This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

ORIGINAL ARTICLE

Immediate Effect of Kinesiology Tape on Functionality, Static and Dynamic Balance, Exercise Capacity and Posture in Users of High-Heeled Shoes

Irem Hzelmeli, PhD, PT*
Zubeyir Sari, PhD, PT†
Hasan Hallaceli, PhD, PT‡
Ozden Gokcek, MsC, PT*
Sekan Davut, MD‡

*Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Hatay Mustafa Kemal University, Hatay, Turkey.
†Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Marmara University, Istanbul, Turkey.
‡Hasan Hallaceli, PhD, PT, Orthopedics And Traumatology Department, Tayfur Ata Sokmen Faculty Of Medicine, Mustafa Kemal University, Hatay, Turkey

Corresponding author: Irem Hzelmeli, PhD, PT, Hatay Mustafa Kemal University, School of Physical Therapy and Rehabilitation, Hatay, Turkey. (E-mail: ihzelmeli@mku.edu.tr)

Background: Using high-heeled shoes in daily life affects the stability of walking, body posture, and functionality. So, the present study was aimed to determine the immediate effect of
Kinesio-taping (KT) on functionality, static and dynamic balance, exercise capacity, posture in young women using high-heeled shoes.

Methods: Thirty-seven females who were used high-heeled shoes with a mean age of 20.32±1.37 years were divided into two groups: control (n=20) and study group(n=17). The study group’s both limbs were taped medially, laterally, and dorsally with KT; no application was made to the control group. Balance [Techno Body Postural Line], functionality [vertical jump and functional reach test], exercise capacity [6-min walk test], human body posture [New York Posture Rating Chart] was assessed.

Results: Use of high-heeled shoes was 8(7-9) hours/day, 5(3-5) days/week, 3(2-6.5) years in the study group versus 6(6-8) hours/day, 4(2.5-5.75) days/week for 4(2.5-5.75) years in the control group. Statistical significance in functional reach distance (cm) was found within the control (p:0.010) and study groups (p:0.005) but not between the groups (p>0.05). Stabilometric mono pedal right foot elips area (mm2; p:0.006) and perimeter (mm;p:0.009); left foot elips area (mm2;p:0.016), perimeter (mm;p:0.023) and front/backward standard deviation (p:0.018); dynamic balance area gap percentage (%; p:0.030) were significant within the study group. Posture, vertical jump distance, exercise capacity, stabilometric test results, bipedal closed-eye&opened eye results were similar within and between the groups (p>0.05).

Conclusions: Kinesio-taping has no immediate effect on exercise capacity, vertical jump function, posture, and bipedal static balance but can modulate the functional reach function, static mono pedal leg balance, and dynamic equilibrium. Further studies are recommended to investigate the additive effect of KT with high heels and after 45 minutes, 24 hours and 72 hours.
Using high-heeled shoes is widespread in modern society, and many studies have shown that wearing high-heeled shoes can create injury effects on several structures \(^1\)\(^2\). Moore et al. reported the epidemiology of use high-heeled shoes-related injuries among a nationally representative population of women in the United States. They stated that females aged between 20-29 years were experienced the highest rates of injury with using high-heeled shoes (18.38 per 100,000 females), most injuries occurred in the foot and ankle as sprain and strain \(^3\). Ankle ligament injury was reported in the literature due to the amount of heel height in users of high-heeled shoes. Also, using high-heeled shoes in daily life affects the stability of the walking, body posture, and functionality \(^1\)\(^3\). The stability is essential to prevent falls or injury in gait ‘which is the ability to move with continuous and repetitive motions’ while maintaining the stability of the body \(^4\). The ankle joint provides propulsion for the lower limbs absorbs impact and provides stable support during gait. The ankle joint also affects balance ability to control the body without movement against gravity and keeps the body upright against gravity or maintaining posture during movements \(^5\). Using high-heeled shoes can alter the force dispersion of the foot, and these types of shoes have a negative effect on foot structure. The greater pressures observed might affect the foot segments involved in control in the complete body posture during the standing phase and throughout the motion, so the impairment in the postural balance occurs \(^6\). Bae et al. stated that standing in high heel shoes caused sudden and temporary postural changes due to the forward shift of the center of gravity, but postural changes disappear when high-heeled shoes were removed \(^7\). However, a previous study has shown that the persistence of postural changes with overuse of these shoes was permanently \(^8\).
Kinesio-taping (KT) is a non-operative treatment, often preferred in soft tissue strains such as ligaments, tendons, and muscle tissue. KT increases circulation of the blood, lymph, and tissue fluids, improves reflexive inhibition of the Golgi tendon organ, lightens immoderate tension of the muscles, and supports the stability of the ankle joints, all of which are conducive to the improvement of gait, balance ability, functionality and exercise capacity\textsuperscript{9,10}. Clinically, KT applies to ankle joints to maintain these functions and prevent secondary injury. KT restricts the excessive movement of the joints and improves the proprioceptive feedback mechanism, providing stability to the ankles\textsuperscript{11}. Ankle, knee joint ligament, tendon, etc. although there are publications that assess the effectiveness of KT in soft tissue problems, publications that examine the contribution of the immediate effect of KT on stability in young individuals are limited. Therefore, the present study was planned to determine the immediate effect of KT on functionality, static and dynamic balance, posture, functional exercise capacity in young people using high-heeled shoes. We hypothesized that KT can immediately impact the effect of the performance, static and dynamic balance, posture, and functionality in users of high-heeled shoes.

Methods

Participants

This was a randomized controlled trial comprising 37 healthy females with a mean age of 20.32±1.37 years. Female students who frequently used high-heeled shoes (heels of over 4 cm for over 6 hours/day, at least 2 times/week for at least a year) were divided into two groups: control (n:20) and study group (n:17). The study was conducted at the Mustafa Kemal University, Department of Physiotherapy and Rehabilitation. All participants provided informed
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

consent to include in the study (the Human Ethics Committee of Marmara University, no: 09/2018/024). A physical therapist gathered data about the use of high-heeled shoes and demographic information. The female healthy students were randomly assigned to one of the two groups using an online random allocation software program (Medcalc Software Inc., Version 19.6.3). The CONSORT flow diagram of the study was shown in Figure 1.

Participants with musculoskeletal injuries or a history of falling, who had a history of flu or cold at the time of the study, were using any medication that affects balance, having a body mass index (BMI) higher than 30 kg/m², or who had any orthopedic or neurologic disorders were excluded.

Techno Body Easy Prokin portative device (PK 200 -Prokin System Bergamo, Italy) measured the static and dynamic balance. Tests were explained to the participants. Data were saved (height, weight, age) and the device was calibrated. During these measurements, we positioned the participants for the optimum position to center both feet barefoot on the origin by referring to the lines on the x and y-axis on the platform (Figures 2, 3, 4, 5, 6). We asked them to stand and hold their hands free.

**Static balance tests**

Static balance tests were stabilometric test, stabilometric compared bipedal closed/opened eye, stabilometric compared mono pedal (right/left foot). All the trials were 30 sec. Participants performed the tests on the stability easy platform. The implemented software (Version 1.2.2) calculated the observed variables. All the stabilometric assessments were calculated ‘ellipse area, perimeter, front-back, and mediolateral standard deviation results. It defines the ellipse
area as a 95% confidence ellipse for the mean of the CoP (center of pressure) anterior, posterior, medial, and lateral coordinates^{12}.

The PK 200 Dynamic balance uses the Pro-Kin system software, which is very simple and intuitive. Provided with several assessment programs, it enables the operator to understand exactly the proprioceptive conditions of the patient being treated. The Participants performed the dynamic tests in a bipedal posture (figures 5, 6) with the easy mode in 30 sec. The optimum position was set to be the same as the static test, with the feet open at the shoulder width and the stand positions of the feet at the same distance as the origin point, referring to the lines on the x and y-axis. The easy type was used for the bipedal equilibrium test^{12}.

Dynamic equilibrium balance was assessed by the result of perimeter Length^{2} (the number of total degrees done), area gap percentage [the percentage of the area included in the drawn on flat view trace regarding the reference circle (%)], medium speed [{the average number of covered degrees for second (°/%)}, medium equilibrium center anterior-posterior axis [{the average among the values reached on backward-forward axis (°)}], medium equilibrium center [the average among the values reached on medium- lateral axis (°)]. Disequilibrium dynamic balance tests included front/right standard deviation, back/left standard deviation, and distance medium error (%)^{12}.

Functionality was assessed with the vertical jump test, functional reach test. For the vertical jump test, the participant stands next to a wall on two feet. The individual’s fingers were covered in chalk dust, and they then extended the arm, leaving a mark on the wall. Remaining in the same position, the individual jumped with all her power and leaves a mark at the highest point she could touch. The distance between these 2 points gave the individual
vertical jump height. For the functional reach test, we pasted a measuring tape on the wall at shoulder height. We asked the individual to extend as far forward as possible while maintaining balance and then return to the starting position. We recorded the functional reach distance with both feet in contact with the ground. The test was repeated for the right and left sides, and the distance reached without losing balance was recorded. The measurements were repeated three times, and we recorded the averages of the measurements.

The 6-minute walking test which reflects the exercise capacity was performed in an indoor corridor at least 30 m in length. The distance (m) that the person walked along the straight corridor in 6 min was recorded.

Posture changes that may occur in 13 different parts of the body are analyzed and scored with New York Posture Rating Chart. Accordingly, if the person’s posture is correct, five (5) points are given, three (3) points if moderately impaired, and one (1) if severely impaired. The total score obtained as a result of the test is 65 minimum 13.

Taping procedure

Both limbs of the study group were taped medially, laterally, and dorsally with KT (figure 7, width: 5cm) by the same physical therapist with > 10 years’ taping therapy experience. The control group received no KT application. Taping was started by tapping the maximally extended tibialis anterior muscle with a 5 cm elastic tape. Then the elastic tape applied to the medial and lateral parts of the calf in a straight direction, starting from the lower both medial and lateral malleolus for the calf muscle. KT was applied by stretching approximately 30-40% to create the desired mechanical effect.
The evaluations related to functionality, static and dynamic balance, posture, exercise capacity were carried out at the baseline and 45 min after the tape application. The same physical therapist conducted all evaluations. The groups were evaluated twice (pre-test and post-test) at a 45-minute interval.

Statistical Analysis
The statistical software SPSS 20.0 (SPSS) was used for statistical analysis. The variables were investigated using histograms, probability polls, and Kolmogorov–Smirnov/Shapiro–Wilk’s test to determine whether they were normally distributed. Descriptive analyses using means and standard deviations and comparisons of variables using Paired sample t-test or Wilcoxon test were presented. The student’s t-test or the Mann–Whitney U test was used to compare parameters between the control and study groups. A two-way ANCOVA test was used to compare the effect of study and control groups on functionality, exercise capacity, balance, and posture. The statistical significance level was set at α = 0.05.

G*Power package software program (G*Power, Version 3.1.9.4, Franz Faul, Universität Kiel, Germany) was used to calculate the required sample size for the study. According to a previous study, it was calculated that a sample consisting of 22 subjects (11 per group) was needed to obtain 80% power with d= 1.121864 effect size, α=0.05 type I error, and β=0.20 type II error.

Results
The general characteristics of the participants are shown in Table 1. The use of high-heeled shoes in the study group was 8(7-9) hours/day, 5(3-5) days/week, for 3(2-6.5) years with 8(5.5-
8.5) heel height (cm) and, 6(6-8) hours/day, 4(2.5-5.75) days/week, for 3(2-5) years with 4(4-6) heel height (cm) was in the control group (Table 1).

Although the vertical jump distance was not statistically significant within and between the groups (p>0.05), there was a statistically significant within the control (p:0.010) and study (p:0.005) groups in terms of functional reach distance (cm) (Table 2). Exercise capacity and posture assessment were not statistically significant within and between the groups (p>0.05); Table 2).

Stabilometric, stabilometric compared bipedal closed eye/opened eye results were not statistically significant between the groups, and also within the study group (p<0.05; Table 2). Stabilometric compared mono pedal elips area (mm²; p:0.016), perimeter length (mm; p:0.009) were statistical significant in right foot and ellipse area (mm²; p:0.016), perimeter (mm; p:0.023) FBSD (p:0.018) in left foot after Kinesio-taping within the study group (Table 2). Dynamic test results were statistically significant: only in area gap percentage(%; p:0.030) within the study group also not between the groups (Table 2; p<0.05).

Discussion

The present study assessed the acute changes in human balance, exercise capacity, human body posture, and functionality after KT application in young females who frequently use high-heeled shoes. The results of this study showed that KT can be immediately effective in mono pedal leg balance and functional reach, which is important for daily life physical activities. However, it failed to improve vertical jump distance, exercise capacity, posture, stabilometric results, bipedal closed-eye, and bipedal opened-eye results. Furthermore, between-group
analyses of the mean differences showed that there were no difference changes after KT application.

The putative mechanisms underlying the results of this study are related to the physiological effects of KT application. Proprioception 'the ability to sense the position and movement of a limb in space' is the combination of joint position sense, sense of muscular attempt and tension is an essential contributor to joint coordination, maintenance of muscle stiffness and help to produce the natural motions for appropriate performance. Since the participants were tested 45 minutes after the intervention, this treatment could have a modulatory effect on sensorimotor integration and motor facilitation, corticospinal projection to the foot muscles\textsuperscript{19-21}. The sensory input might modulated motor cortex plasticity. This is another possible mechanism that might have played a role in the motor adaptation to the interventions. Also, It is known that KT stimulate proprioception, inducing an illusory perception of movement\textsuperscript{22-25}. Therefore, the role of perception of movement and motor imagery with acute KT applications should investigated.

A previous study showed that standing in high-heeled shoes causes immediate and temporary postural changes because of the modification of the center of gravity. High heels instigate the primary elevation of the calcaneus bone associated with the flexion of the tibiotalar joint and changing the alignment of the ankles causes elevation and forward displacement of the center of gravity. This change in the ankle joint affects the biomechanics of the body, ultimately resulting in postural imbalance\textsuperscript{26}. There was an improvement in posture in the study group after KT but not statistically significant in the present study. Postural changes, in our opinion, could be evaluated with high heels.
Weitkunat et al. examined the effects of the application of KT over the ankle joints of healthy participants in their gait and balance ability. They found that after application of the ankle joint taping, gait velocity significantly increased and there were statistically significant differences in balance variables. They investigated the immediate effect of KT, similar to our study. Contrary to this study we found statistical differences in mono pedal right and left foot static balance and area gap percentage in the dynamic balance after KT. The postural control system needs to integrate sensory information to estimate the spatial position of the body to generate suitable force and control the body position and because of this control of the mono pedal leg can change with the musculoskeletal system. We think this result may be because of the difference in the lower extremities’ muscle strength of the individuals. Lower extremity peripheral muscle strength could be evaluated and added to the study.

In a study, Lee and Lee investigated the immediate effect of KT in the dynamic balance with the Star Excursion Balance Test in soccer players, while we tested using the techno body postural line. They used different tape methods for the ankle and found significant increases in the anterior and posterolateral reached distances. Contrary to this study, we didn’t find any difference in anteroposterior or mediolateral dynamic balance results after KT. We think the reason why our study results differed from Lee’s research was because of different anthropometric characteristics. These parameters may be the topic of our future study.

Jackson et al. investigated whether KT could help with balance deficits associated with chronic ankle instability. Unlike our study, the participants in the KT group had 4 strips applied to the foot and lower leg. In this previous study differences between the groups were assessed at 48 hours post-application of the tape. In contrast, we assessed the immediate effects of KT on young women. One major difference between these studies and ours was the time the KT
remained on the skin before balance testing. Bicici et al. assessed balance immediately after the KT application, whereas Hettle et al. left the KT on for 20 minutes. Both groups concluded that KT did not affect balance. Shields et al. left the tape on for 24 hours, and the investigators found minor balance improvements but concluded that these were not clinically meaningful. There are positive results of publications that reviewing the immediate or 3-4-day effects of KT on balance, joint stability, and exercise. In contrast to these studies, we left tape for 45 minutes similar to Aytar et al.’s study. We found minor balance improvements (mono pedal leg balance (R&L), area gap percentage of dynamic balance. We thought these different applied KT times can show the physiologic effect time of KT.

Hapsari and Xiong investigated functional reach time and realized that time increased for tests at different heel heights. They found that different heel heights could negatively affect the functionality and balance. Contrary to the previous study, we assessed the functionality, posture, and balance without shoes. Ankle stability has been negatively affected before the KT in our study. In the present study, although the participants in the control group are classified as high-heeled shoe users, it can be seen how high-heeled shoe use varies in use time and size of the heel affect the static and dynamic balance, functionality, posture, and exercise capacity according to the study group.

Nakajima and Baldridge observed that the application of KT to the ankle did not change vertical jump height, but increased the dynamic postural control in healthy subjects. Similar to this study, we could not found statistically significant differences in the vertical jump tests but we found in area gap percentage results of equilibrium balance. These differences may concern the musculoskeletal system.
Kertenegera et al. stated that taping the ankle affected performance, improved stair descent, and increased self-efficacy and perceived confidence in dynamic tasks. Their findings were that taping might reduce apprehension without affecting functional performance in those with functional ankle instability and permitted continued physical activity or participation in sport. As with their findings, we found that KT immediately affected only some functional performance and balance parameters after application. But there was no statistical difference in 6-min walk test distance within after KT too in our study. In contrast, previous study researchers claimed that the use of Kinesio taping may help to improve posture control as well as exercise patterns and instantly produce immediate effects on walking and balance in patients with foot drop after stroke. We think KT can affect balance, postural control, and well-being while walking through a long-term application.

This study had several limitations. First, the lack of application of the Kinesio taping to the control group. To increase the evidence level in this study, the control group could tape with sham tape. Second, our study focused on initial effects; we could repeat measurements after 45 minutes, 24 hours, and 72 hours to see the instant effect of Kinesio taping. Third, we did not measure the immediate effects of Kinesio taping with wearing high-heeled shoes on the balance device.

In conclusion, the positive effects of KT on body balance, joint stability, and exercise applications were mentioned in previous studies. Present study is one of the rare studies showing the immediate effectiveness of KT in users of high-heeled shoes. It is now possible to explore motor cortex plasticity in humans using noninvasive brain stimulation techniques. So, there is a need for future more studies aimed to investigate mechanism underlying of immediate KT applications. Also, the role of perception of motion and motor imagery should
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

investigated in KT. A pilot study with sham-kinesio taping can be designed. Further studies are recommended to investigate the additive effect of KT with high heels and after 45 minutes, 24 hours and 72 hours.

Acknowledgments: The authors would like to thank all participants and centers that participated in this study.

Financial Disclosure: None reported.

Conflict of Interest: None reported.

Dual Publication: The abstract was presented at the 1st International Congress On Physiotechnotherapy (Icptt) conference on May 09-13 2018 Sarajevo, Bosnia, and Herzegovina.

References


This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.


This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Table 1. Characteristics of participants

<table>
<thead>
<tr>
<th></th>
<th>Study group (n:17) X±SD/median(IQR)</th>
<th>Control group (n:20) X±SD/median(IQR)</th>
<th>Mean difference [%95CI]/U</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>20(19-21)</td>
<td>21(19-21)</td>
<td>142</td>
<td>0.381</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165(161-165)</td>
<td>135(163-169)</td>
<td>147</td>
<td>0.478</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>56.17±4.83</td>
<td>61.95±6.03</td>
<td>5.77([-9.47]-[2.07])</td>
<td>0.003</td>
</tr>
<tr>
<td>Frequency of use of high-heeled shoes (hours/day)</td>
<td>8(7-9)</td>
<td>6(6-8)</td>
<td>93.50</td>
<td>0.016*</td>
</tr>
<tr>
<td>Frequency of use of high-heeled shoes (days/week)</td>
<td>5(3-5)</td>
<td>4(2.5-5.75)</td>
<td>149</td>
<td>0.514</td>
</tr>
<tr>
<td>Frequency of use of high-heeled shoes (years)</td>
<td>3(2-6.5)</td>
<td>3(2-5)</td>
<td>168</td>
<td>0.950</td>
</tr>
<tr>
<td>Heel height (cm)</td>
<td>8(5.5-8.5)</td>
<td>4(4-6)</td>
<td>55</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

Independent Samples Test, Mann–Whitney U test: p<0.05
Table 2. Comparison of the Functional Exercise Capacity, Static and Dynamic Balance, Posture and Functionality Between the Groups

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Study Group</th>
<th>Within the group p</th>
<th>Between the groups p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test X±SD/Median (IQR)</td>
<td>Post-test X±SD/Median (IQR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-min walk test (m)</td>
<td>552.06±53.57</td>
<td>546.00±40.10</td>
<td>0.613</td>
<td>0.883</td>
</tr>
<tr>
<td>6-min test %</td>
<td>65.17±6.93</td>
<td>64.45±5.37</td>
<td>0.694</td>
<td>0.856</td>
</tr>
<tr>
<td>Vertical jump distance(m)</td>
<td>26.47±5.11</td>
<td>26.54±5.25</td>
<td>0.882</td>
<td>0.158</td>
</tr>
<tr>
<td>Functional reach (m)</td>
<td>39.34±5.40</td>
<td>40.02±4.97</td>
<td>0.010*</td>
<td>0.005*</td>
</tr>
<tr>
<td>Newyork Posture</td>
<td>48.71±7.48</td>
<td>48.85±7.67</td>
<td>0.387</td>
<td>0.051</td>
</tr>
</tbody>
</table>

Stabilometric Test

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Study Group</th>
<th>Within the group p</th>
<th>Between the groups p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipse Area(mm 2)</td>
<td>230.29±99.21</td>
<td>188.46±103.22</td>
<td>0.112</td>
<td>0.433</td>
</tr>
<tr>
<td>Perimeter (mm)</td>
<td>202.27±63.21</td>
<td>196.44±59.22</td>
<td>0.312</td>
<td>0.336</td>
</tr>
<tr>
<td>FBSD</td>
<td>2.45±0.70</td>
<td>2.44±0.71</td>
<td>0.264</td>
<td>0.456</td>
</tr>
<tr>
<td>MLSD</td>
<td>4.53±1.83</td>
<td>4.29±1.78</td>
<td>0.144</td>
<td>0.257</td>
</tr>
</tbody>
</table>

Bipedal CE

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Study Group</th>
<th>Within the group p</th>
<th>Between the groups p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipse Area(mm 2)</td>
<td>268.42±192.05</td>
<td>225.81±113.72</td>
<td>0.070</td>
<td>0.375</td>
</tr>
<tr>
<td>Perimeter (mm)</td>
<td>224.47±79.77</td>
<td>219.55±79.73</td>
<td>0.527</td>
<td>0.372</td>
</tr>
<tr>
<td>FBSD</td>
<td>2.96±1.75</td>
<td>3.06±1.71</td>
<td>0.865</td>
<td>0.355</td>
</tr>
<tr>
<td>MLSD</td>
<td>4.70±1.56</td>
<td>4.69±1.77</td>
<td>0.458</td>
<td>0.639</td>
</tr>
</tbody>
</table>

Bipedal OE
<table>
<thead>
<tr>
<th></th>
<th>Ellipse Area (mm²)</th>
<th>Perimeter (mm)</th>
<th>FBSD</th>
<th>MLSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopedal R</td>
<td>183.87±104.21</td>
<td>196.67±89.08</td>
<td>0.726</td>
<td>433.41±348.11</td>
</tr>
<tr>
<td></td>
<td>176.29±75.98</td>
<td>183.83±79.21</td>
<td>0.694</td>
<td>224.75±60.95</td>
</tr>
<tr>
<td></td>
<td>2.27±0.87</td>
<td>2.57±0.89</td>
<td>0.563</td>
<td>3.89±1.97</td>
</tr>
<tr>
<td></td>
<td>3.97±1.50</td>
<td>4.13±1.58</td>
<td>0.706</td>
<td>5.73±1.87</td>
</tr>
<tr>
<td>Monopedal L</td>
<td>1466.95±663.57</td>
<td>1507.02±763.38</td>
<td>0.884</td>
<td>1597.25±667.48</td>
</tr>
<tr>
<td></td>
<td>647.57±161.23</td>
<td>622.19±173.84</td>
<td>0.439</td>
<td>555.60±170.40</td>
</tr>
<tr>
<td></td>
<td>10.36±1.27</td>
<td>10.11±0.97</td>
<td>0.175</td>
<td>10.35±1.13</td>
</tr>
<tr>
<td></td>
<td>6.50±2.07</td>
<td>6.22±1.97</td>
<td>0.311</td>
<td>7.46±2.53</td>
</tr>
<tr>
<td>Dynamic Balance Tests Results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front/right SD</td>
<td>3.66±1.14</td>
<td>2.96±1.06</td>
<td>0.407</td>
<td>3.23±0.83</td>
</tr>
<tr>
<td>Backward/left SD</td>
<td>2.92±1.27</td>
<td>2.84±1.44</td>
<td>0.395</td>
<td>3.29±1.10</td>
</tr>
<tr>
<td>Distance medium error %</td>
<td>3.13±1.43</td>
<td>3.42±1.56</td>
<td>0.623</td>
<td>3.05±1.41</td>
</tr>
<tr>
<td>Perimeter length %</td>
<td>308.61±67.35</td>
<td>315.55±80.12</td>
<td>0.617</td>
<td>353.29±65.57</td>
</tr>
<tr>
<td>Area gap percentage %</td>
<td>10.67±9.94</td>
<td>10.16±9.66</td>
<td>0.918</td>
<td>10.27±7.94</td>
</tr>
<tr>
<td>Medium speed / %</td>
<td>10.68±2.41</td>
<td>10.53±2.76</td>
<td>0.395</td>
<td>11.99±2.10</td>
</tr>
<tr>
<td>Medium equilibrium centre (AP) *</td>
<td>0.90±1.05</td>
<td>0.91±0.85</td>
<td>0.510</td>
<td>1.26±0.86</td>
</tr>
<tr>
<td>Medium equilibrium centre (ML) *</td>
<td>0.76±0.73</td>
<td>0.58±0.38</td>
<td>0.227</td>
<td>0.79±0.70</td>
</tr>
</tbody>
</table>
FBSD: Forward-backward standard deviation, ML: Medium-lateral, AP: antero-posterior, SD: standard deviation, OP: Open eye, CP: Close eye, R: Right, L: Left. Ancova test; p<0.05
Figure 1. Flow chart of the randomized controlled trial in accordance with the CONSORT statement.
Figure 2. Results of static stabilometric assessments
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Figure 3. Stabilometric assessments
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Figure 4. Platform of stabilometric assessments
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Figure 5. Dynamic balance assessment
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Figure 6. Dynamic balance unstable platform
This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Figure 7. Kinesio taping application