International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067; Impact Factor: RJIF 5.24
Received: 31-01-2019; Accepted: 02-03-2019
www.sportsjournal.in
Volume 4; Issue 3; May 2019; Page No. 07-12

Compare the effect of ankle taping versus balance exercises on static and dynamic postural stability in *Kathak* dancers with chronic ankle instabilities

Renuka Akolkar[1], Gauri Kulkarni[2], Sucheta Golhar[3]

[1] BPT, Maharashtra University of Health Sciences, PES Modern College of Physiotherapy, Pune, Maharashtra, India

[2] Associate Professor, Maharashtra University of Health Sciences, PES Modern College of Physiotherapy, Pune, Maharashtra, India

[3] Principal, Maharashtra University of Health Sciences, PES Modern College of Physiotherapy, Pune, Maharashtra, India

Abstract

Objective: The objective of this study was to compare the effect of ankle taping versus balance exercises on static and dynamic postural stability in *Kathak* dancers with chronic ankle instabilities by the end of 6 weeks.

Subjects and methods: 50 female *Kathak* dancers with chronic ankle instability were randomly assigned into two equal groups: ankle taping and balance exercises. The balance exercise group performed balance exercises along with conventional treatment protocol for 6 weeks 3 session/ week. Ankle taping was performed for 6 weeks and was renewed 3 times/ week along with conventional treatment protocol. Before and after interventions, time in balance test and star excursion balance test were done.

Result: In ankle taping group time in balance test improved from 6.84±1.625 to 10.36±1.890. In balance training group time in balance test improved from 8.92±2.482 to 15.96±2.821.

In ankle taping group, SEBT improved in anterior direction from 65.40±6.45 to 70.75±5.706, anteromedial from 67.88±6.912 to 72.412±7.013, medially from 65.34±6.98 to 69.88±5.94, posteromedially from 64.78±7.97 to 68.98±6.32, posteriorly from 58.53±5.78 to 64.26±5.16, posterolaterally from 58.01±7.10 to 63.75±6.90, laterally from 49.460±7.88 to 54.85±8.74 and anteromedially from 58.46±11.39 to 63.002±11.11.

In balance training group, SEBT improved in anterior direction from 65.66±10.15 to 73.12±10.54, anteromedially from 67.06±10.85 to 75.05±10.56, medially from 69.03±10.87 to 72.59±3.83, posteromedially from 68.76±5.57 to 72±4.11, posteriorly from 60.95±7.145 to 66.55±7.084, posterolaterally from 61.07±13.51 to 64.68±9.46, laterally from 50.24±8.27 to 54.50±7, anterolaterally from 62.77±17.73 to 68.33±9.60.

Conclusion: Balance training showed significant effect on static postural stability but there was no significant difference in dynamic postural stability.

Keywords: *Kathak* dancers, chronic ankle instability, postural stability, ankle taping, balance exercises

1. Introduction

Ankle joint is a synovial joint of the hinge variety. The upper articulating surface is formed by Lower end of tibia including the medial malleolus, Lateral malleolus of fibula and Inferior transverse tibiofibular ligament while the lower articulating surface is formed by Upper, medial and lateral aspects of talus. The stability of ankle joint is ensured by close interlocking of the articular surfaces, strong collateral ligaments and the tendons that cross the joint. The ligaments for ankle joint are fibrous capsule, deltoid ligament medially and Anterior talofibular ligament, Posterior talofibular ligament and Calcaneofibular ligament laterally.

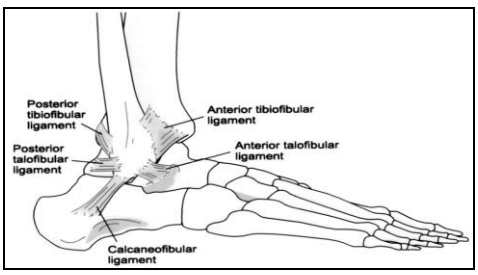

Fig 1

Chronic ankle instability has been defined as "repetitive bouts of lateral ankle instability resulting in numerous ankle sprains" [1]. The commonly cited characteristics of chronic ankle instability include giving way of ankle, mechanical instability, pain and swelling, loss of strength, recurrent sprains and functional instability [2]. The lateral ankle instability refers to the existence of an unstable ankle due to lateral ligamentous damage caused by excessive supination or inversion of the rearfoot [2].

Lateral ankle sprain occurs due excessive supination of the rear foot about an externally rotated lower leg soon after initial contact of the rear foot during gait or landing from a jump. Excessive inversion and internal rotation coupled with external rotation of the lower leg, results in strain to the lateral ankle ligaments. If the strain exceeds the tensile strength of the tissue in any of the ligaments, ligamentous damage occurs. Increased plantarflexion at initial contact increases the chances of suffering a lateral ankle sprain. The anterior talofibular ligament is the first ligament damaged during a lateral ankle sprain, followed by calcaneofibular ligament. Injury to the posterior talofibular ligament is typical only in severe ankle sprains and mostly associated by fractures or dislocations or both [2].

There are two potential causes for chronic ankle instability- Mechanical instability and Functional instability. Mechanical instability occurs by the factors that alter mechanics of one or more joints within ankle complex like pathological laxity, impaired arthrokinematics, synovial inflammation and impingement, and degenerative changes. Functional instability may occur because of specific insufficiencies in proprioception, neuromuscular control, postural control, or strength. CAI can be caused by mechanical instability, functional instability or a combination of both the entities [2].

After acute ankle sprain and in those with history of repetitive ankle sprains, impaired postural control during single-leg stance has been demonstrated frequently [2]. A recently published meta-analysis has concluded that subjects with ankle instability exhibit postural stability deficits in both static and dynamic situations [4].

Kathak dance includes hasty swirls, refined footwork, and acute postures. So while performing *Kathak*, the foot is repetitively taken to extreme ranges of dorsiflexion and plantar flexion, making excessive use of these muscles. During *bhramaris (chakkars)*, the whirling movements are performed with the heel as the fulcrum with the ankle held into dorsiflexion. The foot postures adapted during *Kathak* dance such as *ugghatitta, agratalasanchara, bhramaris,* etc consists of extreme plantarflexion and dorsiflexion which may lead to putting the ligaments of the ankle joint under the tension, thus putting the foot into high risk of instability.

According to the study, 70% of *Kathak* dancers were found to have functionalankleinstability [4].

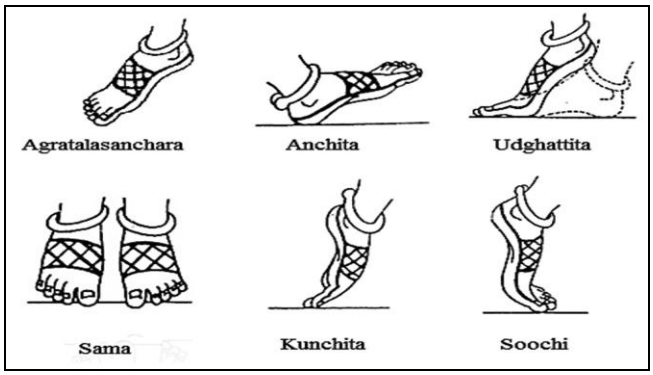

Fig 2

Rehabilitation for the ankle injuries should be structured and individualized.[5] Measures to prevent injury have included specific strength training, proprioceptive training and external support, such as braces and non-elastic athletic tape [3]. Once the pain free range of motion and weight bearing have been gained, balance-training exercises should be incorporated to normalize neuromuscular control [5]. For improvement of proprioception, many types of exercise have been proposed. Bouet and gahery stated that balance exercises improve neuromuscular relation and reduce proprioception errors [6].

Another technique to enhance proprioception is the taping. Improved proprioception leads to better function and reduction of disability. Kinesio taping is used to prevent injuries and to help injuries to heal. It also improves efficiency in sports, improve lymph and venous circulation, decrease oedema, stimulate mechanoreceptors and increase awareness of a subject with regard to ankle position, reduce pain and improve muscle performance. Taping improves dynamic stability by increasing sensory input, decreasing the delay in postural reflexes and increasing stability [6]. Taping is able to control the centre of pressure sway speed and lead to better performance in maintaining stability when a perturbation is applied [6]. Balance and taping could both improve postural control by improving proprioception inputs, but comparing these two techniques to select the best strategy to manage proprioception deficit is a challenge in *Kathak* dancers with ankle instability.

2. Methodology

2.1 Purpose

The purpose of this study was to compare the effect of ankle taping versus balance exercises on static and dynamic postural stability in *Kathak* dancers with chronic ankle instabilities by the end of 6 weeks.

2.2 Selection of subjects

50 female subjects were included in study on the basis of Cumberland ankle instability tool as it is used to indicate functional ankle instability. Subjects having score of less than 27 in CAIT Score were included in the study. Women with history of spinal, hip, knee or ankle pathology, neurological impairment, lower limb fracture, recent surgical history were excluded to restrain the results of the study from any error. Women with bilateral ankle instability were excluded to achieve uniformity while treating patients.

2.3 Procedure

The selected subjects were divided into two groups by using even and odd method each group consisted of 25 subjects. Pre-treatment assessment was carried out for subjects in both groups using time in balance test and star excursion balance test for assessing dynamic postural stability. Subjects in even group received ankle taping along with conventional treatment. Ankle taping was performed for 6 weeks and was renewed 3 times a week. Subjects in odd group received balance training along with conventional treatment for 6 weeks, 3 times a week.

The study was carried out for duration of 6 weeks.

At the end of 6 weeks, time in balance test and star excursion balance test was done.

Conventional treatment

Table 1

component	Frequency
Achilles tendon stretch non weight bearing	15-30sec*3-5*/day
Isometric strength training Plantar flexion Dorsiflexion Inversion Eversion	Hold for 5-10s, 5-10 repetitions per day

Ankle taping

- The subject's foot will be placed in a relaxed position initially with the foot up.
- First strip will be placed from anterior mid-foot to immediately inferior to tibial tuberosity over the tibialis anterior muscle whilst being stretched at 120% of its length.
- Second strip will be applied from the medial malleolus, round the heel and split just below the lateral malleolus,

one branch will be applied anteriorly and second branch posterior to the lateral malleolus and from there onwards both ran to attach laterally to the end of first tape.

- Third strip will be stretched to 140% and will be applied across the ankle just covering the medial and lateral malleolus.
- Fourth strip will be applied from the arch and stretched to 6 inches above both malleoli.

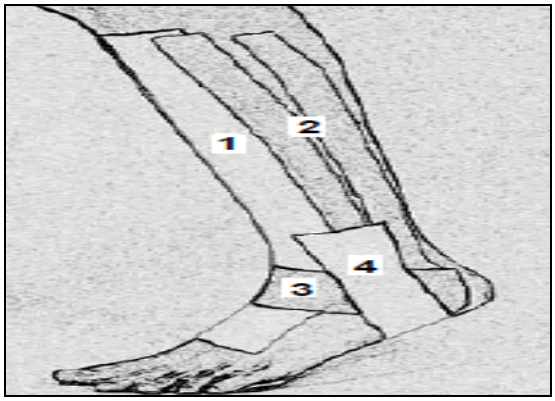

Fig 3

Balance Training Protocol

- Circular wobble board: rotate board in clockwise and counter clockwise directions non weight bearing and weight bearing for bilateral and unilateral stance 5-10 repetitions, 2-3*/day Exercises can be performed with eyes open or closed and with or without resistance
- Walking on different surfaces: walk in normal or heel to toe fashion over various surfaces (eg hard floor, uneven carpet, different foam pads) 20-50 ft, 5-10*/day Exercises can be performed with eyes open or closed and with or without resistance
- Manual proprioceptive neuromuscular facilitation exercises: clinician provides degrees of resistance and random perturbations as subject moves the foot through functional patterns 5-20 repetitions 1-2*/day Velocity and resistance can be varied to stimulate sensory feedback.

2.4 Findings

i) Intragroup Time in Balance test (paired t test)

a) Group 1- kinesio taping

p value<0.0001(extremely significant)

t=18.283

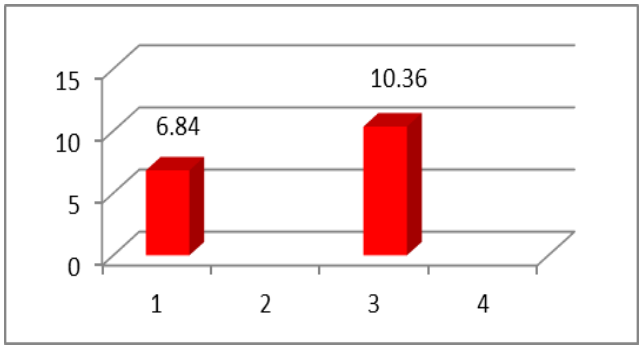

Fig 4

b) Group 2- Balance Training

p<0.0001(extremely significant)

t=18.283

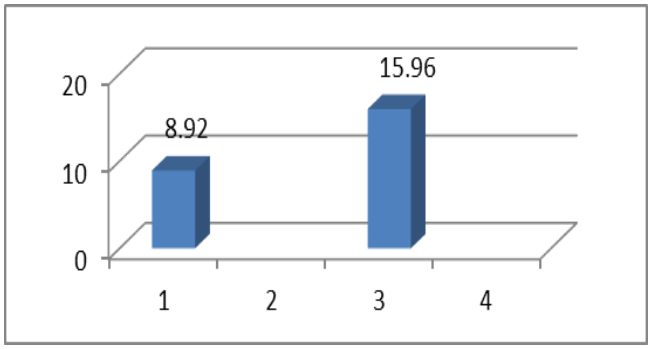

Fig 5

ii) Intergroup Time in Balance test (unpaired t test)

P<0.0001(extremely significant)

t=8.246

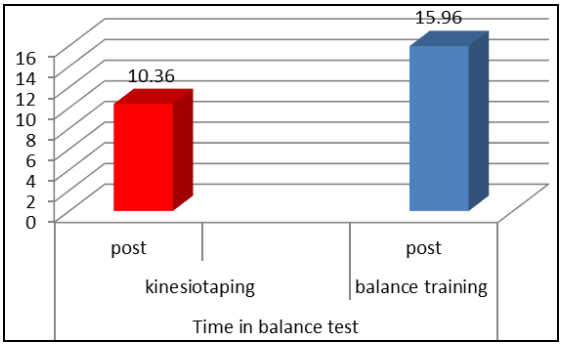

Fig 6

iii) Intragroup SEBT (paired t test)

a) Group 1-Kinesio taping

Table 2

SEBT kinesio taping		mean	SD	*t* value	*p* value
anterior	pre	65.4	6.45	14.842	<0.0001 (extremely significant)
	post	70.75	5.706		
anteromedial	pre	67.88	6.912	12.645	<0.0001 (extremely significant)
	post	72.41	7.013		
medial	pre	65.34	6.98	6.124	<0.0001 (extremely significant)
	post	69.88	5.94		
posteromedial	pre	64.78	7.97	5.674	<0.0001 (extremely significant)
	post	68.98	6.32		
posterior	pre	58.53	5.78	14.723	<0.0001 (extremely significant)
	post	64.26	5.16		
posterolateral	pre	58.01	7.10	15.28	<0.0001

	post	63.7	6.90		(extremely significant)
lateral	pre	49.46	7.88	9.579	<0.0001
	post	54.85	8.74		(extremely significant)
anterolateral	pre	58.46	11.39	9.618	<0.0001
	post	63	11.11		(extremely significant)

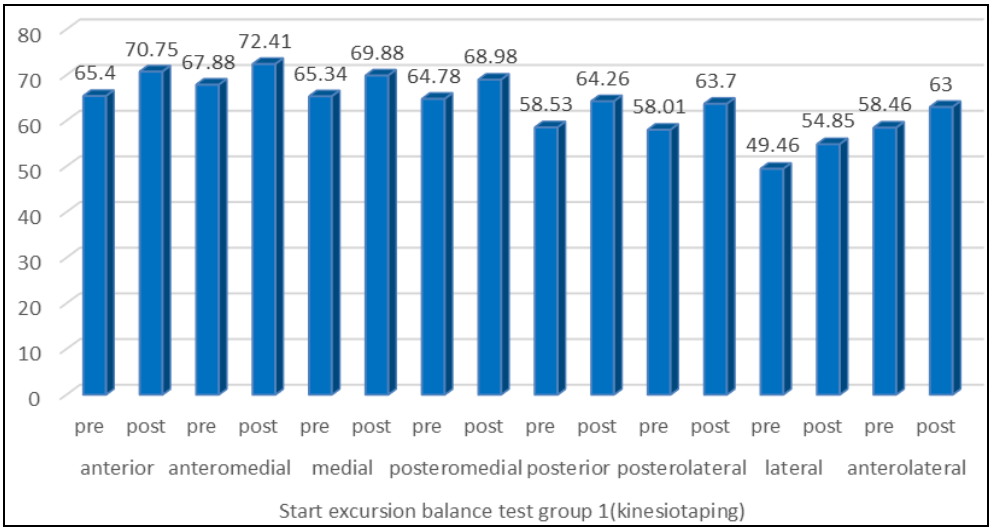

Fig 7

b) Group 2-Balance training

Table 3

SEBT balance training		Mean	SD	*t* value	*p* value
anterior	pre	65.66	10.154	8.864	<0.0001
	post	73.12	10.54		(extremely significant)
anteromedial	pre	67.06	10.85	11.215	<0.0001
	post	75.05	10.56		(extremely significant)
medial	pre	69.03	10.87	4.643	<0.0001
	post	72.59	3.83		(extremely significant)
posteromedial	pre	68.76	5.57	4.414	P=0.0002
	post	72	4.11		(very significant)
posterior	pre	60.95	7.145	6.950	<0.0001
	post	66.55	7.084		(extremely significant)
posterolateral	pre	61.07	13.516	2.928	0.0074
	post	64.68	9.46		(very significant)
lateral	pre	50.24	8.275	3.683	0.0012
	post	54.5	7		(very significant)
anterolateral	pre	62.771	17.73	3.323	0.0028
	post	68.33	9.603		(very significant)

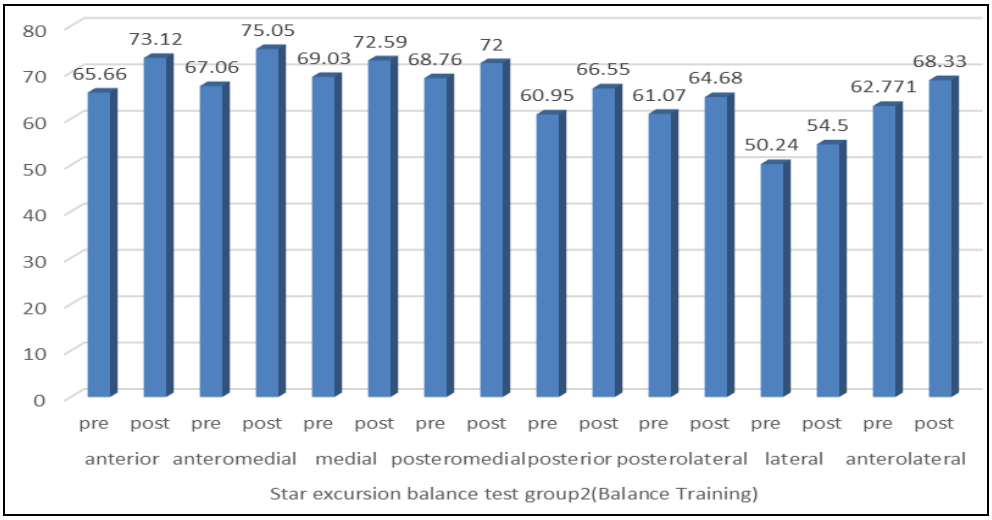

Fig 8

iv) Intergroup SEBT (unpaired t test) both post values

Table 4

SEBT	GROUPS	Mean	SD	*t* value	*p* value
Anterior	Balance training	73.12	10.54	0.9912	0.3265 (not significant)
	Kinesio taping	70.75	5.70		
anteromedial	Balance training	75.05	10.56	1.041	0.3031 (not significant)
	Kinesio taping	72.41	7.01		
medial	Balance training	72.59	9.519	1.205	0.2340 (not significant)
	Kinesio taping	69.88	5.94		
posteromedial	Balance training	72	4.11	2.004	0.0507 (not significant)
	Kinesio taping	68.98	6.32		
posterior	Balance training	66.55	7.08	1.304	0.1985 (not significant)
	Kinesio taping	64.26	5.17		
posterolateral	Balance training	64.68	9.467	0.3974	0.6928 (not significant)
	Kinesio taping	63.75	6.90		
lateral	Balance training	54.5	7	0.1584	0.8748 (not significant)
	Kinesio taping	54.85	8.741		
anterolateral	Balance training	68.33	9.6	1.816	0.0756 (not significant)
	Kinesio taping	63	11.11		

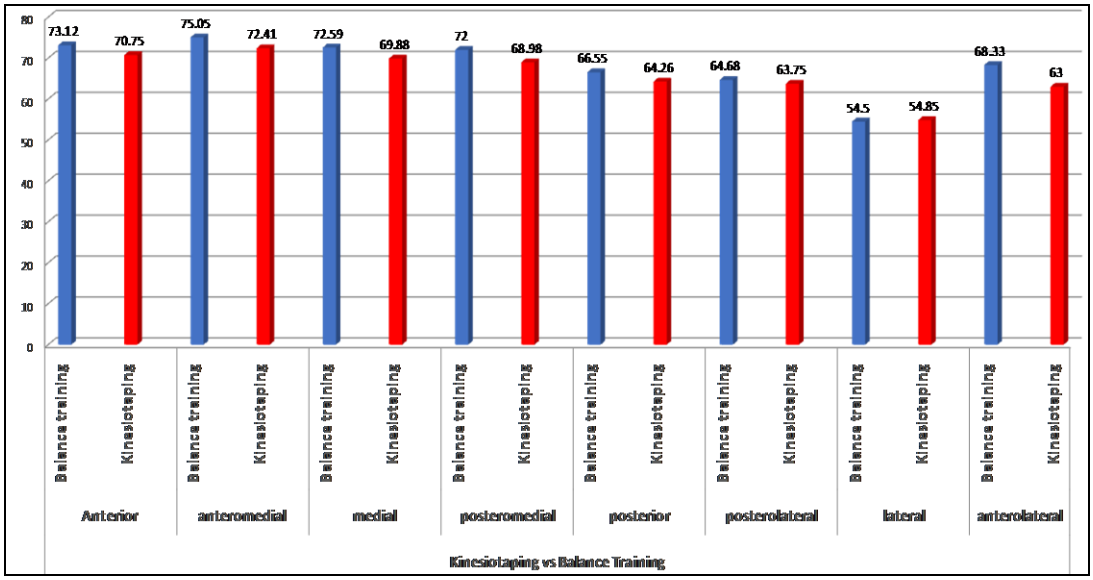

Fig 9

3. Result

After the analysis of data, it proves treatment given in group 2 is effective in improving static balance as post treatment mean value for kinesio taping is 10.36±1.890 but for balance training is 15.96±2.821 with *p* value<0.0001 which is extremely significant.

Also, treatment given in group 1(kinesio taping with conventional treatment) and group 2(balance training with conventional treatment) are showing no significant difference in improving dynamic balance. As intergroup SEBT score comparison by unpaired t test and it shows *p* value for anterior = 0.3265, anteromedial *p*= 0.3031, medial *p*= 0.2340, posteromedial *p*= 0.0507, posterior *p*= 0.1985, posterolateral *p*= 0.6928, lateral *p*=0.8748 and anterolateral *p*= 0.0756 which is not significant.

4. Discussion

The present study was done to compare the effect of ankle taping and balance exercises on postural stability in *Kathak* dancers with chronic ankle instability. In this study total 50 samples of age group 18-35yrs were included with 25 participants in each group. Subjects were included in study on the basis of Cumberland ankle instability tool as it is used to indicate functional ankle instability [4]. Subjects having score of less than 27 in CAIT Score were included in the study. Women with history of spinal, hip, knee or ankle pathology, neurological impairment, lower limb fracture, recent surgical history were excluded to restrain the results of the study from any error [4]. Women with bilateral ankle instability were excluded to achieve uniformity while treating patients.

Kathak dancers are prone to develop functional disability and instabilities at ankle joint [4]. Kinesio taping and balance training are both proved to improve postural stability [6] but no study was done comparing effect of both techniques on postural stability in *Kathak* dancers. So the present study focused on comparing effect of ankle taping versus balance exercises on postural stability in *Kathak* dancers with chronic ankle instability.

The outcome measures used were time in balance test and star excursion balance test for assessing static and dynamic postural stability respectively. Time in balance test included single legged stance on a firm surface and assessed the amount of time participant can remain on a single leg

without losing balance.

While star excursion balance test included s participant's reaching in all 8 directions including anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral and anterolateral direction while standing on affected leg.

Kinesio taping was given for 6 weeks and renewed 3 times/session. When pre and post data analysis was done within group 1, time in balance test showed improvement in static balance with t=18.283 and *p* value <0.0001 and dynamic balance was improved in anterior(t=14.842), anteromedial(t=12.645), medial (t=6.124), posteromedial(t=5.674), posterior(t=14.72), posterolateral(t= 15.28), lateral(t=9.519) and anterolateral(t=9.618) directions with *p* value <0.0001.We found that kinesio taping is effective in improving static and dynamic balance because Kinesio taping enhances proprioception which leads to better function and reduction of disability. It improves efficiency in sports, improves lymph and venous circulation, decreased edema, stimulates mechanoreceptors and improves muscle performance. Kinesio taping improves dynamic stability by increasing sensory input, decreasing delay in postural reflexes and increasing stability [6].

Balance exercises were for 6 weeks, 3 sessions per week. When pre and post data for group 2 was analysed, time in balance test showed improvement in static balance with t=20.189 and *p*value <0.0001 and dynamic balance was improved in anterior (t=8.864), anteromedial (t=11.215), medial (t=4.643), posteromedial (t=4.414), posterior (t=6.950), posterolateral (t= 2.928), lateral (t=3.638) and anterolateral (t=3.323) directions with *p* value <0.0001. We found that balance exercises improves static and dynamic postural stability. The balance exercise protocol included rotations of wobble board in clockwise and counter clockwise directions non weight bearing and weight bearing for bilateral and unilateral stance(5-10reps), walking on different surfaces (20-50 feet/session) and manual proprioceptive neuromuscular facilitation exercises (5-20reps).

But on comparing both the treatment groups statistically, balance training showed significant effect on static postural stability (t=8.246 and *p*<0.0001) but there was no significant difference in dynamic postural stability (*p* value not significant).

Bouet and Gahery stated that balance exercises improve neuromuscular relations and reduce proprioceptive errors which helps improving postural stability [6]. Conventional treatment protocol included achilles tendon stretch non weight bearing (15-30 sec hold) 3-5 times/session and isometric strength training for plantar flexors, dorsiflexors, invertors and evertors [5].

Asghar Akbari *et al*. showed the positive effect of balance exercises on postural stability and the results were showing positive effect of ankle taping on postural stability [6].

Mervat A. Mohamed *et al*. showed that kinesiotape has superior effect than athletic tape in patients with first degree ankle sprain and can be used safely for improving ankle joint stability [3].

Carl G Mattacola *et al*. stated that proprioceptive training is initiated for recovery of balance and postural stability. Proprioception is useful for preventing injury in slow, moderately rapid, or even rapid tasks.

In this study, when intergroup post data was analysed, we found that effect of balance training combined with conventional treatment was more significant to improve static balance than kinesio taping combined with conventional treatment. But for dynamic balance, both treatment protocols showed no significant difference.

5. Conclusion

In this study, both the treatment showed equal effect in improving dynamic balance in chronic ankle instability in *Kathak* dancers. Balance training is more effective in improving static postural stability in *Kathak* dancers with chronic ankle instability.

6. References

1. Hiller CE, Kilbreath SL, Refshauge KM. Chronic ankle instability: evolution of the model. Journal of athletic training. 2011; 46(2):133-41.
2. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. Journal of athletic training. 2002; 37(4):364.
3. Mohamed MA, Radwan NL, Al Shimaa RA. Effect of kinesio-taping on ankle joint stability. International Journal of Medical Research and Health Sciences. 2016; 5(5):51-8.
4. Sabharwal R, Singh S. Prevalence of ankle instabilities and disabilities among female *Kathak* dancers. Physiotherapy-The Journal of Indian Association of Physiotherapists. 2017; 11(2):45.
5. Mattacola CG, Dwyer MK. Rehabilitation of the ankle after acute sprain or chronic instability. Journal of athletic training. 2002; 37(4):413.
6. Akbari A, Sarmadi A, Zafardanesh P. The effect of ankle taping and balance exercises on postural stability indices in healthy women. Journal of physical therapy science. 2014; 26(5):763-9.
7. https://www.scienceforsport.com/star-excursion-balance-test/
8. Mohamed MA, Radwan NL, Al Shimaa RA. Effect of kinesio-taping on ankle joint stability. International Journal of Medical Research and Health Sciences. 2016; 5(5):51-8.
9. https://www.natajournals.org/action/downloadCitation
10. https://www.researchgate.net/publication/287785890_Common_dance_related_musculoskeletal_injuries
11. Linens SW, Ross SE, Arnold BL, Gayle R, Pidcoe P. Postural-stability tests that identify individuals with chronic ankle instability. J Athl Train. 2014; 49(1):15-23.