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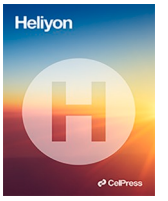

Research article

From injury to rehabilitation: How kinesiology taping helps patients with first metatarsophalangeal joint sprain (turf toe) in pain reduction, gait parameters and functional ability improvement. A randomized clinical trial

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ABSTRACT

Objective: Turf toe is a common sports injury that may affect mobility and functional ability. For complete recovery, rehabilitation modalities are required to overcome these issues. This study investigated whether kinesio taping (KT) would reduce pain, improve gait performance, and enhance the functional capacity of turf toe patients undergoing physical therapy.
Methods: sixty patients with grade II turf toe (age; 25–30 years) assigned randomly into three treatment groups; KT applied alongside an exercise program conducted three times/week for 12 successive weeks. (KT group; n = 20), placebo taping plus exercise (Placebo group; n = 20), or exercise only (Control group; n = 20). Pain, gait parameters, and functional ability assessed using VAS, 3D gait analysis, and 6MWT respectively pre- and post-treatment.
Results: There was a significant post-treatment decrease in VAS score in the KT group lower than the control or placebo group and a significant increase in 6MWT distance in the KT group higher than the control or placebo group ($p < 0.001$). Additionally, there was a significant post-treatment increase in step length, stride length, cadence and velocity of KT group higher than control and placebo group ($p < 0.05$). There was no significant difference in gait parameters between control and placebo groups post treatment ($p > 0.05$).
Conclusions: The findings of the study demonstrated that KT is a useful complementary modality to exercise in patients with turf toe, as it may result in more favorable improvements to pain, gait

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characteristics, and functional abilities. Further studies should be conducted to assess the long-term effects, different KT application methods, and tailored treatment protocols on turf toe.

1. Introduction

Turf toe refers to a sprain of the metatarsophalangeal (MTP) joint of the big toe. Strong upward push on the big toe while the rest of the foot is still leading to hyperextension of the ligament beneath the toe, causing a sprain of the plantar capsule ligament. The injury results from using flexible shoes in conjunction with a hard artificial surface [1]. The majority of turf toe injuries happen from hitting the ground or slamming into another player in athletes [2]. Essentially, this results in an axial strain on the ankle with fixed equines and a hyperextended MTP joint. The plantar capsular ligamentous complex that supports the hallux MTP joint is attenuated or disrupted because of the load driving the joint into hyperextension [3].

Turf toe injuries are frequently broken down into three grades, starting with grade I, which is a less serious injury as there is just stretching or sprain of the plantar complex with a very small micro-ligament tear, but the MTP joint is still functioning [4]. A partial tear of the plantar complex, diffuses discomfort, and the patient can hardly bear weight on the affected joint in grade II turf toe [5]. Complete plantar complex tears, instability, significant soreness and swelling over the first MTP joint, frequent varus-valgus instability, and a loss of hallux flexion represent grade III injuries [6].

Discomfort and pain were the first signs that the patient would report, then stiffness of the MTP joint and possible swelling over a day. Ecchymosis can appear within a 12- to 48-h time frame. Turf toe not only causes unbearable pain right away, but it can also decrease the joint flexibility, causing the joint to become stiff and more prone to arthritis over time [6]. The big toe may be injured again more frequently in the future because of the joint's restricted mobility. Also, patients may have weakness in push-off, crouching, and pivoting, premature heel rise, and decreased time of stance phase on the affected limb [7].

In the early stages of treatment, all degrees of injury are comparable. Pain and swelling can be lessened by using rest, ice, compression, and elevation. Additionally, anti-inflammatory drugs can be used to treat acute symptoms. It has been recommended that Grade I injuries be handled conservatively, with early rehabilitation and closed reduction [8]. At the same time, grade II injuries can be symptomatically treated with the addition of custom orthotics, a walking boot, a protected weight-bearing device, casting, and a rehabilitation program. In contrast, surgical reduction is recommended for Grade III injuries [9].

The use of Kinesiology Taping (KT) in clinical practice as an alternative to conventional taping and bracing techniques has recently piqued the interest of health professionals for treating a range of conditions, including musculoskeletal damage, oedema, sports injury, and joint instability [10]. The basis for the use of KT is its ability to enhance circulation, reduce pain or other aberrant sensations, promote muscle activity, clear lymphatic fluid buildup or skin hemorrhages, and adjust joint misalignments. KT Tape can help patients with turf toe by providing therapeutic stability and support while maintaining a healthy range of motion [11].

Even though turf toe is a prevalent condition, there is a notable lack of comprehensive studies investigating effective therapies, particularly non-invasive interventions, for pain reduction, gait parameter improvement, and better functional capacity in turf toe patients. This study seeks to overcome that gap and provide significant information to the clinical and sports medical communities, offering a novel possibility for managing turf-toe. So, the primary objective of this study was to assess the effectiveness of Kinesiology taping in relieving pain related to first metatarsophalangeal joint sprain (turf toe); secondary objectives were to evaluate the impact of Kinesiology taping on gait parameters such as step length, cadence, and velocity to understand how it influences the biomechanics of walking, and identify changes in overall functional capacity, as a result of the intervention.

Intriguingly, the emergence of KT as an alternative to traditional techniques offers a novel avenue for intervention. KT, known for its ability to enhance circulation, reduce pain, and promote muscle activity, presents a potential solution for turf toe patients by providing therapeutic stability and support while maintaining a healthy range of motion [10,11]. However, the literature lacks comprehensive studies assessing the efficacy of KT in treating turf toe, highlighting the need for further investigation.

The findings of this study could increase our understanding of the efficacy of kinesiology taping as an intervention for turf toe. Patients, especially athletes, frequently have difficulties healing from turf toe, affecting their performance and career length. Positive findings from this study could lead to more effective rehabilitation procedures, potentially reducing healing durations and allowing players to return to their respective sports with better confidence and a lower risk of re-injury. Furthermore, the findings of the study will provide useful insights that may drive future research directions in sports medicine and rehabilitation. Researchers can build on these findings by investigating further aspects of kinesiology tapping or comparing its efficacy to other therapies, thereby contributing to the continual evolution of best practices in the area.

2. Materials & methods

2.1. Study design

This randomized controlled clinical trial was carried out between September 2021 and August 2022 at Prince Sattam bin Abdulaziz University (PSAU), Saudi Arabia, in the Outpatient Clinic of the College of Applied Medical Sciences. The study considered the ethical standards of the Declaration of Helsinki of 1964 and was approved by the PSAU Physical Therapy Research Ethics Committee (No: RHPT/0021/0063). The approval process included a thorough assessment of the research protocol to ensure the rights, well-being, and privacy of participants. Patients were informed of the study's protocols and required to sign informed consent forms. Informed consent

protocols were created to offer participants clear information about the study, its objectives, potential risks, and benefits, as well as their freedom to withdraw at any time without consequence. Furthermore, any ethical issues that emerged during the study were reported and handled as soon as possible in accordance with ethical standards. Pain and gait parameters were evaluated before and after the intervention by an independent researcher who was not knowledgeable of the treatment allocation. The following identifier has been assigned to the study on ClinicalTrials.gov: NCT05982431.

2.2. Participants

Sixty patients of both sexes with grade II turf toe aged 25–30 years joined in this study. They were assessed for eligibility to participate in the study by a member of the research team. They have been recruited from the Orthopedic clinical of King Khaled Hospital, the university hospital and other referral hospitals in Al-Kharj, Saudi Arabia. The inclusion criteria for the study comprised athletes with grade II turf toe, medically stable, not in a state of active exacerbation, able to bear weight on the affected foot, had foot pain for more than a month prior to enrollment, did not have persistent, incapacitating pain, and had a doctor's note approving their decision to stop taking painkillers during the research, the patient's general health, including factors such as blood pressure, heart rate, and respiratory function, should be within normal ranges. However, the participants were excluded if they had any surgical intervention before, range of motion limitation in the ankle joint, inability to exercise, systemic disease, or any other orthopaedic problem at ankle joints. These criteria were systematically applied during the screening process to identify eligible participants. Participants and therapists were blinded regarding group assignment.

Participant were assigned randomly to the control, placebo, or KT group following a simple randomization procedure. A web-based research randomizer (http://www.randomizer.org/index.htm) was used to create three equal balanced subsets of the participants' consecutive numbers between 1 and 60, and the resulting subsets were then randomly assigned to the treatment groups [12]. They were randomized into three equal groups (n = 20), exercise program (control group), placebo KT plus exercise (placebo group), and KT plus exercise (KT group). The setting and parameters used in this randomization were: the number subsets as it was three subsets, the range of consecutive numbers were between 1 and 60, group assignment and group allocation into the three equal groups (control, placebo, and KT groups). All 60 patients completed the study procedures.

2.3. Assessment

The main outcome was the visual analog scale (VAS), which measures the intensity of pain. Nevertheless, functional capacity was assessed using a 6-min walk test, and gait characteristics were measured with the VICON 3D motion analysis system as secondary outcomes.

2.3.1. Pain

A 10-cm VAS score was employed as a pain assessment instrument; it is a well-established and widely accessed method. It is a horizontal line 10 cm in length; the line's left end (0 cm) was labelled "No Pain," while the line's right end (10 cm) was labelled "Worst Pain Experience." The participants used the VAS score after they received precise, standardized instructions. They were told that the pain scale indicated a range of pain levels, from the least amount of pain to the most excruciating suffering possible. Participants were instructed to cut the line at a place that represented the level of pain they felt [13].

2.3.2. Gait

Gait data were recorded using the VICON 3D motion analysis system's which comprises twelve high-speed computerized cameras manufactured by (Vicon Motion Systems Ltd., based in Oxford, UK), The cameras operated at 120-Hz sampling rate, ensuring a detailed and accurate capture of motion and two force plates (Kistler Instrument AG, Switzerland), the force plates operated at a rate of 1000 Hz, provided high-frequency data capture, enabling precise measurement during gait analysis. Using double-face sticky tape, 15 reflective markers (10 mm in diameter) were placed on well-known anatomical landmarks. One on the sacrum and bilaterally on the following points: the middle tibia, the lateral aspect of the knee, the mid-thigh, and the anterior superior iliac spine (the middle point between the knee marker and the lateral malleolus), and heel and forefoot between the second and third metatarsal heads [14]. Prior to the test, all patients received instructions on how it would be conducted. Three trials were recorded using a mid-gait procedure, with 2 min between each attempt. They were required to walk bare feet on their normal pace along a 10-m walkway. For this study, we collected and analyzed some spatiotemporal characteristics of gait (step length, stride length, cadence, and velocity).

2.3.3. Functional ability assessment

The 6-min walk test was used as a reliable method to evaluate participants' functional ability according to the guidelines of the American Thoracic Society [15]. Accepted as a submaximal test that has been demonstrated to be useful and well tolerated in both healthy individuals and patients with musculoskeletal disorders [16]. Prior to test, participants were instructed about the test's objective and shown the start and endpoints of 50- meter route. The participants were encouraged increase as much as possible the distance walked within 6 min. The designated assessor accompanied them and used a timer to track the length of the walk. To guarantee consistency, strict limits were maintained during the test, prohibiting any type of running, jumping, or hopping. Consistently, all participants underwent the same standardized test, which contributed to the uniformity and reproducibility of functional ability assessments across the study cohort.

2.4. Intervention

2.4.1. Traditional physical therapy program

All groups underwent a 60-min exercise program, three times a week on alternate days for 12 successive weeks, in a controlled and monitored setting with carful adherence to planned time, intensity and frequency. All patients were given a clear and consistent instructions and there were regular check-ins to address any issues or challenges which are included in Table 1 [16–19].

2.4.2. Kinsio taping

One full strip of KT tape and one half-length strip were needed for the KT application (Kintex brand). While seated or lying flat, the toe was placed in extension or dorsiflexion (with the toe moved as close to the shin of the tibia) as shown in Fig. 1. Apply the anchor for the first vertical strip (long strip) with no stretch between the big toe and second toe, then apply 50 % stretch from the top of the big toe to the heel along the back of the heel again with no tension on the opposite end. taking the second horizontal small strip between big toe and second toe, apply a50 % stretch from the top of the big toe follows by laying down the ends underneath the toe diagonally with no tension [20].

For the placebo group, the same tape was applied in the same way between the previously mentioned anatomical landmarks, but with 0 % tension. The tape was changed every two days before exercises while patients were attending the physical exercise session.

2.5. Sample size

Using the G-Power software (version 3.1.9.2; Franz Faul, Universitat Kiel, Germany), a priori power analysis was used to establish the appropriate sample size. The analysis was based on independent means and pooled standard deviation of VAS score, which were obtained from a pilot study (unpublished) including five participants with grade II turf toe who received the same interventions employed in the present study and revealed that the required sample size for this study was 52 participants. The calculation was made with F tests-MANOVA: repeated measures, within-between interaction, $\alpha = 0.05$, $\beta = 0.2$, effect size = 0.2. To account for the drop-off, however, a larger sample size of 60 participants (20 per group) was used to adjust for potential dropout rates.

2.6. Pre-analysis plan

In this pre-analysis plan, we outlined our intended analyses and statistical methods to ensure transparency and provide clarity on our planned approach by using the statistical package for social studies (SPSS) version 25 for Windows (IBM Corp., Armonk, NY, USA). First, we planned to conduct descriptive statistics to present a comprehensive overview of sample characteristics using the ANOVA test, the Shapiro-Wilk test, and Levene's test for homogeneity of variances. For outcomes (pain, gait characteristics, and functional ability), an analysis of mixed design MANOVA will be employed-Bonferroni correction for subsequent multiple comparisons. The level of significance for all statistical tests is $p < 0.05$.

2.7. Statistical analysis

Participant characteristics were summarized and compared between groups using the ANOVA test. Sex distributions were compared between groups using the Chi-squared test. Shapiro-Wilk test and Levene's test for homogeneity of variances were conducted to check normal distribution of data and homogeneity between groups, respectively. A mixed design MANOVA was performed to compare within and between groups effects on VAS score, 6MWD and gait parameters. Bonferroni correction was carried out for subsequent multiple comparison. Partial squared eta was considered as the effect size. The level of significance for all statistical tests was set at $p < 0.05$. Statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM Corp., Armonk, NY, USA). The statistician was blinded regarding group assignment.

Table 1
Traditional physical therapy program.

Exercise	Description	Time
Cryotherapy	- Cold packs over the affected area to manage inflammation and assist the healing of the soft tissues	20 min'
Range of motion exercises (ROM)	- Range-of-motion exercises to regain function and mobility in the foot and big toe, starting with gentle passive movements that are progress to active movement as the toe heals	10 min
Muscle-strengthening exercises	- Toe raises, calf raises, squats, lunges, toe crunches, curling a towel up with the toes, moving the toes in a bucket of sand, quick foot exercises, and cycling with suitable toe support are also used to preserve fitness without straining the toe. Toe flexion with a resistance band, toe spreaders, and heel rises have been used. Finally, for power recovery, lunges, tip-toe walking, and single-leg calf raises off a step were performed. Exercises progressed to more impactful activities (jogging, running, cutting, and jumping) as participants achieved improvement.	10 min
Manual therapy	- Gently move and manipulate the muscles and joints of the foot and toe.	10 min
Balance training	- Balance exercises on one foot to improve proprioception and stability.	10 min
Footwear	- Appropriate footwear should be advised to maintain support and decrease stress on the toes.	

Fig. 1. KT application.

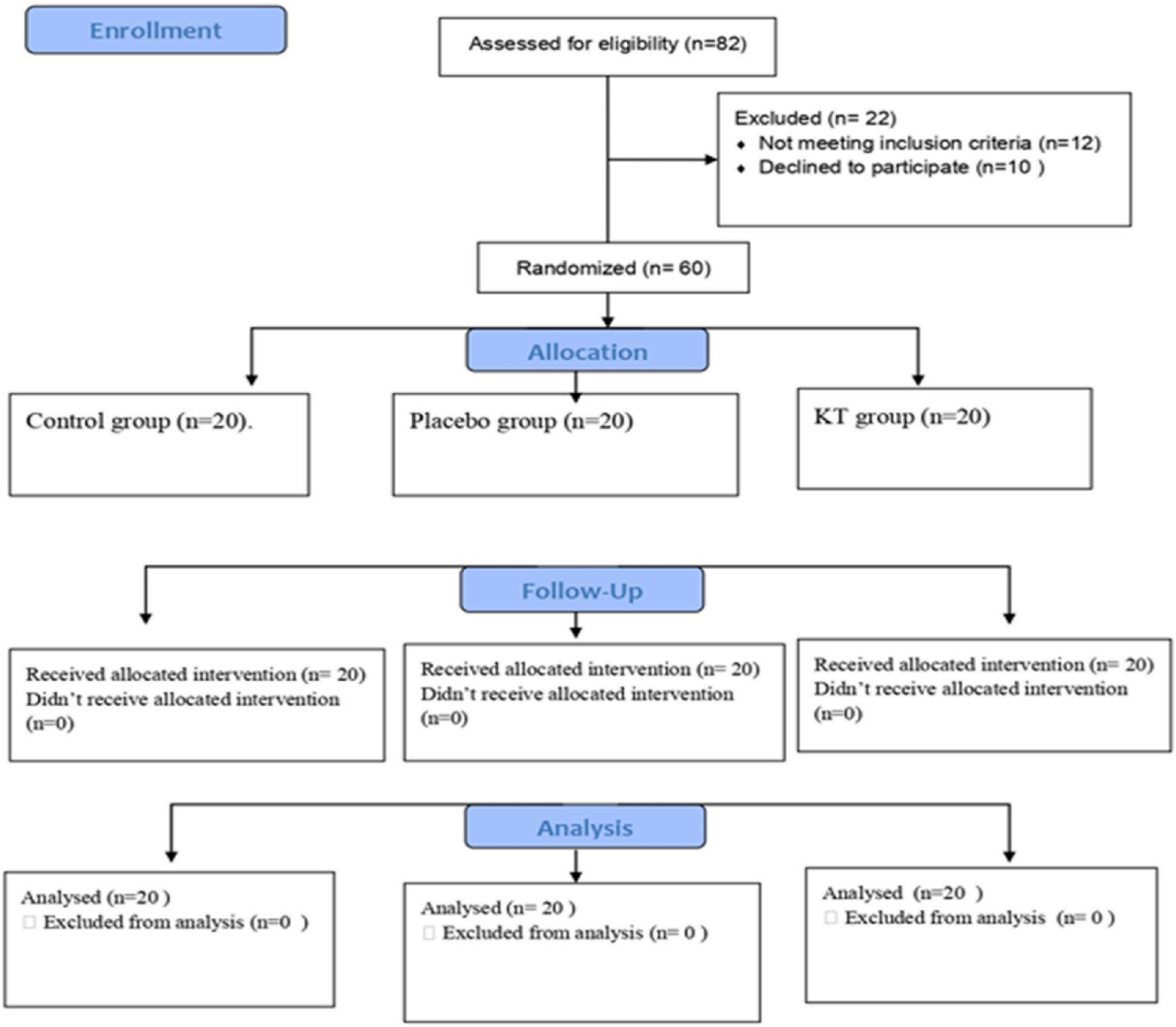

Fig. 2. Participants' flowchart.

3. Results

Sixty patients with grade II turf toe (out of an 82 potentially eligible) were appropriate for this study and were randomly assigned to control, placebo, and KT group (20 patients for each group). The participants' flowchart is shown in Fig. 2.

3.1. Participant baseline characteristics

Table 2 showed the participant characteristics of control, placebo, and KT groups. There was no significant difference between groups in age, weight, height, BMI, and sex distribution ($p > 0.05$).

3.2. Effect of treatment on VAS score, 6MWD and gait parameters

Mixed MANOVA revealed a significant interaction effect of treatment and time ($F = 15.35$, $p = 0.001$, $\eta^2 = 0.63$). There was a significant main effect of treatment ($F = 3.74$, $p = 0.001$, $\eta^2 = 0.3$). There was a significant main effect time ($F = 555.66$, $p = 0.001$, $\eta^2 = 0.98$).

3.3. Within group comparison pain, functional ability, and gait parameters

There was a significant decrease in VAS score post treatment compared with that pretreatment in the three groups ($p < 0.001$) as shown in Table 3. There was a significant increase in 6MWD post treatment compared with that pretreatment in the three groups ($p < 0.001$) as shown in Table 4. There was a significant increase in step length, stride length, cadence and velocity post treatment compared with that pretreatment in the three groups ($p < 0.001$) as shown in Table 5.

3.4. Between group comparison pain, functional ability, and gait parameters

There was a significant decrease in VAS score of KT group compared with that of control and placebo group post treatment ($p < 0.001$). There was no significant difference in VAS score between control and placebo groups post treatment ($p > 0.05$) as shown in Table 3. There was a significant increase in 6MWD of KT group compared with that of control and placebo group post treatment ($p < 0.001$). There was no significant difference in 6MWD between control and placebo groups post treatment ($p > 0.05$) as shown in Table 4. There was a significant increase in step length, stride length, cadence and velocity of KT group compared with that of control and placebo group post treatment ($p < 0.05$). There was no significant difference in gait parameters between control and placebo groups post treatment ($p > 0.05$) as shown in Table 5.

4. Discussion

The objective of the present study was to examine the effects of adding KT to exercises on pain, gait, and functional ability in patients with turf toe. According to the study's findings, the KT group showed a meaningful reduction in pain relative to the control and placebo groups, as the pain score was 6.35 in VAS score and reduced to 0.9 scores. It has further been shown that the KT group attained favorable improvements in gait parameters (more explicitly, step length, stride length, cadence, and velocity). Step length increased from 65.73 cm to 73.07 cm in the KT group; stride length was increased from 134.65 cm to 145.95 cm. Also, the velocity was 127.45 and improved to 138.15 cm/s. Furthermore, participants in the KT group walked longer distances compared to the control participants, as the distance changed from 354.20 m to 430.70 m, suggestive of favorable functional capacity.

Pain amelioration may be attributed to the application of KT, which stimulates large-fiber cutaneous mechanoreceptors that may inhibit the transmission of nociceptive impulses in the spinal column and decrease pain via an ascending pathway. Also, KT is considered to decompress underlying structures by expanding subcutaneous space and allowing for better circulation, thereby nourishing underlying tissue and reducing pain [21]. The flexibility of the tape exerts a steady pull on the skin, giving the area of the body it covers constant proprioceptive information. Elastic therapeutic tape also offers certain distinctive qualities, such as being

Table 2
Within-group comparisons in the basic characteristics of participants.

	Control group	Placebo group	KT group	p-value
	mean ± SD ($n = 20$)	mean ± SD ($n = 20$)	mean ± SD ($n = 20$)	
Age (years)	27 ± 1.65	27.5 ± 1.70	27.35 ± 1.72	0.63
Weight (kg)	68.6 ± 6.74	67.9 ± 4.24	67.7 ± 4.83	0.85
Height (cm)	169.55 ± 4.95	170.05 ± 3.63	171.75 ± 4.06	0.23
BMI (kg/m^2)	23.84 ± 1.87	23.49 ± 1.57	22.95 ± 1.52	0.24
Sex, n (%)				
Females	9 (45 %)	8 (40 %)	10 (50 %)	0.81
Males	11 (55 %)	12 (60 %)	10 (50 %)	

SD, standard deviation; p-value, level of significance.

Table 3
Within-group and between group comparisons in the VAS score pre and post treatment of control, placebo and KT groups.

VAS score	Control group	Placebo group	KT group	*p*-value		
	mean ± SD (n = 20)	mean ± SD (n = 20)	mean ± SD (n = 20)	Control vs placebo	Control vs KT	Placebo vs KT
Pretreatment	6.4 ± 0.5	6.25 ± 0.78	6.35 ± 0.58	0.73	0.96	0.87
Post treatment	2.35 ± 0.48	2.15 ± 0.58	0.9 ± 0.87	0.55	0.001	0.001
MD (% of change)	4.05 (63.28 %)	4.1 (65.6 %)	5.45 (85.82 %)			
	p= 0.001	*p= 0.001*	*p= 0.001*			

SD, Standard deviation; MD, Mean difference; p-value, Level of significance, m, Meter.

Table 4
Within-group and between group comparisons in the 6MWD pre and post treatment of control, placebo, and KT groups.

	Control group	Placebo group	KT group	*p*-value		
	mean ± SD (n = 20)	mean ± SD (n = 20)	mean ± SD (n = 20)	Control vs placebo	Control vs KT	Placebo vs KT
6MWD (m)						
Pretreatment	342.8 ± 30.23	347.85 ± 29.34	354.20 ± 27.95	0.84	0.43	0.77
Post treatment	398.85 ± 23.57	400.55 ± 27.30	430.70 ± 20.98	0.97	0.001	0.001
MD (% of change)	−56.05 (16.35 %)	−52.7 (15.15 %)	−76.5 (21.6 %)			
	p = 0.001	p = 0.001	p = 0.001			

SD, Standard deviation; MD, Mean difference; p-value, Level of significance, m, Meter.

Table 5
Within-group and between group comparisons in the step length, stride length, cadence, and velocity pre and post treatment of control, placebo, and KT groups.

	Control group	Placebo group	KT group	p-value		
	mean ± SD (n = 20)	mean ± SD (n = 20)	mean ± SD (n = 20)	Control vs placebo	Control vs KT	Placebo vs KT
Step length (cm)						
Pretreatment	63.74 ± 5.33	64.77 ± 4.85	65.87 ± 5.08	0.79	0.38	0.77
Post treatment	67.5 ± 5.74	68.4 ± 4.53	73.07 ± 3.62	0.81	0.001	0.008
MD (% of change)	−3.76 (5.89 %)	−3.63 (5.60 %)	−7.2 (10.93 %)			
	p= 0.001	*p= 0.001*	*p= 0.001*			
Stride length (m)						
Pretreatment	133.25 ± 5.43	134.07 ± 7.12	134.65 ± 6.11	0.91	0.76	0.95
Post treatment	136.5 ± 5.55	139 ± 8.27	145.95 ± 8.23	0.54	0.001	0.01
MD (% of change)	−3.25 (2.43 %)	−4.93 (3.77 %)	−11.3 (8.39 %)			
	p= 0.001	*p= 0.001*	*p= 0.001*			
Cadence (steps/min)						
Pretreatment	115.95 ± 3.57	117.15 ± 4.28	116.45 ± 5.52	0.68	0.93	0.87
Post treatment	120.10 ± 2.31	122.15 ± 3.45	127 ± 4.54	0.17	0.001	0.001
MD (% of change)	−4.15 (3.57 %)	−5 (4.26 %)	−10.55 (9.05 %)			
	p= 0.001	*p= 0.001*	*p= 0.001*			
Velocity (cm/sec)						
Pretreatment	127.05 ± 4.98	129.5 ± 5.42	127.45 ± 5.78	0.33	0.97	0.45
Post treatment	130.6 ± 5.51	133.45 ± 4.45	138.15 ± 6.11	0.22	0.001	0.02
MD (% of change)	−3.55 (2.79 %)	−3.95 (3.05 %)	−10.7 (8.4 %)			
	p= 0.001	*p= 0.001*	*p= 0.001*			

SD, Standard deviation; MD, Mean difference; p-value, Level of significance; cm, Centimeter; m, Meter; steps/min, steps/minutes; cm/sec, Centimeter/seconds.

heat-activated, water-resistant, and retaining its skin adhesion qualities for up to five days. Also, elastic therapeutic tape lifts the skin away from the underlying tissue to allow a release of pressure on injured structures and decrease pain [22,23].

The result of the current study agreed with Tsai et al., who studied the effect of KT on pain in patients with plantar fasciitis; they reported a meaningful reduction in pain after 6 days of application of KT and exercises compared to exercises alone [24]. Also, the results are in line with Azab et al., who observed a significant reduction in pain after the application of KT for ankle joints in patients with juvenile rheumatoid arthritis [25]. The same was seen in a study by Lee SM and Lee JH, where a significant pain reduction was noted after 4 weeks of ankle taping in young women with inversion and eversion sprains [26].

Furthermore, the placebo effect or the psychosocial impact of receiving a novel intervention, such as kinesiology taping, may have contributed to the established improvements, and these results were supported by Oken, who claims that the placebo effect causes the release of analgesia neurotransmitters [27]. In patients receiving treatment for neck pain, Bishop et al. [[28] discovered that patient expectations are strongly connected with positive outcomes 1 month after treatment [28]. These results suggest that a placebo has an

actual physiological outcome.

After the application of KT, significant improvements were noticed in gait parameters (step length, stride length, cadence, and velocity) compared to the placebo and control groups. These improvements may be related to decreased pain sensation, improved joint stability, and improved sensory and proprioceptive sensation. Several studies confirmed the effect of KT in the inhibition of movement; Yazici et al. stated that tape stabilizes the joint and prevents excess motion while providing somatosensory information to the brain [29]. In a study conducted by Mohamed et al. to investigate the effect of KT on ankle joint stability in patients with ankle joint sprains The study concluded that KT was effective in improving ankle joint stability and improving balance in these patients [30].

The results of the current study are in accordance with a study by Kim MK and Shin YJ, who concluded that with KT application in soccer players with severe ankle sprains, there were significant improvements in ankle joint stability and walking ability [31]. Kim et al. stated that the application of kinesiology taping has a positive effect on ankle joint stability and gait characteristics [32].

Reliving pain relief and enhancement of the walking parameters may lead to an overall improvement in functional capacity. This comes in agreement with Gholami et al., who concluded that the application of KT resulted in the enhancement of balance score and functional ability in athletes with post-anterior cruciate ligament reconstruction [33]. Also, Azab et al. concluded that the application of KT was useful in pain reduction and the improvement of functional ability in adolescents with hemophilia [34].

From our findings in the current study, the application of Kinesiology Tape (KT) has a significant impact on their everyday life and general well-being. Individuals' mobility improves as their pain subsides, allowing them to engage in everyday tasks more comfortably. This not only improves the quality of their daily lives but also has a favorable impact on their mental and emotional states. Pain relief frequently leads to better sleep, less stress, and an overall better attitude. Furthermore, reduced discomfort encourages more active engagement in rehabilitation, resulting in a faster recovery and return to routine activities. Also, athletes with turf toe can benefit from the Kinesio tape application, as they can engage in training and competitions with greater focus and intensity when they are pain-free. Decreased pain and improved walking parameters promote higher compliance with rehabilitation regimens, allowing players to recover faster and return to sports sooner.

The study outcomes might be applied to a wide range of populations involved in sports and activities that cause toe injuries. The use of KT as a therapeutic adjunct, especially given its non-invasive nature and ease of deployment, implies that it could be useful in a variety of clinical contexts. Furthermore, our controlled trial opens the door to investigating the real-world effectiveness of KT outside of the clinic, boosting the generalizability of our findings to a broader range of settings. These factors highlight the external validity of our findings as well as their applicability to practitioners and researchers in the larger field of sports medicine and rehabilitation.

Despite the favorable results of the present study on pain reduction, improvement in gait parameters, and functional status, there are some limitations. First, the small sample size may have affected certain variables and influenced the results. Therefore, these results cannot be generalized to all participants who have turf toe. Second, the current study focused on specific grades of turf toe and specific age groups, which makes it difficult to generalize the results to all patients with turf toe. So, further studies are needed to examine the effect of kinesiology taping on other grades of turf toe. Third, the experiment was a pre-post design (examining the short-term effect) and a relatively short-duration intervention, which makes it difficult to observe the long-term effect of taping. Hence, additional research is required to determine the long-term advantages of kinesiology taping, including a long-term follow-up examination. Fourth, the measurement of pain was applied by the VAS score, which is a self-reported measure that may contribute to bias. To diminish this, participants were given obvious instructions on how to use the VAS score, and efforts were made to ensure that the pain scale was understood consistently.

Also, further research integrating patient-reported outcomes and evaluating the effect of pain reduction on the overall quality of life would enhance the understanding of the Kinesiology taping effect for patients with turf toe. Finally, investigating the biomechanical processes that underlie the noted enhancements in gait parameters may contribute to a better comprehension of how kinesiology tape affects functional results.

5. Conclusions

Based on the findings of the current study, kinesiology taping is a beneficial supplementary strategy in the treatment of turf toe. Kinesiology tape has the potential to reduce pain, improve gait characteristics, and improve functional capacity in those with turf toes. While it cannot be used in place of traditional treatments, it is a useful addition. Further studies should be conducted to assess the long-term effects, different KT application methods, and tailored treatment protocols on turf toe.

Data availability

The authors declare that all relevant data supporting the findings of this study are available within the article.

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CRediT authorship contribution statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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