

The Effect of Kinesiotape For Dynamic Balance of Chronic Ankle Instability (CAI) in Youth Indonesian Athletes

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Abstract: The effect of kinesiotape (KT) to correction and facilitation techniques after ten minutes of dynamic balance using the star excursion balance test (SEBT) on chronic ankle instability injury (CAI). One hundred eleven (111) subjects were divided into group 1 correction techniques (n = 21), group 2 facilitation techniques (n = 26), and group 3 controls / normal (n = 64). Quasi experimental randomized controlled trial by testing the SEBT percentage pre and post, and testing the SEBT percentage after 10 minutes in group 1 and group 2, compared to normal 3-ankle group. Paired sample t-test pre (87,62% ± 9,631) and post (98,14% ± 10,556) group 1 p = 0,000 (p <0,005) there is difference of dynamic balance, paired sample t-test pre (90, 12.5% ± 8,529) and post (96,5% ± 14,049) group 2 p = 0,015 (p <0,05) there is difference of dynamic balance, independent sample t-test post group 1 and group 2 p = 0,659 (p > 0, 05) and ANOVA group 1, group 2, & group 3 (95,13% ± 11,31) p = 0,585 (p > 0,05) there is no difference of dynamic balance. Both techniques of KT on ankle have a neurophysiological effect on dynamic balance same as normal ankle.

1 INTRODUCTION

Sprain lateral ligaments of the ankle joint are the most commonly injured by active athletes. The impairment found that this ligament will cause signs and symptoms such as pain, swelling, and feel the joints slack or unstable (Kobayashi and Gamada, 2014). Athletes who have already experienced this injury will be the risk of recurrent or repetitive injuries with symptoms not getting better or worst (Bonnell et al., 2010). Some opinions suggest that this injury occurs after repeated injuries more than twice and more than 3 months (Gribble et al., 2014).

One data explains that during the 11-year league UEFA Champions were 1080 occurrences of ankle injuries with a ratio of 0.7-1 / 1000 hours (Walden et al., 2013). Lateral sprain ankle is the most commonly experienced limb injury in the athlete with an incidence rate of 20% -40% in various sports (Walden et al., 2013, Sawkins K, 2007). Ankle injuries are more common in women and children active in team sports.

A subjective complaint by some athlete who had a history of ankle injuries, they will feel painful and unstable when they practiced and played (Donovan

and Hertel, 2012). There is some athlete who suffered repetitive injuries and some are not. Some studies explained that chronic ankle instability (CAI) is caused by instability of the ankle joint alongside a single motion. In this case, there are two types of joint instability, namely mechanical stability and functional stability (Giannini et al., 2014, Kobayashi and Gamada, 2014).

Individuals with CAI will be had hypermobility and joint hypomobility, hypermobility due to decreased joint stability and hypomobility due to changes in the position of the distal talocrural and tibiofibular joint (Hoch and Grindstaff, 2012, Hubbard and Hertel, 2006). Hypomobility is characterized by the limitations of dorsal flexion and plantar flexion. This limitation will be decreased the action of the joint mechanism and proprioceptors, reduce muscle contraction, static and dynamic control of postural, and the pattern of gait that affect to recurrent injuries (Hoch and Grindstaff, 2012).

The x-ray observations in this condition and sub-acute sprained ankle explained that this injury will change the position of fibular bone shift to the anterior of tibia (Hubbard et al., 2006, Hubbard and Hertel, 2008). Furthermore, talus bone also shifts to the anterior, this reasons why athlete felt pain at

anterior side of the ankle, difficult for dorsal flexion and it will facilitate the ankle joint in the plantarflexion and inversion position (Wikstrom and Hubbard, 2010).

Based on the above paragraph explanation, there needs external support using Kinesio tape (KT) to improve the position of the fibula and talus bone to increase the function of mechanoreceptor which implies the dynamic balance and reduces the risk the recurrent tear of ligament during practice. According to Kumbriak (2012), there are four techniques using Kinesio tape, namely muscle facilitation, ligament correction, bone position correction, and lymphatics. In this study, the techniques designate used are muscle facilitation and bone position correction applied to the ankle. This technique will enhance the work of sensory function mechanoreceptor which increase the joint position and proprioception to become more stable.

KT gives an effect to correct the muscle tone and muscle contraction because of the activation subcutaneous mechanoreceptor that regulates sensory feedback stimulation of the fascia and muscle layers. This feedback will respond to the proprioceptive to transmit information to the central nervous system (CNS) and return back to the peripheral motor system to controlled muscle tone whether it facilitates and inhibits according to desired needs and stimulation. Furthermore, to some pathologies caused by autonomic controls, KT should be able to provide information through the mechanoreceptors into the hypothalamus thereby providing stimulation of tone control globally (Seo et al., 2016, Chang et al., 2015).

2 METHOD

2.1 Subject

One hundred eleven (111) feet of observations were obtained from students of the Student Sport Education Center (SSEC) Ragunan Jakarta, Indonesia divided into three (3) groups, with inclusive for CAI (group 1 (KT with Bone position correction technique) and group 2 (KT with Muscle facilitation technique) male and female aged 15-20 years, have a history of ankle injuries more than once times (≥ 1 times) in the presence of inflammation and physical activity limitation, ever felt more than 2 times feeling unstable at the ankle joints, recurrent injuries without any new inflammation condition, and self-assessment of ankle injuries with CAIT < 24 point. For group 3

with a normal foot, the criteria are male and female athletes 15-20 years old, had no history of injury ankle and knee, self-assessment of ankle injury with Cumberland Ankle Instability Tool (CAIT) ≥ 24 point. The exclusion criteria of the subject there were having a history of musculoskeletal surgery actions including bones, ligaments, muscles, and nerves around the ankle joint, has a history of foot fracture, musculoskeletal acute injuries (sprains, strains, and fractures) within a period of three months during the examination. The randomized control trial group with a twenty-one (21) feet with CAI entered in group KT with bone position correction technique, twenty-six (26) feet with CAI entered in group KT with muscle facilitation technique, and sixty-four legs (64) healthy or without CAI were not given any intervention.

2.2 Instrument

Measurements the dynamic balance was using the Star Excursion Balance Test (SEBT) were performed before and after 10 minutes given KT in both intervention groups. Whereas the healthy foot group can measurements were taken at any time.

2.3 KT Technique

2.3.1 Bone Position Correction Technique

Using four pieces of KT attached to the area of the fibula bone to maintain the position of the fibula.

2.3.2 Muscle Facilitation Technique

Using three pieces of KT attached to the peroneus longus and brevis muscles and given resistance to the anterior ankle (figure 1).

Table 1: ANOVA.

Perlakuan	Rerata \pm sd (%)	F	p
Grup 1 (Bone Correction Technique)(n=21)	98,14 \pm 10,556		
Grup 2 (Muscle Facilitation technique)(n=26)	96,5 \pm 14,049	0,539	0,585
Grup 3 (Normal Ankle)(n=64)	95,13 \pm 11,31		



Figure 1: Muscle facilitation technique (Bicici, et al, 2012).



Figure 2: Fibulla correction technique.

3 RESULT

For group 1 the dynamic balance before and after given KT with bone position correction technique was tested using paired sample t-test. The results show that there was a difference in dynamic balance with $p = 0,000 (<0,005)$. This describes that there was an effect for KT in increasing of dynamic balance in athletes with CAI. While in group 2 was given KT with muscle facilitation technique was tested using paired sample t-test. The result shows that there was a difference in dynamic balance with $p = 0,015 (<0,005)$. This also describes that there

was a difference in dynamic balance in athletes with CAI (table 2).

Seeing the benefits of these KT techniques will be compared with normal ankle SEBT values tested using ANOVA. The result shows that there was no difference in the dynamic balance between KT applied and normal feet with $p = 0,539 (> 0,005)$. This describes that the use of this KT gives the same dynamic balance effect as a normal ankle (Table 1).

4 DISCUSSION

Based on the results, the effect of dynamic balance using SEBT concomitant with a research report by Tamburella et al (2014) which explained the use of KT for 48 hours in neurological cases can improve balance in the spinal cord injury, spasticity and road patterns. According to this KT will enhance sensory input by providing a reciprocal response to proprioceptive and controlling muscle tone (Tamburella et al., 2014). Cortesi, et al (2011) also reported that in cases of multiple sclerosis, KT applied at the ankle will improve motion control, exteroceptive afferent function, and motor excitability in the soleus muscle when standing one foot with the eyes closed. The use of KT on the ankle can also improve posture stability (Cortesi et al., 2011). Both reports explain that the elastic adhesive (Kinesio tape) has an effect on the neurophysiological functions in the target area the function of stability will be increased. It describes that the use of KT can help improve the function of joint structures so that athletes with CAI can feel more stable in joint awareness. Followed by Mohamed et al (2016) explaining KT applied to a first-degree ankle injury will speeds up functional improvement.

In this study, there was no difference of SEBT value between group 1 (bone position correction technique) $98,14 \pm 10,556$, group 2 p(muscle

Table 2: Before and After Both Group (Paired sample t-test).

Group	Sample (n)	Mean±sd (%)		p
		Before	After	
Group 1 (bone position correction technique)	21	87,62±9,631	98,14±10,556	0,000 (p<0,05)
Group 2 (muscle facilitation technique)	26	90,12±8,529	96,5±14,049	0,015 (p<0,05)

facilitation technique) $96,5 \pm 14,049$ and group 3 (normal ankle) $95,13 \pm 11,31$. Both KT techniques employed provide balance enhancements parallel to normal ankle balances. Park and Lee (2016) describe the use of KT in 12 hemiplegic stroke patients with decreased body coordination and motion can improve the ability to walk straight. Improved body and motion coordination after KT may be caused by afferent stimulation of the mechanoreceptors of the skin that responds to efferent feedback on the muscle. So, the work of the cutaneous fusimotor reflex and gamma motor fibers will increase muscle fiber and motor muscle tone (Kim et al., 2014, Park and Lee, 2016). William et al. (2012) in his meta-analysis report explained that the effect of KT can be used as prevention tools for ankle recurrent injuries even though the resulting motor enhancement increases not satisfied (Wilson and Bialocerkowski, 2015).

The CAI condition had found in this study is ankle injury will need the basic physiology of the somatosensory function that was damaged while injured cannot provide the efferent/motoric feedback system on ankle stability would be a risk of recurrent injury (Williams et al., 2012, Mohamed et al., 2016). Kinesiotape applied to the ankle joint may perform as an external control to give a perception on the ankle joint to increase automation of motor control while neurophysiological excitability in dynamic balance for the athlete with CAI condition (Lemos et al., 2017).

5 CONCLUSIONS

CAI is a condition of ankle injuries that often occur in athletes and high risk for recurrent injuries. The use of the Cumberland Ankle Instability Tool (CAIT) can serve as a diagnostic tool for CAI so that the determination for the therapy program is more appropriate. The dynamic balance with SEBT can be used as a standard to see motor control of the lower limbs to measure the risk of recurrent ankle injuries. The use of Kinesio tape can be given before the athlete/sportsman during exercises or competition to give some perceptions of stability in the ankle joint.

REFERENCES

Bicici, S., Karatas, N. and Baltaci, G. 2012. Effect of athletic taping and kinesiotaping® on measurements of functional performance in basketball players with

- chronic inversion ankle sprains. *International journal of sports physical therapy*, 7, 154-166.
- Bonnel, F., Toullec, E., Mabit, C. and Tourné, Y. 2010. Chronic ankle instability: biomechanics and pathomechanics of ligaments injury and associated lesions. *Orthopaedics & traumatology: surgery & research*, 96, 424-432.
- Chang, W.-D., Chen, F.-C., Lee, C.-L., Lin, H.-Y. and Lai, P.-T. 2015. Effects of kinesio taping versus mcconnell taping for patellofemoral pain syndrome: a systematic review and meta-analysis. *Evidence-based complementary and alternative medicine: ecam*, 2015, 471208.
- Cortesi, M., Cattaneo, D. and Jonsdottir, J. 2011. Effect of kinesio taping on standing balance in subjects with multiple sclerosis: a pilot study. *Neurorehabilitation*, 28, 365-372.
- Donovan, L. and Hertel, J. 2012. A new paradigm for rehabilitation of patients with chronic ankle instability. *The physician and sportsmedicine*, 40, 41-51.
- Giannini, S., Ruffilli, A., Pagliuzzi, G., Mazzotti, A., Evangelisti, G., Buda, R. and Faldini, C. 2014. Treatment algorithm for chronic lateral ankle instability. *Muscles ligaments tendons j*, 4, 455-60.
- Gribble, P. A., Delahunt, E., Bleakley, C. M., Caulfield, B., Docherty, C. L., Fong, D. T.-P., Fourchet, F., Hertel, J., Hiller, C.E., Kaminski, T.W., Mckeon, P.O., Refshauge, K.M., Van der Wees, P., Vicenzino, W. and Wikstrom, E.A. 2014. Selection criteria for patients with chronic ankle instability in controlled research: a position statement of the international ankle consortium. *Journal of athletic training*, 49, 121-127.
- Hoch, M.C. and Grindstaff, T.L. 2012. Effectiveness of joint mobilization in patients with chronic ankle instability: a review of the literature. *Athletic training and sports health care*, 4, 237-244.
- Hubbard, T.J. and Hertel, J. 2006. Mechanical contributions to chronic lateral ankle instability. *Sports medicine*, 36, 263-277.
- Hubbard, T. J. and Hertel, J. 2008. Anterior positional fault of the fibula after sub-acute lateral ankle sprains. *Manual therapy*, 13, 63-67.
- Hubbard, T.J., Hertel, J. and Sherbondy, P. 2006. Fibular position in individuals with self-reported chronic ankle instability. *Journal of orthopedic & sports physical therapy*, 36, 3-9.
- Kim, W.-I., Choi, Y.-K., Lee, J.-H. and Park, Y.-H. 2014. The effect of muscle facilitation using kinesio taping on walking and balance of stroke patients. *Journal of physical therapy science*, 26, 1831-1834.
- Kobayashi, T. and Gamada, K. 2014. Lateral ankle sprain and chronic ankle instability: a critical review. *Foot ankle spec*, 7, 298-326.
- Kumbrink 2012. K-taping an illustrated guide. Berlin: springer-verlag.
- Lemos, A., Wulf, G., Lewthwaite, R. and Chiviacowsky, S. 2017. Autonomy support enhances performance expectancies, positive affect, and motor learning. *Psychology of sport and exercise*, 31, 28-34.

- Mohamed, M.A., Radwan, N.L. and Al Shimaa, R.A. 2016. Effect of kinesio-taping on ankle joint stability. *International journal of medical research and health sciences*, 5, 51-58.
- Park, Y.-H. and Lee, J.-H. 2016. Effects of proprioceptive sense-based kinesio taping on walking imbalance. *Journal of physical therapy science*, 28, 3060-3062.
- Sawkins, K, R.K., Kilbreath, S, Raymond, J. 2007. The placebo effect of ankle taping. *Med sci sports*, 39(5):781-7.
- Seo, H.-D., Kim, M.-Y., Choi, J.-E., Lim, G.-H., Jung, S.-I., Park, S.-H., Cheon, S.-H. and Lee, H.-Y. 2016. Effects of kinesio taping on joint position sense of the ankle. *Journal of physical therapy science*, 28, 1158-1160.
- Tamburella, F., Scivoletto, G. and Molinari, M. 2014. Somatosensory inputs by application of kinesiotaping: effects on spasticity, balance, and gait in chronic spinal cord injury. *Frontiers in human neuroscience*, 8, 367.
- Walden, M., Hagglund, M. and Ekstrand, J. 2013. Time-trends and circumstances surrounding ankle injuries in men's professional football: an 11-year follow-up of the uefa champions league injury study. *Br j sports med*, 47, 748-53.
- Wikstrom, E. A. and Hubbard, T. J. 2010. Talar positional fault in persons with chronic ankle instability. *Archives of physical medicine and rehabilitation*, 91, 1267-1271.
- Williams, S., Whatman, C., Hume, P. A. and Sheerin, K. 2012. Kinesio taping in treatment and prevention of sports injuries. *Sports medicine*, 42, 153-164.
- Wilson, B. and Bialocerkowski, A. 2015. The effects of kinesiotape applied to the lateral aspect of the ankle: relevance to ankle sprains – a systematic review. *Plos one*, 10, e0124214.