



Effects of taping to restrict knee valgus movement during single leg landing

*Sho Iwata, Yukio Urabe, Noriaki Maeda,
Eri Fujii, Shuhei Numano

Graduate School of Biomedical and Health Sciences,
Hiroshima University

Introduction knee joint ligament injury

Traumatism movement

- Anterior Cruciate Ligament : ACL
- Medial Collateral Ligament : MCL

✓ Landing movement, Stop movement, Cutting movement

(Olsen et al., 2004, Kobayashi 1994)

✓ Especially, it is larger in the landing movement

(Noyes et al., 1997)

Traumatism position

✓ ACL and MCL injuries occur when knee joint valgus is forced

(Shin et al., 2014)

✓ Knee joint slight flexion, knee joint valgus angle

(Olsen et al., 2004)

It may be possible to avoid the ACL and MCL injuries by restricting the knee valgus movement

Prevention of ACL and MCL injuries

Movement
coaching

Strength training

Taping

Effects of taping to knee joint

- ✓ Tibia anterior translation and knee joint rotation decreased
(Anderson et al., 1993)
- ✓ Increasing a number of the tape, knee joint extension restrictions increased
(Urabe et al., 1995)

Effects of taping to prevent a knee joint ligament injury during sports task remain unclear.

Purpose

The purpose of this study was to investigate whether there were differences in time sequence changes in knee joint movement with tape restricting the knee joint.

Hypothesis

The knee joint valgus angle and the knee joint valgus moment are decreases when using tape.

Materials and methods

◆ Subjects

The participants were 18 female students with no history of knee injury

Age (y.o.)	Height (cm)	Weight (kg)	BMI (kg/m ²)
20.7 ± 1.0	159.0 ± 5.7	50.7 ± 4.2	20.0 ± 1.1

(Average ± SD)

The foot of single leg landing was defined as the supporting leg when kicking a soccer ball

Carried out with approval of the Hiroshima University Graduate School Medicine, Dentistry drugs Health Sciences mind body function life control Sciences ethics committee (ID 1501)

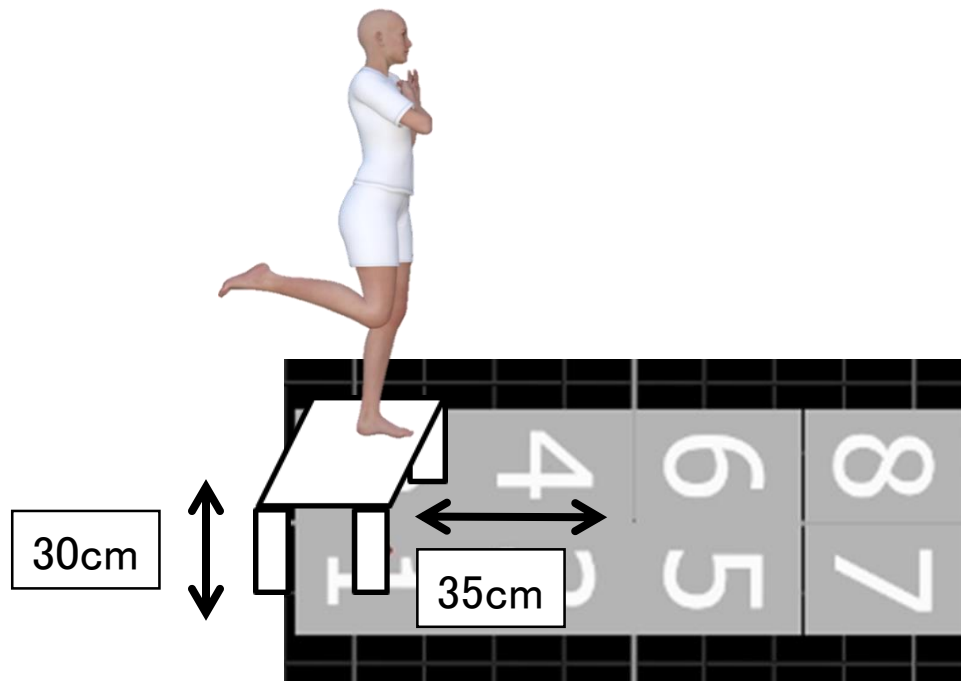
Experimental task

Single leg landing from a 30 cm platform , jumped 35 cm away from the platform
(3 successful trials)

Devices

Three dimensional motion analysis system (VICON MX ; Vicon Motion Systems)
with 16 units infrared cameras at sampling frequency 100 (Hz)

One force plate (AMTI) at sampling frequency 1,000 (Hz)



The taping method restricting knee valgus

V Wrapping ort

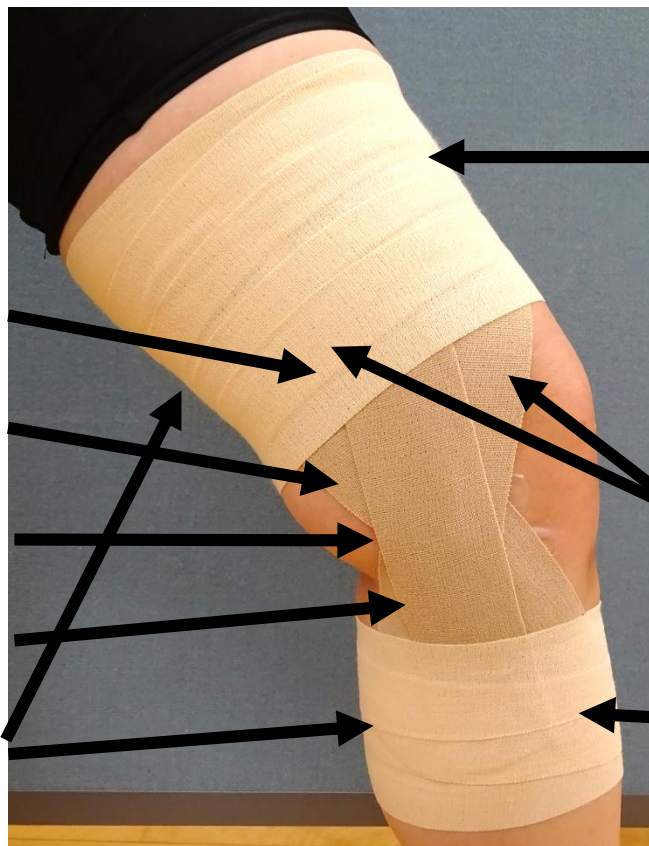
50 mm elastic tape

Medial epicondyle

MCL

Medial condyle

50 mm thin elastic tape



Mid thigh 75 mm
Non elastic tape

50 mm elastic tape

Crus maximum
38 mm

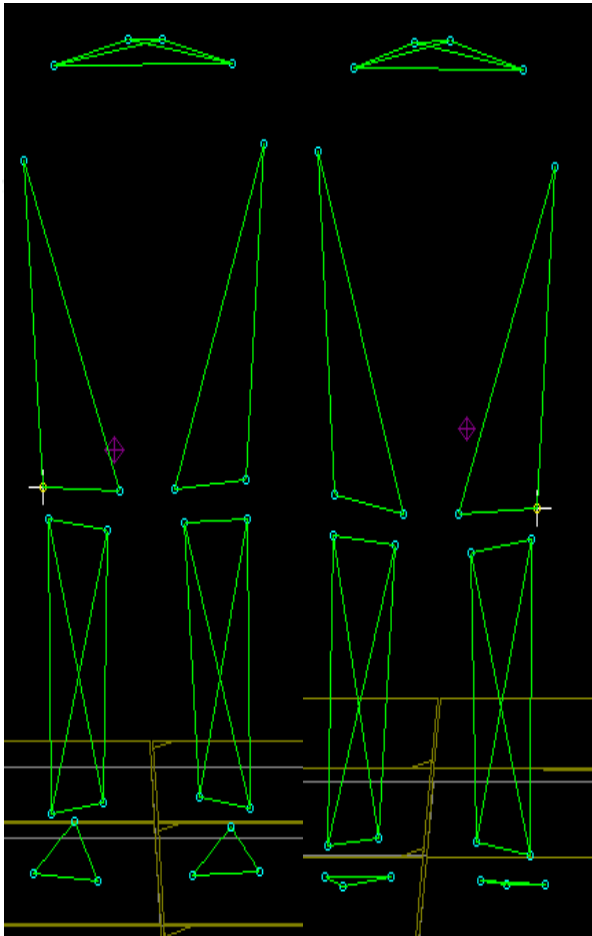
Non elastic tape

⊗ Taping was used everything Nitto Medical Corporation

To the tension of the rope at a constant, draw tape to the attachment of the hand held dynamometer, it was attached to when it becomes 30 N.

Motion analysis

Marker pasting position



- It was analyzed using behavior analysis software Body Builder (Vicon Motion Systems)

Definition of joint angle

- valgus angle: Angle of the y axis circumference of the tibia segment with respect to the thigh segment
- flexion angle: Angle of the Xxaxis circumference of the tibia segment with respect to the thigh segment

Definition of joint moment

- Based on the living body fixed number of the segmental mass, the position coordinate of the marker and ground reaction force data, it was calculate the joint moment in the knee joint center

Analysis items

- ① Foot contact and maximum knee flexion, valgus angles ($^{\circ}$)
- ② Foot contact and maximum knee flexion, valgus moments (Nm/kg)
- ③ Vertical ground reaction force (N/kg)

Statistical analysis

SPSS ver 20.0 (I.B.M, Japan)

without tape VS tape (Time sequence change, foot contact and maximum of each analysis items)

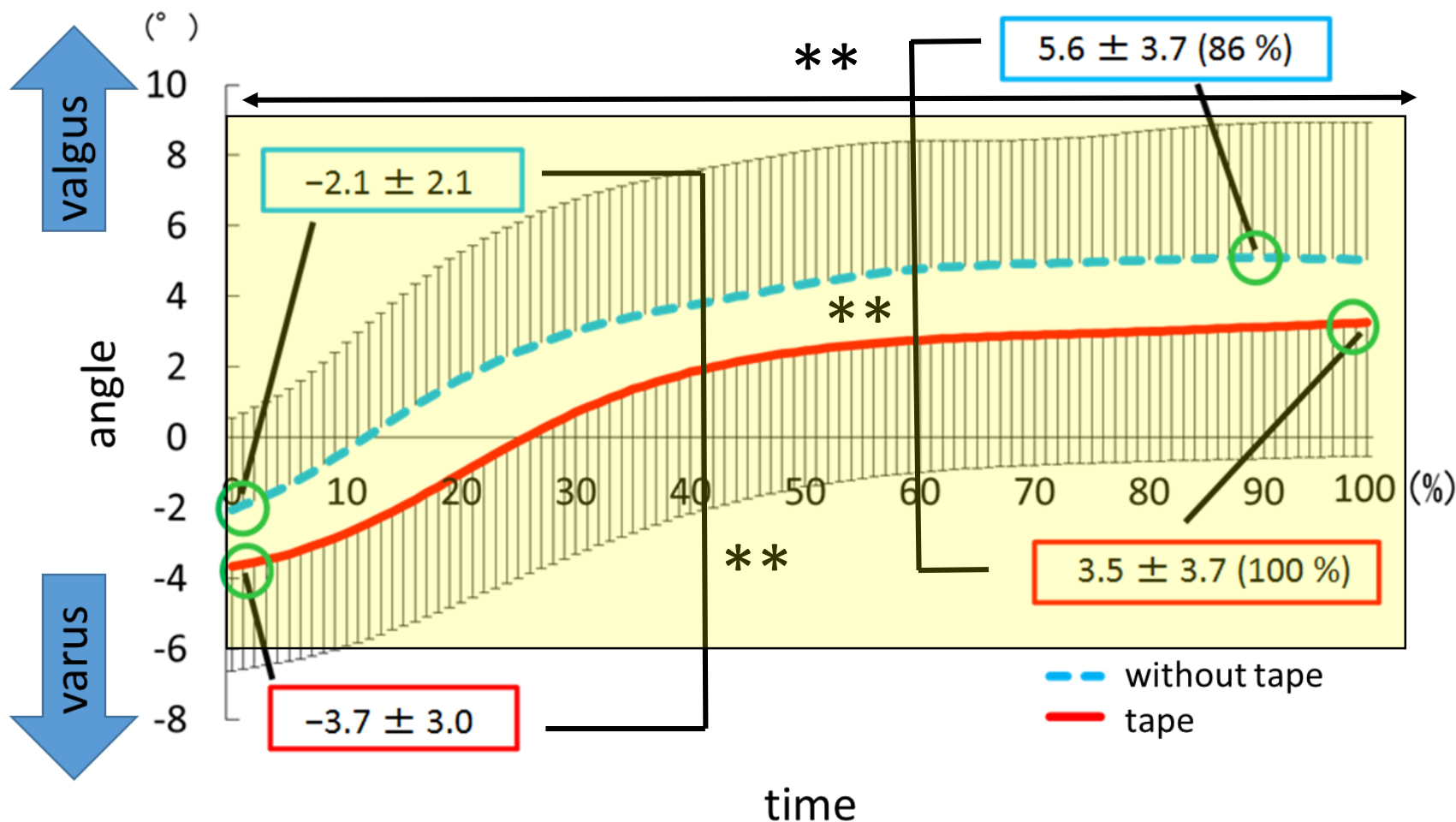
paired student's t-tests

The significance level was set at $p < 0.05$.

Results knee joint valgus angles

Time sequence changes

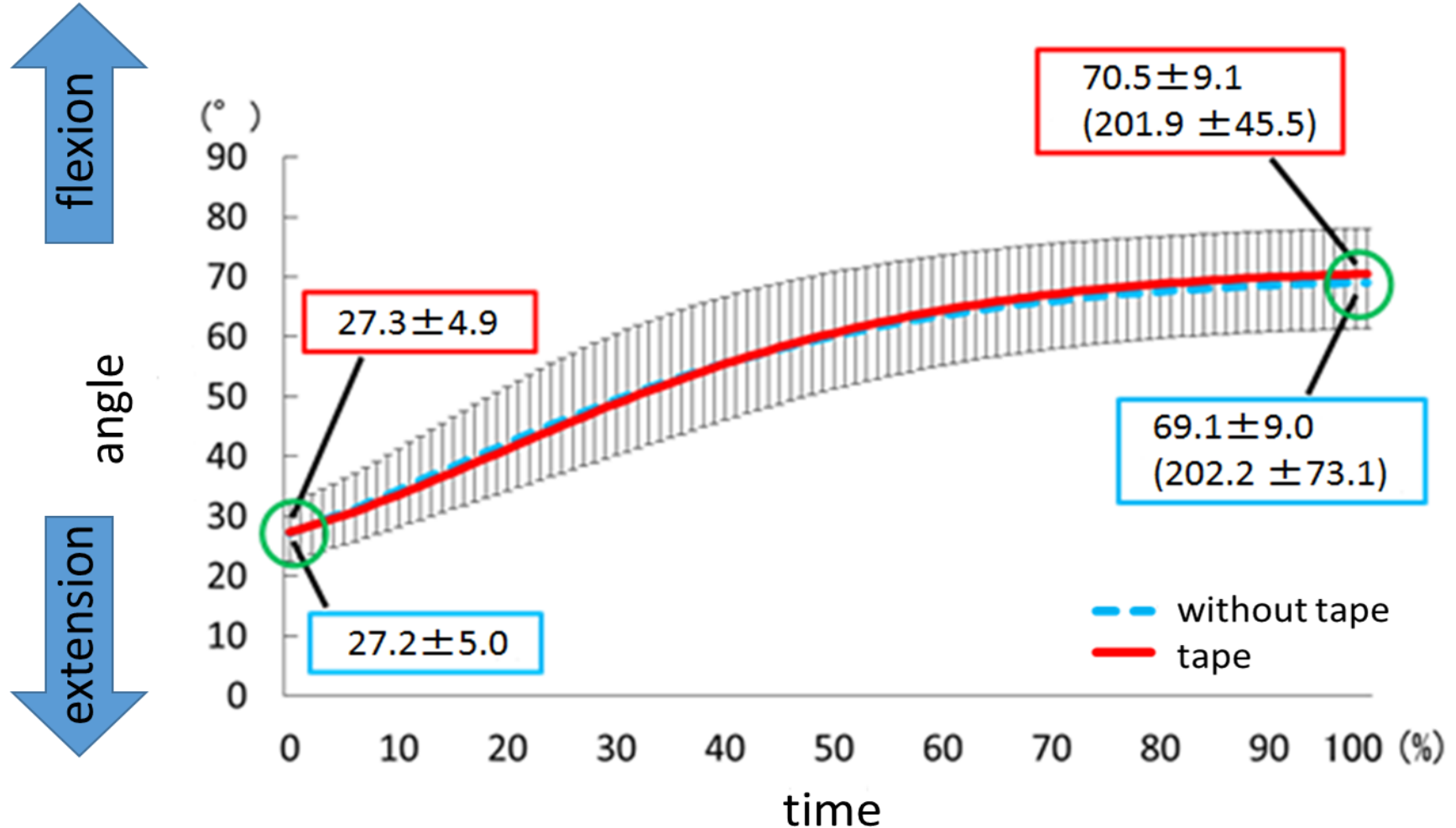
** : $p < 0.01$



Compared to the values without taping, foot contact and maximum knee valgus angle significantly decreased with taping ($p < 0.01$).

knee joint flexion angles

Time sequence changes

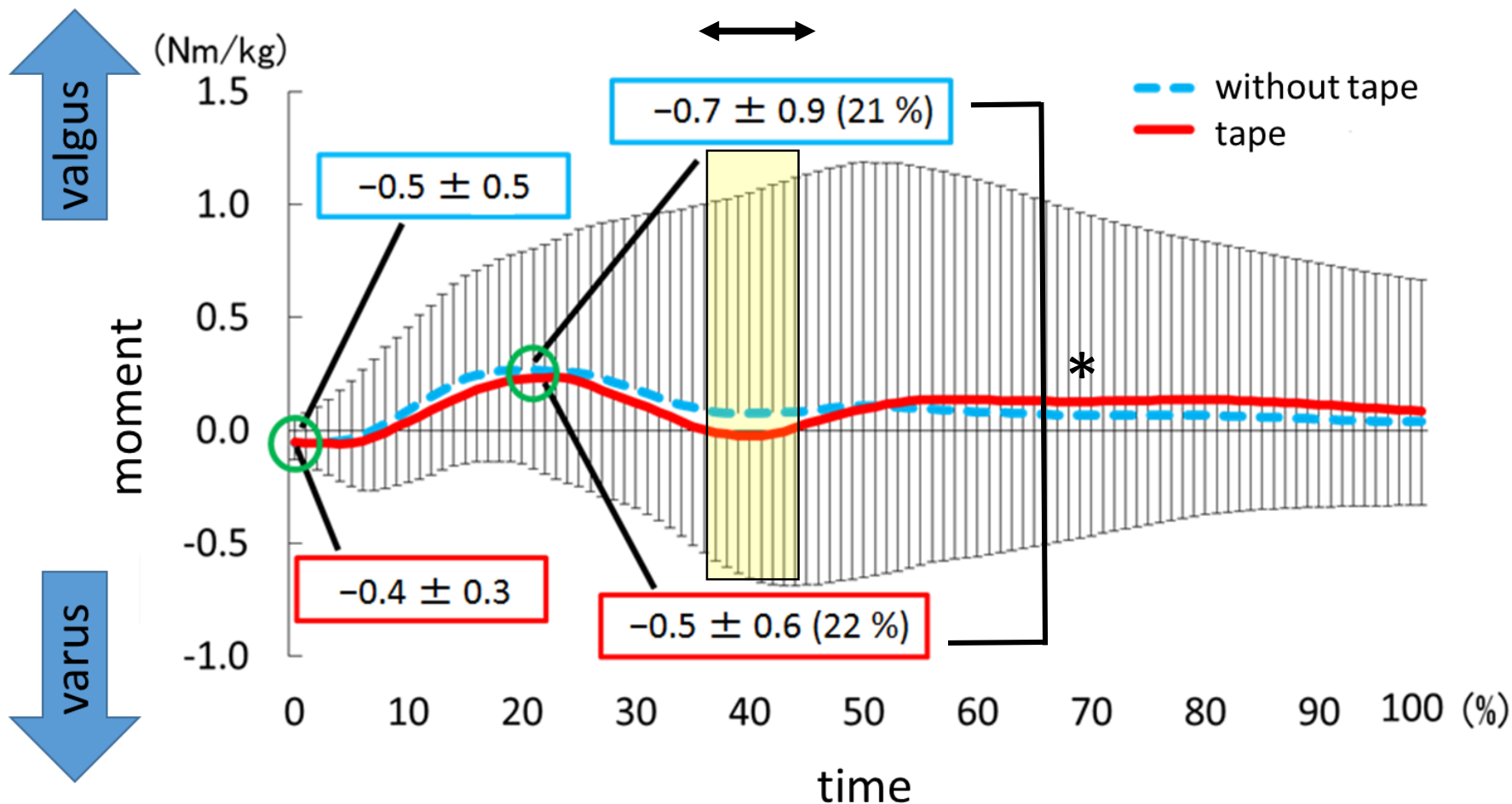


There were no significant differences in the foot contact and maximum knee joint flexion angle

Knee joint valgus moments

Time sequence changes

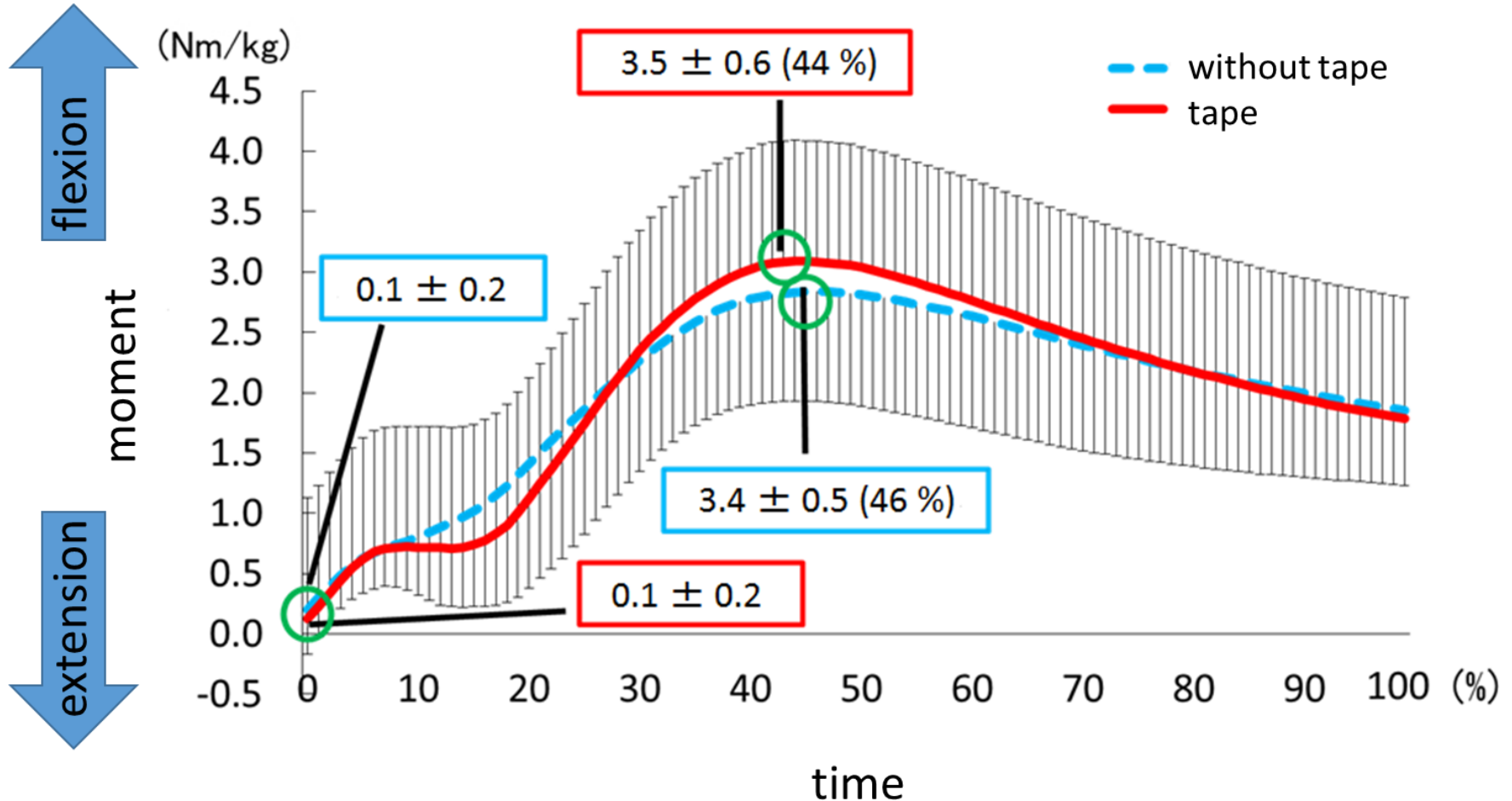
* : $p < 0.05$



Maximum knee valgus moment also significantly decreased with taping compared with without taping ($p < 0.05$).

Knee joint flexion moments

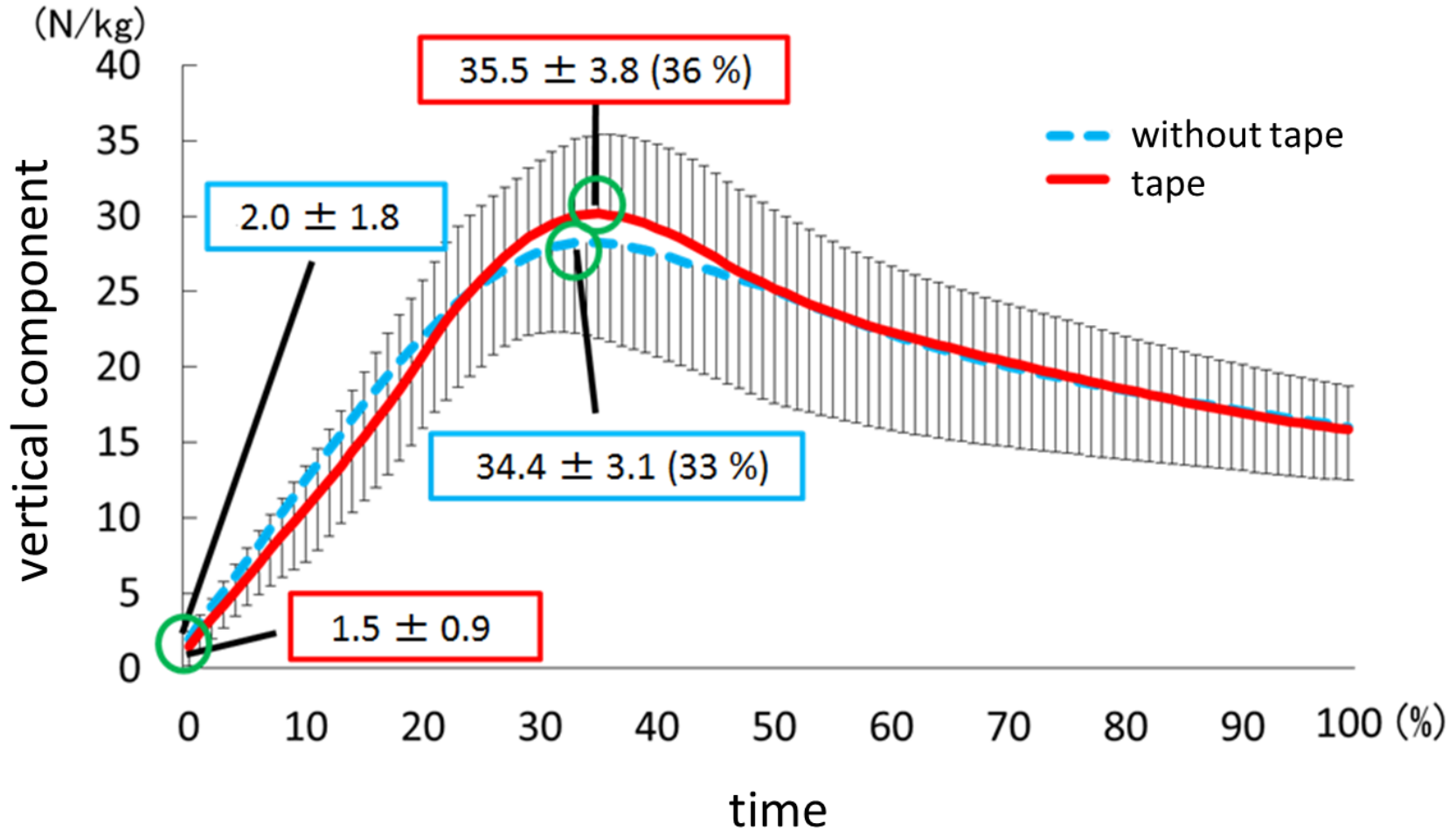
Time sequence changes



There were no significant differences in the foot contact and maximum knee joint flexion moments

Vertical ground reaction force

Time sequence changes



There were no significant differences in the foot contact and maximum vertical ground reaction force

Discussion

Valgus angle restrict factors

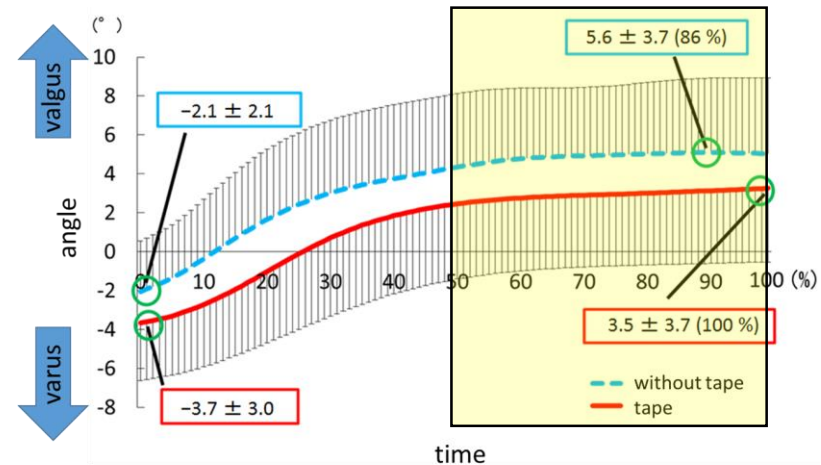
- MCL (superficial layer)
- ACL (Neumann., 2005)

knee joint flexion increase \Rightarrow Loosing ligament (Wang et al., 1973)

The tape may have supported ligament function

Valgus moment restrict factors

- Vector of ground reaction force
- Distance of the ground reaction force vector from the knee joint center (Ogasawara et al., 2010)



Restrict the knee joint valgus angle



Distance of the ground reaction force vector from the knee joint center is shortened



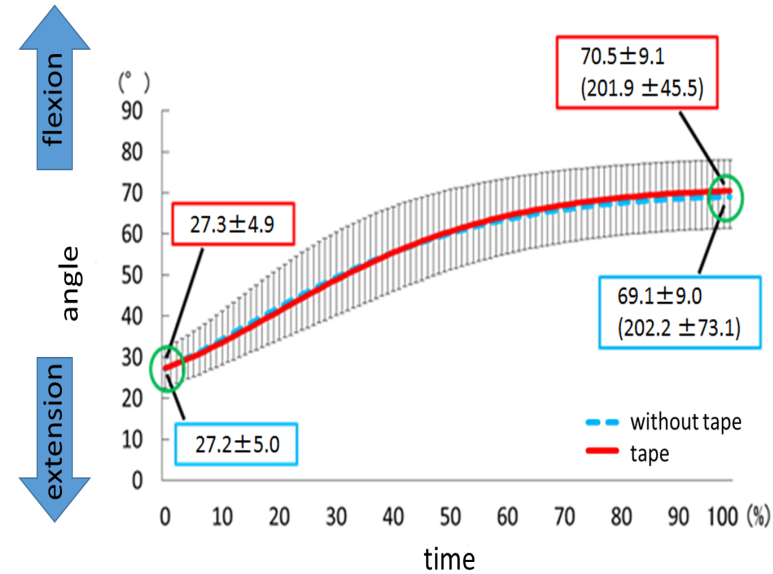
Valgus moment is reduced

Relationship of knee joint flexion and valgus movement

There is no difference in the knee joint flexion

Whether to tape or not { The strain of the ACL and MCL are at the same level

Valgus motion is reduced by tapes



Vertical ground reaction force

- When landing with knee flexed less 90° , ankle and the knee joint are responsible for Shock absorption (Devita et al., 1992)

Tapes for restricting knee valgus used in this study only restricted the knee joint valgus angle and motion, and this supports our hypothesis

Conclusion

1. The effects for knee joint valgus restricting taping were examined in the knee joint valgus , flexion angle and moment during single leg landing
2. Compared with the flexion values without tape, knee valgus angle and moment at foot contact and maximum knee flexion
3. Knee flexion angle and moment at foot contact and maximum knee flexion, and vertical ground reaction force did not change with and without tape