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Effect of kinesio-taping on ankle joint stability

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ABSTRACT

Ankle Instability is characterized by recurrent giving way and often develops after repeated lateral ankle sprains. Kinesiotape is more elastic than traditional athletic tape and is becoming increasingly popular. It is reported to decrease pain, improve muscle function, circulation and proprioception, however, research examining the effects of Kinesiotape in ankle instability is limited. The objective of this study was to determine if applying Kinesiotape to unstable ankle may improve performance in the Star Excursion Balance Test (SEBT), which has been shown to be a sensitive and reliable measure for quantifying dynamic balance. Thirty subjects with first degree ankle sprain were participated in this study. SEBT was used to test the subject dynamic balance under three conditions; without taping, with white athletic tape and with kinesiotape. One way repeated measure ANOVA using Greenhouse-Geisser corrections were conducted to evaluate differences in SEBT for the three conditions. Pairwise comparison of the outcome measures in the three occasions (without taping, with athletic taping, and with kinesio taping) revealed statistically significant differences of all outcomes between occasion 1 (without taping) and occasion 2 (with athletic taping) favoring the athletic taping ($p < 0.05$). Also, a statistically significant difference between occasion 1 (without taping) and occasion 3 (with kinesio taping) were found ($p < 0.05$) favoring kinesio taping. Moreover, pairwise comparison of the ankle stability outcomes using athletic taping versus kinesio taping indicated a statistically significant difference ($p < 0.05$) in favor of kinesio taping measures. Conclusion: kinesiotape has superior effect than athletic tape in patients with first degree ankle sprain and can be used safely for improving ankle joint stability.

Key words: kinesiotape –SEBT- taping - ankle stability

INTRODUCTION

Ankle sprains are the most common type of injury in team sports. As the ankle re-injury rate is known to be high, it is important to identify specific injury prevention strategies. Measures to prevent injury have typically included specific strength training; proprioceptive training and external support, such as braces and non-elastic athletic tape [1] .Previous researches have shown that ankle joint taping is the most effective method in reducing the incidence of repeated injury in subjects with a history of ankle joint sprain [2].

Non-elastic adhesive tape has been used for injury prevention and during rehabilitation after ankle injury. This type of tape has been shown to be effective in restraining ankle inversion, and its use may decrease the incidence of ankle sprains. The mechanisms responsible may not only be due to the mechanical restriction of the range of ankle inversion but also to other prophylactic benefits of applying adhesive tape include deceleration of the inversion motion, afferent input to the central nervous system and placebo effects [3].

In 1980, a new type of elastic tape called Kinesio-Tape (KT) was introduced by KenzoKase[4].It is supposed to improve local circulation, reduce edema, facilitate or relax muscle, and improve joint function by enhancing sensory mechanisms. Although the efficacy of the tape has not been extensively studied, its popularity as part of clinical practice in physical therapy is growing. Recent studies indicate that KT may provide some short-term gains with respect to pain and range of motion of the shoulder and cervical spine, and that application of the tape may affect muscle activation levels [5].

KT is latex free and quick drying, and is typically applied in single strips and left on the skin for 3 to 5 days at a time. When it is used to prevent ankle sprains, it may be better tolerated and more cost effective than taping with non-elastic athletic tape. Due to its elastic properties, the ability of KT to enhance functional stability of the ankle relies on its purported effects on proprioception and muscle activation rather than mechanical support [1].However, this effect has not been studied up to date.

A recently published meta-analysis has comprehensively concluded that subjects with ankle instability exhibit postural stability deficits in both static and dynamic situations [6]. One measure of dynamic postural stability is the Star Excursion Balance Test (SEBT). The SEBT involves moving from a start position of bilateral stance to a single-leg stance while maximally reaching along set multidirectional lines with the opposite leg without compromising equilibrium. It has good intra- and inter tester reliability [7]. Olmsted et al,[8]were the first to investigate the efficacy of the SEBT in detecting postural stability impairments in a population of patients with ankle instability compared with healthy controls and the subject's own uninjured side. Decreased mean reach distances in all directions in the ankle instability group were observed, suggesting that the SEBT is a functional test capable of detecting impairment in ankle instability. Therefore, the SEBT may be an applicable clinical tool for assessing postural stability deficits in subjects with ankle instability [9].

Owing to the potential effects of taping on reducing the incidence of ankle injury and with decreased postural stability being reported as a risk factor for ankle joint injury, further investigations into the effects of taping on a dynamic measure of postural stability is warranted. The aim of the present study was to investigate the effect of two different ankle joint taping mechanisms (with white athletic tape and with KT) on dynamic postural stability in a group of subjects with first degree ankle sprain. We hypothesized that; both taping mechanisms would be accompanied by an increase in reach distance on the SEBT compared to the control untapped trials.

MATERIALS AND METHODS

SUBJECTS

Thirty female patients with first degree ankle sprain one month prior to testing on the dominant side were selected from Faculty of Applied Medical science; Prince Sattam Bin Abdulaziz University. They were on ordinary activity level , their mean age was 21.17(2.15) years, their mean height was161.27(2.53) cm and their mean weight was 61(2.10) kg, these patients were treated only by RICE technique (rest, ice, compression, elevation).Patients were excluded if they have any of the following, a history of spinal, hip, knee or foot pathology, any neurological impairment or a history of lower limb fractures, Significant ligament laxity as determined through clinical evaluation and vestibular or balance disorders. The study was approved by the ethical committee of the Faculty of Applied Medical Science, Prince Sattam Bin Abdulaziz University.

RANDOMIZATION

Thirty five patients were identified as potential participants. Three patients were excluded because they failed to fulfill the inclusion criteria, and two patients refused to participate in the study. Then the study was consisting of a repeated-measures design, with 30 participants who were tested by using the star excursion balance test under 3 conditions (random application to eliminate learning effect): without taping, with white athletic tape and with kinesiotape. Taping procedures were applied by the same physiotherapist to ensure consistency throughout the study

EVALUATIVE PROCEDURE

The diagnosis of first degree ankle sprain was based on orthopedic evaluation included an assessment for presence of pain, valgus and varus stress tests to determine ankle ligamentous stability, circulatory tests, assessment of cutaneous sensation, and tests of active, passive, and resisted ranges of motions, and on the Cumberland Ankle Instability Tool (CAIT) and an ankle injury history questionnaire. Subjects with a history of one ankle sprain and a CAIT score at or above 27 were selected.

TAPING PROCEDURE

Kinesiotape was applied to the unstable ankle as for a lateral ankle sprain [4]. The subject's foot was placed in a relaxed position initially with the foot up. Firstly, a strip of tape was placed from the anterior mid-foot to

immediately inferior to tibial tuberosity, over the tibialis anterior muscle, whilst being stretched at 120% of its length. The second strip was applied from the medial malleolus, round the heel, and split just below the lateral malleolus. The first branch was applied anteriorly, the second posteriorly, to the lateral malleolus and from there onwards both ran to attach laterally to the end of the first tape. The third strip was stretched to 140% and was applied across the ankle, just covering the medial and lateral malleoli. Finally, the fourth strip was applied from the arch and stretched to six inches above both malleoli [10]. Kinesiotape was applied by the same researcher. The white athletic tape was done by the same procedure as Kinesiotape.(Fig.1)

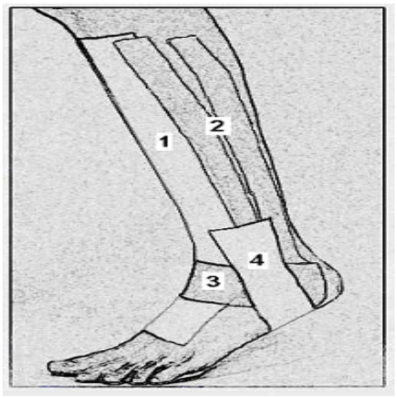

Fig. (1): application of kinesiotape on the ankle joint

SEBT PROCEDURE

The Star Excursion Balance Test (SEBT) was used to collect the participants' dynamic postural control [11]. The SEBT´s evaluator was blinded about the type of the tape applied .The objective of the SEBT is to reach as far as possible with one leg while maintaining balance with the contralateral leg. The SEBT was measured in the athletic training room with 2-inch adhesive tape on the hard floor. The grid was made with 8 lines extending at 45° increments from the center of the grid. The participants stood in the center of the grid. Each line was named: Anterior (A), Anterolateral (AL), Lateral (L), Posterolateral (PL), Posterior (P), Posteromedial (PM), Medial (M), Anteromedial (AM), in accordance to the excursion direction associated with the stance leg (Figure 2). The investigator demonstrated the SEBT test, and after the demonstration, as recommended by previous researchers. The participants practiced the test 3 times in 8 directions in order to familiarize themselves with the test and limit learning effect. The participants were instructed to maintain a single-leg stance in the center of the grid placed on the floor. While standing on one leg, they were instructed to try to reach the other leg as far as possible along the 8 lines and touch the furthest point possible on the line with the toes. Participants were also instructed to touch the tape with the reach foot as lightly as possible without bearing weight. Once the participant completed the toe touch on the tape they returned to a bilateral stance while maintaining equilibrium. During the test, the subjects stood on their taped leg in the middle of the grid, and extended their other leg as far as they could while maintaining balance. They were instructed to "try to reach as far as you can without losing balance, and touch with your other foot on the tape." They performed the reach in a sequential order in either counterclockwise or clockwise directions starting from the front. If the participant was standing on his or her left leg, the test was performed in a clockwise direction. If the participant was standing on his or her right leg, the test was performed in a counterclockwise direction. However, whichever direction they start, the first line they touch is always the A, then the AL, then the L, and so on. The participants performed the test three times, touching each of the eight lines, and their mean was recorded. There was a 30 second break between each reach, or the participants were allowed a longer break if they thought necessary. The distance of each reach was divided by the length of the subject's leg, and multiplied by 100 to keep the subject's leg length from influencing the results. The test was repeated in case the following occurred: participant did not make contact with the ground with the opposite foot while standing on the stance leg, 2) the participant moved the stance leg, 3) the participant lost balance during the trial, 4) the participant failed to maintain start and return position for a full second, 5) if the investigator determined that the participant have touched the ground with the reach foot that caused the reach foot to bear weight.

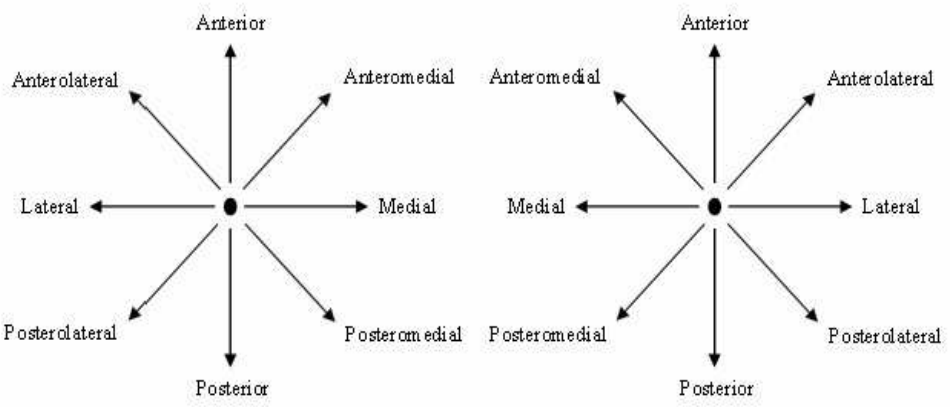

Fig. (2): Star excursion balance test

STATISTICAL ANALYSIS

Descriptive statistics (mean and standard deviation) were computed for all data. One way repeated measure ANOVA using Greenhouse-Geisser corrections was conducted to compare the mean differences of the outcome measures of Star Excursion Balance Test in three occasions; without taping, with athletic taping and with kinesiotaping. Least Significant Difference (LSD) test was used to determine the significant difference between the 3 occasions of measurement. The level of significance for all statistical tests was set at $p < 0.05$.

RESULTS

Thirty five patients were assessed for eligibility. Thirty patients met the criteria and the outcome measures of their assessment were analyzed. Their mean age, weight, height, and BMI were 21.17(2.15) years, 61(2.10) kg, 161.27(2.53) cm, and 23.30(0.93). Their mean scores of functional ankle instabilities as indicated by Cumberland Ankle Instability Tool were 22.07(1.41) (table 1).

Table 1: Baseline characteristics

	Mean (SD)	**Range**
Age	21.17 (2.15)	17 - 25
Weight	61 (2.10)	55 - 65
Height	161.27 (2.53)	155 - 167
BMI	23.30 (0.96)	21 - 25
CAI	22.07 (1.14)	20 - 24

As demonstrated in table (2) and figures 3,4 and 5, statistical analysis of the outcome measures of Star Excursion Balance Test in all directions (anterior, anterolateral, lateral, posterolateral, posterior, posteromedial, medial, and anteromedial) in three occasions (without tapping, with athletic tapping and with kinesiotape) indicated a statistically significant differences of all outcome measures ($p < 0.05$).

Table 2: The mean differences of SEBT

Groups	Anterior	Antero-medial	Medial	Postero-medial	Posterior	Postero-lateral	lateral	Antero-lateral
Without	78.63±2.46	72.77±2.28	80.03±3.50	79.86±2.09	88.20±3.86	79.40±2.14	67.20±1.58	79.23±1.61
Athletic taping	79.80±2.44	74.00±1.64	81.80±3.75	81.00±3.79	89.77±4.83	80.77±3.04	68.27±1.91	80.77±1.52
Kensio taping	81.93±4.90	75.80±2.68	84.43±4.22	82.63±4.60	91.20±5.78	81.87±3.51	70.50±3.50	81.97±2.59
P value	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001

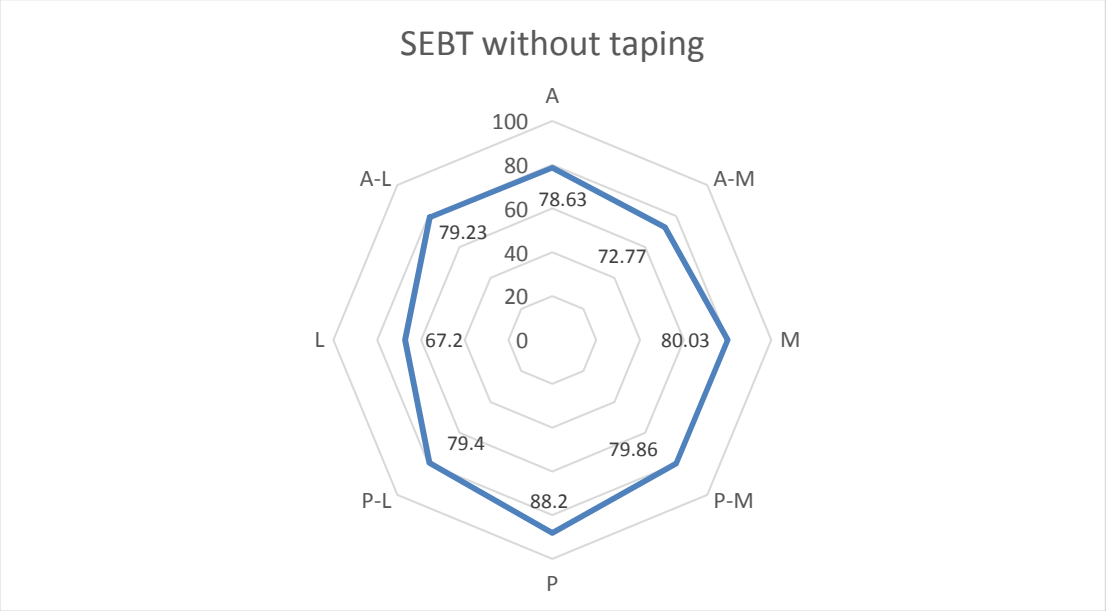

Fig. 3: Mean outcome measures of SEBT without taping

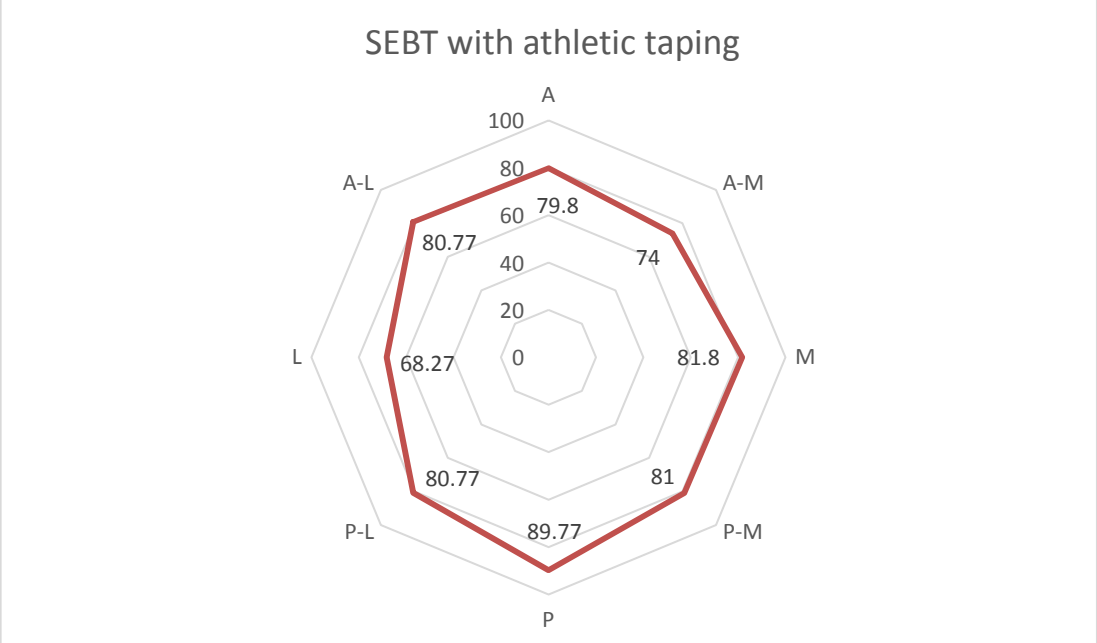

Fig. 4: Mean outcome measures of SEBT with athletic taping

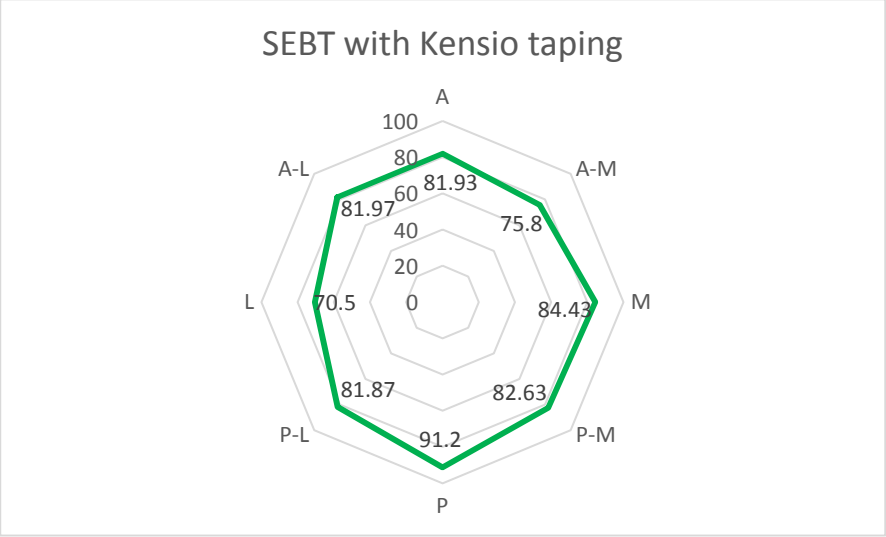

Fig. 5: Mean outcome measures of SEBT with kinesiotaping

Pairwise comparison of the outcome measures in the three occasions (without taping, with athletic taping, and with kinesiotaping) by the LSD test revealed a statistically significant differences of all outcomes between occasion 1 (without taping) and occasion 2 (with athletic tapping) favoring the athletic taping ($p < 0.05$) in favor of athletic taping. Also, a statistically significant difference between occasion 1 (without taping) and occasion 3 (with kensiotaping) were found ($p < 0.05$) favoring kinesiotaping. Moreover, pairwise comparison of the ankle stability outcomes with athletic taping versus kinesiotaping indicated a statistically significant difference ($p < 0.05$) in favor of kinesiotaping measures (table 3).

Table 3: Pairwise comparison

Groups	Anterior		Antero-medial		Medial		Postero-medial		Posterior		Postero-lateral		lateral		Antero-lateral	
	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value	Mean diff.	P value
Without and A.tape	-1.67	0.039	-1.23	0.018	-1.77	0.038	-1.13	0.025	-1.57	0.010	-1.37	0.004	-1.07	0.032	-1.53	0.001
Without and K.tape	-3.30	0.002	-3.03	0.001	-4.40	0.001	-2.77	0.001	-3.00	0.002	-2.47	0.001	-3.30	0.001	-2.73	0.001
A.tape and K.tape	-2.13	0.029	-1.80	0.002	-2.63	0.003	-1.63	0.035	-1.43	0.046	-1.10	0.024	-2.23	0.002	-1.20	0.037

DISCUSSION

Numerous researchers have reported the effect of kinesiotape (KT) for function, pain and ROM in the past .However, the results are mixed and further investigation are warranted .The purpose of this study was to investigate the effect of kinesiotaping on dynamic ankle joint stability. The main findings of the current study showed that the outcome measures in the three occasions (without taping, with athletic tape, and with KT) by the LSD test revealed a statistically significant differences between occasion 1 (without taping) and occasion 2 (with athletic taping) favoring the athletic taping($p < 0.05$) . Also, a statistically significant difference between occasion 1 (without taping) and occasion 3 (with kinesiotaping) were found ($p < 0.05$) favoring kinesiotaping. Moreover, ankle stability outcomes using athletic tape versus kinesiotape were revealed a statistically significant difference ($p < 0.05$) in favor of kinesiotape measures.

The significant effect of KT on dynamic ankle stability in patients with first degree ankle sprain found in this current study may be attributed to number of hypotheses. First, the presence of impaired proprioception following a lateral ankle sprain, it is biologically plausible that KT may increase afferent input and hence improve measures of proprioception [12]. Second, KT could increase the self-efficacy of the individual with an unstable ankle, potentially resulting in greater confidence, stability and assurance when performing the SEBT. Also, this come in agreement with the study of Pijnappel[13], who found that KT favor other types of tapes in improving postural control and attributed this to the stimulation of the cutaneous extroceptors from the foot and ankle . In our study, KT was found to improve dynamic postural stability in all directions in the SEBT which may be attributed to its application on patients with first degree ankle sprain. In addition, Murray and Husk [14], showed that KT enhanced proprioception in

individuals who had ankle pathology, because it allowed to have its effect on injured tissue .On the other hand, Halseth et al.[10] reported that KT appears to have no effect as their studies performed on healthy ankles .

Fayson et al, [15] have used the SEBT to evaluate the effectiveness of elastic therapeutic tape applied to the ankle for improving balance in healthy uninjured individuals. These studies have consistently found that elastic kinesiotape does not improve balance in this group. There are several potential reasons for these findings, but the results lead us to believe that initial proprioceptive deficits must exist in some sort of pathology for the elastic therapeutic tape to have a detectable impact on these reaching tasks.

It was theorized that KT mimics the properties of the skin's epidermis. Specifically, the tape's elasticity creates a constant pull on the skin, subsequently providing constant proprioceptive information to the area of the body it covers. Elastic therapeutic tape also, has some unique attributes: its heat activated, retains its skin-adhesion properties for up to five days, and is water resistant. According to manufacturers, elastic therapeutic tape lifts the skin away from the underlying tissue to facilitate a release of pressure on injured structures [16].

The effect of traditional tape provides superior benefits than no tape may regard to deceleration of inversion velocity and facilitation of dynamic neuromuscular protective mechanisms. Furthermore, tape offers a means to address the complex interrelated biomechanical factors that are responsible for subtalar joint injury and rotatory instability of the talocrural joint [17].

Further research is necessary to fully elucidate the exact mechanisms by which kinesiotape improve dynamic stability of the ankle and subsequently reduce the incidence of repeated injury in subjects with chronic ankle instability. Limitations of the present study include the small sample size (n=30) and muscle fatigue.

CONCLUSION

Kinesio tape has superior effect than athletic tape in patients with first degree ankle sprain and can be used safely for improving ankle joint stability.

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