult women with flexible flat feet. Specifically, elastic taping significantly enhanced lower limb muscle strength ($p<0.05$), suggesting its effectiveness in improving muscular performance. While there was a general increase in muscle strength across all foot movements with both taping methods, these increases were not statistically significant ($p>0.05$) except for the case with elastic taping.

In terms of gait analysis, both elastic and inelastic taping significantly increased step length ($p<0.05$), indicating improvements in gait performance. However, a significant increase in stride length was observed exclusively with elastic taping ($p<0.05$), underscoring the specific benefit of elastic taping in enhancing longer gait patterns.

Balance ability, assessed through the Romberg test, showed no significant difference in sway length and velocity before and after taping ($p > 0.05$). Nonetheless, the Limits of Stability measurements revealed a significant decrease in instability after applying all types of taping compared to the pre-taping condition ($p < 0.05$), demonstrating that taping, in general, contributes to enhanced balance and stability.

4. Conclusion

The study concludes that taping techniques, both elastic and non-elastic, are effective in mitigating excessive pronation, improving functional foot movements, and boosting dorsiflexion muscle strength, as well as step and stride length in women with flexible flat feet. The findings indicate that taping notably enhances the width of gait, suggesting its potential as a beneficial therapeutic intervention for individuals with flexible flat feet, aiming to improve their walking patterns and overall foot functionality.

[Table 1] General subject characteristics(N=10).

Characteristics	Mean± SD
Age(years)	21.03±1.21
Height(cm)	161.51±5.85
Weight(kg)	57.87±11.41

[Table 2] Difference of Ankle strength according to Taping Types.

Taping Type	No Tape	Low-Dye	Inelastic	Elastic	F	p
Dorsiflexion	19.36±6.04	20.06±6.81	20.85±8.01	21.41±7.24	4.24	0.02 ab
Plantarflexion	17.26±3.62	19.58±4.83	19.64±6.83	19.69±5.69	2.69	0.08
Inversion	12.38±3.43	12.80±2.80	13.38±3.82	12.28±3.82	0.32	0.47
Eversion	12.33±2.54	13.53±2.31	13.09±2.75	12.60±2.53	2.48	0.07

[Table 3] Difference of Step length & Stride length according to Taping Types

Taping Type	No tape	Low-Dye	Inelastic	Elastic	F	p
step length(㎝)	37.82±7.78	40.03±8.04	40.43±5.63	40.77±7.83	3.87	0.01ab
stride length(㎝)	114.15±18.09	117.64±17.84	116.99±15.67	120.24±17.98	6.43	0.01b

[Table 4] Difference of Step length & Stride length according to Taping Types

Taping Type	No tape	Low-Dye	Inelastic	Elastic	F	p
sway length(㎟)	12.03±3.77	13.67±6.48	12.82±5.42	12.93±5.99	1.17	0.34
sway velocity(㎟)	0.41±0.13	0.46±0.21	0.43±0.18	0.43±0.20	1.64	0.20
LOS(㎝)	10096.06±3251.56	8991.61±3500.21	9038.29±2884.41	9245.77±3019.21	3.84	0.01 abc

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