

## EFFECT OF KINESIO TAPING ON NECK FLEXORS AND CRANIOVERTEBRAL ANGLE IN SUBJECTS WITH FORWARD HEAD POSTURE: A RANDOMISED CONTROLLED TRIAL

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### ABSTRACT

**Background:** A pilot study on effect of kinesio taping has proved its effectiveness in subjects with forward head posture. However, there is need to conduct a controlled study by comparing it with placebo kinesio taping to prove its effectiveness.

**Objective:** To compare the effects of kinesio and placebo kinesio taping on endurance of neck flexors and craniovertebral angle in subjects with forward head posture.

**Materials and Methods:** 30 participants with forward head posture were recruited in the study and were randomly assigned into 2 groups: Kinesio taping group and Placebo kinesio taping group. Outcome measures were assessed before and after 6 days of treatment by the assessor who was blinded to the treatment groups.

**Results:** Pre and post treatment values showed statistically significant result for both the groups in terms of pain, craniovertebral angle and isometric neck flexor endurance score. Also when comparison was made, both the groups showed equally significant results.

**Conclusion:** Kinesio taping appears to be effective in improving forward head posture. But when compared with Placebo kinesio taping, it did not prove to be superior in treating forward head posture.

**KEY WORDS:** Forward head posture, Craniovertebral angle, Kinesio taping, Neck flexor endurance.

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### INTRODUCTION

Forward head posture (FHP) is the anterior positioning of the cervical spine [1]. It involves an excessive anterior position of the head in relation to the theoretical plumb line perpendicular to the body's center of gravity [2]. FHP is considered to coexist with hyperextension of upper cervical spine, flattening of lower

cervical spine, rounding of the upper back and elevation and protraction of the shoulders [3-5].

A forward head posture can be the result of injuries like sprains and strains of the neck, weak neck muscles and poor posture [6] and it alters the muscle activity in neck protraction and retraction [7,8]. The muscles that become tight

and facilitated are pectorals, upper trapezius, levator scapulae, sternocleidomastoid, suboccipitals, subscapularis, latissimus dorsi and arm flexors. The muscles that become weak and inhibited are longus capitis, longus colli, hyoids, serratus anterior, rhomboids, lower trapezius, posterior rotator cuff and arm extensors [9,10]. When the pressure on the neck and shoulder is present, the neck and shoulders have to carry the added weight all day in an isometric contraction.

Symptoms of forward head posture include forward head position, chronic pain (neck, shoulders, upper, lower and middle back), TM joint dysfunction, teeth clenching, fatigue, arthritis, pinched nerves, decreased range of motion, loss of overall height, myofascial pain syndrome, headaches and migraines, numbness or tingling in arms and hands, muscle spasms, sore and tight chest and neck muscles, asthma, impaired athletic performance, poor sleep or insomnia, disc degeneration, trigeminal neuralgia (facial pain), mouth breathing / sleep apnea [7].

The commonly used research measure for diagnosing FHP is by calculating the craniovertebral angle which is the angle found at the intersection of a line drawn from the tragus of the ear through the spinous process of C7 and a horizontal line through C7 [11]. It is assessed by using plumb line measurement [12], postural assessment system, digital photograph technique [13] and various other sophisticated instruments like head posture spinal curvature instrument and electronic head posture instrument. As poor isometric performance of the cervical flexor muscles is proved to be associated with FHP [9], measurement of endurance capacity of the cervical flexor muscle group is also done to rule out the severity [11].

The treatment of FHP support exercise therapy [14], mobilization, manipulations and the use of kinesio tape. Among this, Kinesio taping is a new therapeutic modality that corrects and treats many musculoskeletal disorders and is based on natural healing process. Kenzo Kase, the creator of Kinesio tape, proposed the mechanisms for the effects of Kinesio Tape which includes altered muscle function by the tape, effects on weakened muscles, improved circulation of

blood and lymph by eliminating tissue fluid or bleeding beneath the skin, decreased pain through neurological suppression, repositioning of subluxed joints by relieving abnormal muscle tension, and helping to affect the function of fascia and muscle [15,16]. Various studies have shown the effect of kinesio tape on Forward Head Posture (FHP) alignment and deep cervical flexors [17,18].

A pilot study on effects of kinesio taping on muscular endurance of neck flexors in only 5 subjects with forward head posture showed positive results in improving the muscular endurance [17]. Also a study investigated the immediate effect of neck retraction taping on forward head posture and the upper trapezius during computer work and found that FHP angle was significantly decreased after the intervention [13]. But there is dearth in high level evidence (RCT) where the effect of taping is studied to confirm the findings of the pilot study. Hence there is need to conduct a further study with larger sample size and a control group which would state the effect of kinesio taping by comparing with placebo kinesio taping. Therefore, the present study is done with a hypothesis that KT taping will have superior benefits on FHP when compared with Placebo KT taping.

## MATERIALS AND METHODS

The study design was double blinded randomized controlled trial where both assessor and participants were blinded and was conducted on local residents restricted to Belgaum city, province Karnataka, country India. Ethical committee approval was obtained from Institutional Ethical Review Committee. Sample size of thirty was calculated on the basis of effect size of pilot study and past research statistics. Participants were screened based on inclusion and exclusion criteria.

**Inclusion criteria:** 1. Age group 18 years to 60 years. 2. Participants willing to participate in the study. 3. Subjects with symptomatic forward head posture. 4. Craniovertebral angle more than  $54^{\circ}$  [19],

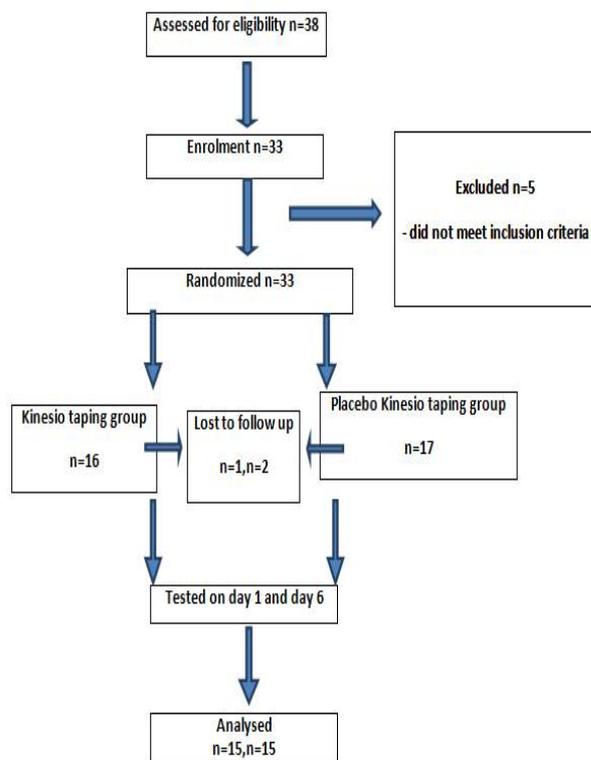
**Exclusion criteria:** 1. Earlier neck surgeries 2. Neck pain with neurological symptoms

3. Subjects with traumatic neck pain 4. Skin allergy 5. Open wounds in the neck region.

Prior to the commencement of the procedure, written informed consent was taken from the subjects. The purpose of the study was explained following which demographic data was collected from the subjects. Assessment was done for the baseline data on 1<sup>ST</sup> DAY. Subjects were randomly allocated to two groups with chit method. (Refer CONSORT diagram). Post treatment reassessment was on 6<sup>th</sup> DAY of the protocol.

**CONSORT diagram**

**Flow chart 1:** Flowchart for the randomized controlled trial.



**Fig. 1:** Calculating Craniovertebral Angle.



**Procedure:** A brief demographic data was noted from the subjects.

**Procedure for assessment:** Craniovertebral angle, which has Inter-rater reliability of (ICC>0.972) and test-retest reliability of (ICC>0.774).

This was measured using the photographic method. The digital camera that was used for taking photographs of the participants was mounted 1.5 m away from the subjects. To maintain the same distance between the camera and the subjects, a spot on the ground was marked for the subjects to stand on and spot was taped on to the floor where camera was held. The subjects stood barefoot and in a standing position, the photos were taken from the subject’s right hand side upon which the CV angle was calculated [12] by measuring the angle found at the intersection of a line drawn from the tragus of the ear through the spinous process of C7 and a horizontal line through C7 [21,23](Figure 2)

**Fig. 2:** Calculating Isometric Cervical Flexor Endurance Score.



Isometric neck flexor muscle endurance score [22,24], which has interrater reliability of 0.83, 0.85, and 0.88 for the 3 testers and Intrarater reliability of 0.78.

Subject was in supine on a plinth, retracted the chin and lifted the head at a distance of 2 cm and was confirmed visually using a vertical ruler placed at the side of the plinth. The time between assuming the test position until the chin began to thrust down was measured in seconds with a stop watch. Chin drop was determined by checking the drop of the subject’s chin by observation. Participants were given a demonstration of the procedure prior to the test. (Figure 3)

NPRS Score [20], which has strong correlation to VAS scores ( $r= 0.94$ , 95% CI = 0.93 to 0.95). On a scale of 0 to 10, subject is told to rate their pain RIGHT NOW, USUAL, BEST and WORST level of pain during the last week. The score is calculated out of 40 by adding all four counts [30].

Subjects were given this form to fill and depending on which the score was noted. By using chit method randomly segregate the subjects into two groups i.e. KT group and Placebo KT group.

**Procedure for application of kinesio tape [17]:**

The tape used in this study was water proof, adhesive, had a width of 5cm. It was able to get stretched up to 140% of its original length. The tape was applied on the skin and replaced on 4th day. The tape was measured and cut according to patient’s required treatment area. For KT group was applied on levator scapulae and upper trapezius. Two strips (I shaped) of the tape were used; subject was asked to stretch the muscles and first strip was applied from Occiput towards the fibers of upper trapezius. Second strip was applied from occiput towards the fibers of levator scapulae. This was applied bilaterally.

For placebo KT group, KT was applied on C7 to T3. Subject was asked to flex his head and I strip

was applied over the spinous process of C7 to T3 with no tension on the ends of the tape. Then subject was asked to return his head to neutral position.

After 3 days tape was reapplied and results were noted on day 6.

**ANALYSIS AND RESULTS:**

SPSS software version 16 software was used. Statistical measures such as mean, standard deviation and tests of significance such as Kolmogorov-Smirnov Z test, Mann-Whitney U test, Wilcoxon matched paired test were used for the analysis of the data. Normality testing of the variables by Kolmogorov-Smirnov Z test showed that it does not follow a normal distribution. Therefore, the non-parametric tests were applied (Table1). Subjects in both the groups match for age, weight, height & BMI (Table3). Within group comparison of KT Group and Placebo KT Group with respect to CV angle ( $p=0.0015,0.0010$ ), ICFES ( $p=0.0007,0.0007$ ) and NPRS scores ( $p=0.0007,0.0007$ ) at pre and post test by Wilcoxon matched paired test showed improvement for both the groups. But between group comparison for CV angle ( $p=0.0971, 0.5755$ ), ICFES ( $p=0.9504,0.9010$ ), NPRS scores ( $p=0.1354,0.8519$ ) by Mann-Whitney U test showed no significant difference between KT Group and Placebo KT Group. (Table 4,5)

**Table 1:** Normality of pre and posttest scores of various variables by Kolmogorov-Smirnov Z test.

Variables	Time points	KT Group		Placebo KT Group	
		Z-value	p-value	Z-value	p-value
CV ANGLE	Pre test	0.8	0.545	0.429	0.993
	Posttest	0.706	0.701	0.727	0.667
	Difference	0.758	0.614	0.756	0.617
NPRS	Pre test	0.708	0.697	0.856	0.456
	Posttest	0.989	0.282	1.162	0.134
	Difference	0.541	0.931	0.664	0.771
ICFES (SEC)	Pre test	0.592	0.875	0.957	0.318
	Posttest	0.403	0.997	0.634	0.816
	Difference	0.743	0.639	0.543	0.93

**Table 2:** Gender distribution.

Gender	KT Group	%	Placebo KT Group	%	Total
Male	1	6.67	2	13.33	3
Female	14	93.33	13	86.67	27
Total	15	100	15	100	30

**Table 3:** demographic distribution by t test.

Subjects in both the groups match for age, weight, height & BMI,

Variable	Group	n	Mean	SD	t-value	p-value
Age	KT Group	15	21.13	1.41	0	1
	Placebo KT Group	15	21.13	1.92		
Weight	KT Group	15	1.61	0.08	0.5816	0.5655
	Placebo KT Group	15	1.59	0.07		
Height	KT Group	15	59.27	10.62	-0.0528	0.9583
	Placebo KT Group	15	59.47	10.14		
BMI	KT Group	15	22.88	3.26	-0.2123	0.8334
	Placebo KT Group	15	23.13	3.12		

**Table 4:** Within group comparison by Wilcoxon matched paired test.

	Groups	Time	Mean	Std.Dv.	Mean Diff.	SD Diff.	% of change	Z-value	P-value
CV angle	KT Group	Pretest	49.53	4.67	-2.8	2.11	-5.65	3.1798	0.0015*
		Posttest	52.33	4.45					
	Placebo KT Group	Pretest	46.8	5.14	-3.67	2.77	-7.83	3.2958	0.0010*
		Posttest	50.47	6.03					
ICFES	KT Group	Pretest	38.27	14.04	-18.53	8.44	-48.43	3.4078	0.0007*
		Posttest	56.8	18.46					
	Placebo KT Group	Pretest	39.07	22.8	-20.33	12.94	-52.05	3.4077	0.0007*
		Posttest	59.4	27.44					
NPRS	KT Group	Pretest	18.27	6.56	9.6	4.73	52.55	3.4075	0.0007*
		Posttest	8.67	4.17					
	Placebo KT Group	Pretest	14.73	5.62	6.73	4.08	45.7	3.4078	0.0007*
		Posttest	8	3.12					

**Table 5:** Between group comparison by Mann-Whitney U test.

	Time	Group	Mean	SD	Sum of ranks	U-value	Z-value	P-value
CV angle	Pretest	KT Group	49.53	4.67	272.5	72.5	-1.6591	0.0971
		Placebo KT Group	46.8	5.14	192.5			
	Posttest	KT Group	52.33	4.45	246	99	-0.56	0.5755
		Placebo KT Group	50.47	6.03	219			
ICFES	Pretest	KT Group	38.27	14.04	234	111	-0.0622	0.9504
		Placebo KT Group	39.07	22.8	231			
	Posttest	KT Group	56.8	18.46	235.5	109.5	-0.1244	0.901
		Placebo KT Group	59.4	27.44	229.5			
NPRS	Pretest	KT Group	18.27	6.56	268.5	76.5	-1.4932	0.1354
		Placebo KT Group	14.73	5.62	196.5			
	Posttest	KT Group	8.67	4.17	228	108	-0.1867	0.8519
		Placebo KT Group	8	3.12	237			

## DISCUSSION

The present randomized controlled trial was aimed to find the effect of Kinesio and Placebo Kinesio taping on neck flexors and Craniovertebral angle in subjects with Forward Head Posture.

Gender distribution in the present study indicates that the FHP occurrence is more in

females (86.67) when compared to males (13.33). This matched the findings of other studies which demonstrated increased occurrence in females than in males [38-40]. The age group between 18 to 60 years was taken as an inclusion criteria as several studies have shown the occurrence of FHP in the above mentioned age group [27]. Reviews have stated that forward head posture increases in

individuals during the work, which involves an excessive anterior positioning of the head in relation to the theoretical plumb line perpendicular to the body's center of gravity. This must be a reason why FHP is the common type of posture in sedentary workers [18,25,38]. Studies also reveal that FHP can be a result of sprains and strains of the neck, imbalance in the neck muscles and the poor posture [6].

Usually long duration workers, working on computers are more susceptible to having neck pain and forward head because of hours spent studying and working on computers [29]. All these activities are done in static sitting position with the head bent forward, where during computer processing the keyboard and monitors are held close together resulting in neck pain and slouched posture.

A study on effect of relatively protruded head and neck posture on postural balance stated that FHP may contribute to the disturbances in the balance in healthy adult [18]. Here the severity of head protrusion with neck extrusion and posture balance were assessed. The reason behind this is the same muscle imbalance created by the attained posture in static position.

The results from the statistical analysis of the present study rejected the alternate hypothesis and proved that there is equal effect of kinesio taping on endurance of neck flexors and craniovertebral angle for FHP subjects

Taping has already proved its effectiveness in improving forward head posture [32-34] where it improves posture with applied prolonged stretch on muscles. Muscle and collagen tissue are very adaptable and researches are indicated that prolonged and low load stretch are more effective than short term stretch. Kinesio tape maintains the proper alignment and in this way it applies prolonged stretch on tight structures surrounding shoulder and neck. Also kinesio tape places short and overactive muscle in lengthened position and shift length-tension curve to right and with decrease overlapping actin-myosin in cross-bridge cycle diminished muscle force production [26].

Won- Gyo Yoo et al (2013) investigated the effect of neck retraction taping on FHP and upper trapezius muscle of computer workers during

computer work. It was stated that the taping tension provided by the Neck retractor taping stimulates cutaneous mechanoreceptor effect and thus prevents and decreases FHP. Also the muscle activity of upper trapezius decrease with NRT compared to without NRT [18]. Also there are studies that disagree with previous possible mechanisms of kinesio taping proposed by Kase et al. and others, which stated that the Kinesio tape is not superior to other interventions [35-37]. A possible explanation given by them for the negative result, is that the magnitude of cutaneous afferent stimulation generated by kinesio taping may not have been strong enough to modulate the changes. A study also indicate that Kinesio Taping was no better than sham taping/placebo and active comparison groups, but the effect sizes were small and probably not clinically significant or the trials were of low quality [31].

The present study stated equal effect of placebo kinesio tape on endurance of neck flexors and craniovertebral angle as the Kinesio tape. Here the cutaneous efferent stimulus and sensory feedback must have provided the same result as the proper Kinesio taping technique on the skin.

Similar results were seen in a pilot study done by Chia-Ning Chiu et al. (2013) on effect of kinesio taping on forward head posture and muscular endurance of deep neck flexors. Here placebo kinesio taping was proved to be better method than traditional kinesio taping method for correcting FHP and improving muscular endurance of deep neck flexors. This is probably because placebo KT generates tension when applied at C7-T3 spinous process and corrects the sitting posture of subjects [17] and must also be an another reason for the equal effects of both the techniques.

**Limitation:** Long term effect of the kinesio taping was not assessed. Despite the intent of Placebo Kinesio Application, the absence of real control group that did not receive any tape intervention precludes ruling out the secondary changes of the study.

**Future Scope:** Effect of kinesio tape and no tape can be assessed, Effect of both, KT and Placebo KT using in combination with other already proved intervention methods.

## CONCLUSION

Kinesio taping appears to be effective in improving forward head posture. But when compared with Placebo kinesio taping, it did not prove to be superior in treating forward head posture.

**Conflicts of interest: None**

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