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Effect of Taping Ankle on Functional Performance

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Abstract. The purpose of this investigation was to evaluate the effects of taping the ankle on functional performance. On the side step movement, EMG and floor reaction forces were collected and a three-dimensional motion analysis was performed. The peak value of the perpendicular, fore, after, and lateral components of floor reaction forces with the ankle taped were significantly higher than with the ankle untaped ($p<0.05$). Rising time from landing to the peak value with taping was significantly shorter than without taping ($p<0.05$). Results of three-dimensional motion analysis revealed that the mean time from landing to stopping the trunk was 1.31 sec. with the ankle on the untaped, and 2.76 sec. with the ankle taped. These results indicated that the balancing and shock absorbing performance of the foot were reduced by taping the ankle.

Key words: Taping, Floor reaction forces, Motion analysis.

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INTRODUCTION

The purpose of taping is to prevent external injuries, and reoccurrence of these injuries during exercising. Taping during exercising is an effective way of protecting and reinforcing tissue, but it restricts the natural mobility of the joints[1)]. Taping a certain part of body can cause partial restriction of ROM, and have an influence on the whole body movement such as balancing.

Taping requires a full knowledge of anatomy, and the negative effects of taping. The ankle sprain is one of the most common sports injuries for those who take part in sports. Particularly, sprain with inversion occurs with a high frequency. The most frequent part to be injured is Lig talofibulare anterius, followed by Lig. calcaneofibulare.

The functional effect of taping ankle is to restrict ROM of the ankle and to reduce excessive movement which may cause impairment. Taping of the foot or legs is often executed so as to prevent an ankle sprain or to compensate functional impairments due to pain during exercises or sequelae of instability disease. An excessive restriction of the joints by taping would, however, be a factor of impediment[3)]. Little has been written about analysis of excessive restrictions in an objective manner. A few reasons are considered: the tension of tape always changes with the density of pilus, the state of sebum cutaneum, and the amount of sweat. The method of taping is slightly difference according to the person doing the taping, and a standard for tape tension does not exist. We are goint to investigate the movement of the lower extremities and the trunk, with and without taping, taking a broad view in a objective manner prior to taking a narrow ap-

proach because this is a subject with a lot of variables. In this study we examined the good and bad effects of taping ankles by analyzing the movement of the lower extremities and the trunk through 1. EMG, 2. Floor Reaction Force, 3. 3 Dimensional Motion Analysis on the side step movement.

METHOD

Subject: one adult in good health with no experience of injury.

Age: 21 years old.

Height: 168 cm.

Weight: 56 kg.

On the arrestment of side steps, the body reaction is measured with the ankle both taped and untaped. The subject kicks off with the left leg to a Floor Reaction Force Plate installed 1.5 m to the right side, and stops quickly, landing with on the right leg.

The data was collected under the following two conditions: 1) landing with the right foot in the saggital direction; 2) stopping on the right foot only, without hopping or stepping. A pilot study was executed so as to minimize the differences of the side step movements in the trials. The furthest distance jumped was measured, and it was chosen as the side distance for the trials.

The subject wore a pair of sports shoes with the ankle both taped and untaped.

Taping

The taping was firmly done, (see Fig. 1) in order to restrict plantar and dorsal flexion, and varus or valgus of ankle joints.

Measurement with EMG

The following eight muscles were measured in exercising: Biceps femoris, Gluteus maximus, Glauteus medius, Tibialis anterior, Gastrocnemius,

Table 1. Ankle range of motion

(degrees)

	without taping	with taping
inversion	55	30
eversion	15	10
plantarflexion	60	40
dorsiflexion	25	10

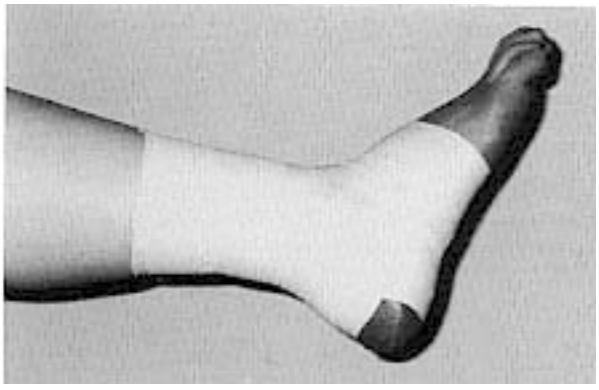

Fig. 1.

Table 2. Peak value of floor reaction forces

(N)

	without taping	with taping
perpendicular component	1508.2 ± 66.5	1811.2 ± 54.2
fore and after component	441.3 ± 58.6	593.1 ± 70.8
lateral component	599.0 ± 9.4	646.4 ± 29.9

Table 3. Mean rising time from landing to peak period and mean time from landing to stopping the trunk

	without taping	with taping
rising time from landing to peak period (msec)	6.94 ± 1.00	4.67 ± 0.30
time from landing to stopping the trunk (sec)	1.31 ± 0.01	2.76 ± 0.45

Peroneus longus, Vastus medials and Adductor longus.

ROM of ankle joint

The ROM of the foot on the landing side was measured with the ankle both taped and untaped. Four angles were measured. Only one inspector made this measurement of ROM. Measurement of the anterior foot was based on the method of Norkin and White, and other measurements were made according to the methods of the Japan Rehabilitation Medical Association[4, 5].

Machine for measurement

The Vicon system by Oxford Metrics (London) was used for the measurement of the floor reaction force, EMG, and movement analysis.

Procedure

1) The ROM of the ankle joint was measured with the ankle untaped.

2) Measurement of Floor Reaction Force, EMG and movement analysis was made after the subject had become well experienced at making side steps 1.5 m to the side.

3) The ankle of the landing foot was taped.

4) ROM of the taped ankle was measured.

5) Measurement of Floor Reaction Force, EMG and movement analysis was made after the subject had become well experienced at side steps 1.5 m to the side.

Data analysis

(1) Floor Reaction Force

a) The peak value, with the ankle taped and untaped, of the perpendicular, fore, after and lateral components of the Floor Rreaction Force were compared.

b) The rising times, with the ankle taped and untaped, from landing to peak period were compared.

(2) Movement analysis

a) When the subject's body was in the air, the height and velocity in the horizontal direction at the highest point was measured, with the ankle taped and untaped, to ensure the similarity of the trials. In the trials used for data analysis no significant differences in these parameters were found.

b) Time from landing to arrestment of the trunk was measured through the frontal locus of the right Acromion. The required times, with the ankle taped and untaped, to stay the trunk were compared.

(3) EMG

The activities of eight muscles, with the ankle taped and untaped, were compared on EMG.

RESULTS

(1)Floor Reaction Force

a) The peak value of the perpendicular, fore, after, and lateral components of the Floor Reaction Force with the ankle taped, was higher than with the ankle untaped.

b) The rising time from landing to the peak value with the ankle taped was shorter than with the ankle untaped (Figs. 2, 3).

(2) Movement analysis

b) The mean time from landing to stopping the trunk was 1.31 sec. with the ankle untaped, and 2.76 sec. with the ankle taped (Figs. 4, 5).

(3) EMG

It was observed that the muscle activities of Gluteus maximus, Glauteus medius and Adductor developed after landing with the ankle taped.

DISCUSSION

Balance for lateral direction

The required time from landing to stopping the trunk was measured by analysis of the frontal locus of Acromion. The required time with the ankle taped increased in a statistically significant manner. Varus and valgus of ankle joint is an important movement to keep lateral balance on stopping side steps. The relative joints with varus and valgus are Articulatio tarsi transversa composed of Articulatio joint, Calcaneocuboideum joint and calcaneonaviculae joint[5].

The mobility of these joints are decreased by taping. It was thought that the the balancing reaction by varus and valgus of the ankle joints was impeded when the ankle was taped, causing an extension of the trunk stopping time. This result might be relevant to the EMG result which showed that movement of Gluteus maximus, Gluteus medius and Adductor developed when the ankle was taped. It might be that since the ankle was firmly taped, the function of varus and valgus to balance laterally was impeded and shaking of the hip joint and the trunk occurred. This could be the reason for the development of the movement of the

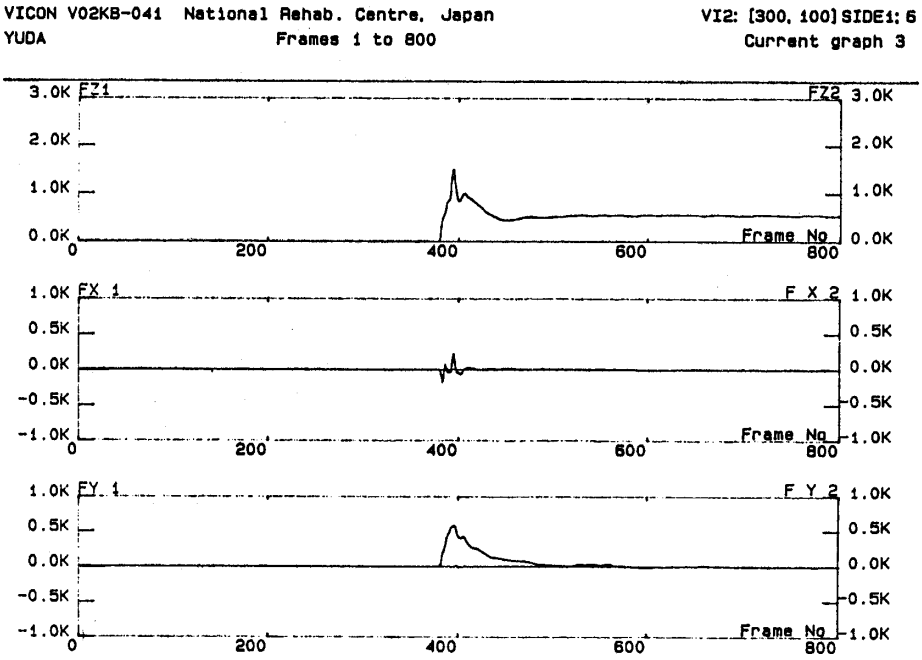

Fig. 2. Floor reaction force with the ankle untaped.

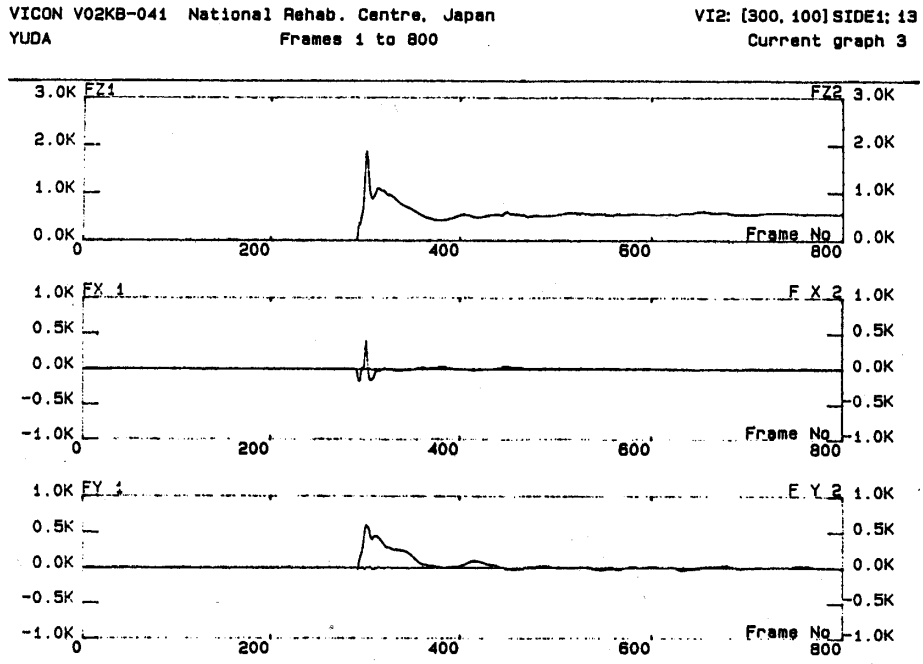

Fig. 3. Floor reaction force with the ankle taped.

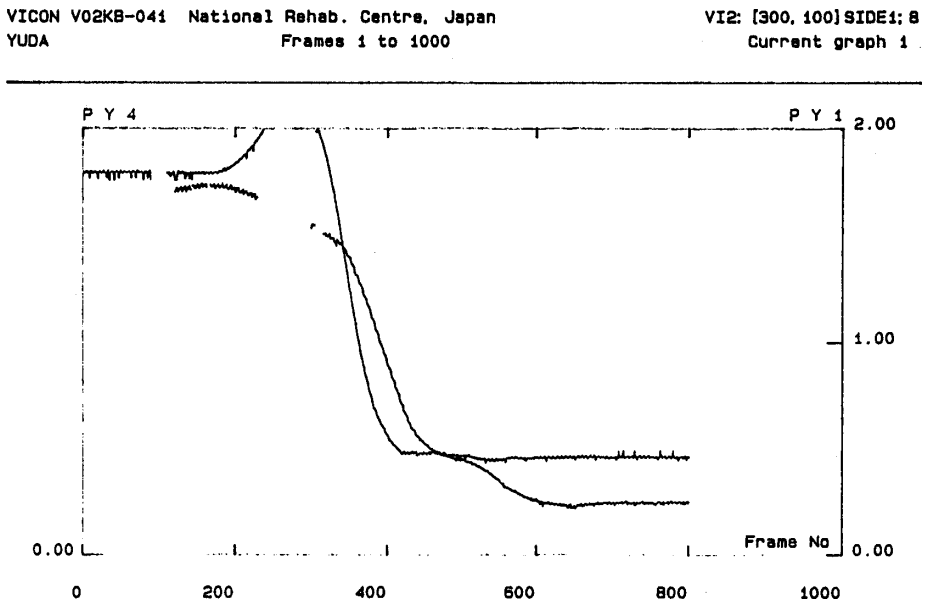

Fig. 4. Frontal locus of right acromion and right lateral malleolus with the ankle untaped.

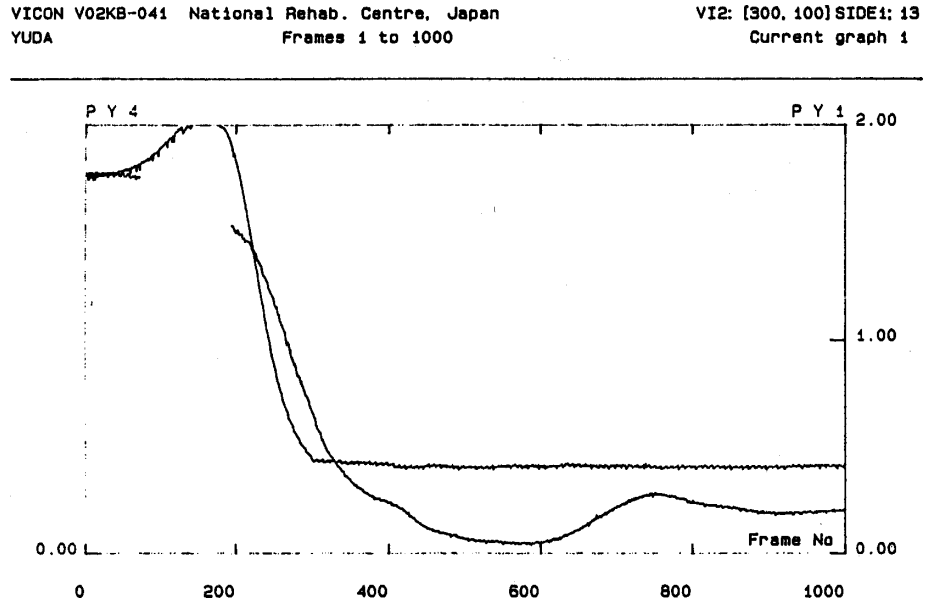

Fig. 5. Frontal locus of right acromion and right lateral malleolus with the ankle taped.

muscles which are relevant to the stability of the hip joint.

We came to the conclusion that taping impedes the foot in achieving good balance, taking a longer time to stop and requiring the upper part of the body to compensate for the lower extremities, making performance in sports worse. Such an effect would be found most pronounced in sports which require pushing and changing of direction.

Floor Reaction Force on landing

The peak value of the perpendicular, fore, after, and lateral components of Floor Reaction Force with the ankle taped was higher than with the ankle untaped, in a statistically significant result. The rising time from landing to the peak value with the ankle taped was shorter than with the ankle untaped in a statistically significant result. One of the causes for this might be that the shock absorbing effect on the floor by a combination of valgus of the posterior foot, inversion of the anterior foot, the arch of the foot which flattens, and internal rotation has decreased because taping inhibits the mobility of the foot. The development of foot reaction force by taping means much more stress is put on the ankle, knee, and hip joints, as well as on the bones or the soft tissues which make up these joints. The above facts show that the shoes, the floor and the amount of exercise should be taken into consideration to prevent Overuse syndrome, when the ankles are taped.

In this trial taping was done firmly done, and as a result the sports performance decreased. Taping of ankles is done by various methods, and it could be done to restrict varus and valgus making plantar and dorsal flexion possible. We intend to measure other taping methods and study the relevance between this result and rapidity.

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