

Biomechanics Effects of Kinesio Taping for Persons with Patellofemoral Pain Syndrome During Stair Climbing

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Abstract — Purpose: The purpose of this study was to examine the biomechanical effects of kinesio taping for persons with patellofemoral pain syndrome during stair climbing. **Methods-** Fifteen women diagnosed with PFPS by an experienced musculoskeletal physiotherapist were recruited and exclusion criteria were based on previous studies. Ten normal subjects were recruited as control group in this study. The ground reaction forces (GRFs) and the EMG activity timing and ratio of VMO and VL were calculated for no tape, placebo tape, and kinesio taping conditions for PFPS and control groups during ascending and descending stair. **Result:** The results showed there was significant difference between no tape and Kinesio tape conditions for PFP group during descending stair ($p<0.05$). And there was significant difference between no tape and Kinesio taping conditions for PFP group ($p<0.05$). **Conclusion:** The results showed Kinesio taping can reduce pain and improve the ratio of VMO/VL for the mechanism of patellar stability.

Keywords — Kinesio taping, patellofemoral pain syndrome, stari climbing

I. INTRODUCTION

Persons with patellofemoral pain syndrome (PFPS) may be due to inadequate medial control from the vastus medialis obliquus muscle (VMO). This inadequate control could be due to a reduction in the tension-producing capacity of the VMO or a problem with the timing of VMO activity in persons with PFPS (Voight and Weider, 1991). The PFPS manifest as anterior knee pain aggravated by activities such as squatting and stair climbing. Forces on the patella range from between one third and one half of a person's body weight during walking to three times body weight during stair climbing and up to seven times body weight during squatting (Reilly and Martens, 1972). Hilyard stated that patellar taping should be used as temporary measure for correction of abnormal patellar movements (Hilyard, 1990). Others have reported that the taping procedure reduced pain in persons with PFPS (Cerny, 1995; Cushnaghan et al., 1994) but there were the inconsistent effects in previous findings (Ng and Cheng, 2002; Salsich et al., 1999).

Kinesio taping, created by Kenzo Kase in 1996, is a specialized tape which is thin, elastic and can be stretched up

to 120%~140% of its original length, making it quite elastic, compared with the conventional taping. It allows a partial to full range of motion for the applied muscles and joints with different pulling forces to the skin. It is proposed that the tapes can lift the skin to increase the space between the skin and muscle. Hence, it reduces the localized pressure and helps the promotion of circulation and lymphatic drainage. As a result, it reduces pain, swelling and muscle spasm. However, only few researches have measured the effectiveness of Kinesio taping and, however, these revealed inconsistent results (Murray and Husk, 2001; Robbins, 1995), and no study assessed the effects of tape in person with PFPS. Therefore, the purpose of this study was to examine the biomechanical effects of kinesio taping for persons with patellofemoral pain syndrome during stair climbing.

II. METHODS

Fifteen women diagnosed with PFPS by an experienced musculoskeletal physiotherapist were recruited and exclusion criteria were based on previous studies. Ten normal subjects were recruited as control group in this study. Subjects were taped for pulling VMO up and pulling VL down in accordance to Kinesio taping manual (Kase et al., 1996), and white athletic tapes were in same position as the placebo condition. Taping procedures were applied by the principal investigator (a certified athletic trainer) to ensure consistency throughout this study.

Data acquisition was accomplished by using two AMTI force-plates (OR 6-5-1000, Advanced Mechanical Technology Inc, MA, USA), and a MA-300 EMG system (Motion Lab System, LA, USA) were integrated to collect data simultaneously. The MA-300EMG system was used to record the EMG activity of VMO and VL. Surface electrodes were longitudinally attached on the muscle bellies after skin preparation. The stair included a 60 cm platform with four steps of 25 cm height and was placed in the center of walkway. Subjects completed a stair stepping task during ascending and descending for five consecutive trials.

The ground reaction forces (GRFs) and the EMG activity timing and ratio of VMO and VL were calculated for no tape, placebo tape, and kinesio tape conditions for PFPS and control groups during ascending and descending stair. An ANOVA for repeated measures were used to compare

the effect of taping conditions and subject groups. Main effect analysis was applied in case of significant difference among the three taping conditions. The level of significance was set at $p < 0.05$.

III. RESULTS

Fig. 1 illustrated the vertical GRF patterns during ascending and descending stairs. The results showed there was significant differences between no tape and Kinesio tape conditions for PFPS group during descending stair ($p < 0.05$), but there was no differences between taping conditions in either the control or the PFPS group during ascending stair. There was significant difference between no tape and Kinesio tape conditions for PFPS group ($p < 0.05$), but there was no differences between taping conditions in the control group (Fig. 2).

The results showed that the onset of VMO activity occurred earlier movement in Kinesio tape compared with no tape condition ($p < 0.05$), but there was no difference between placebo tape and no tape condition.

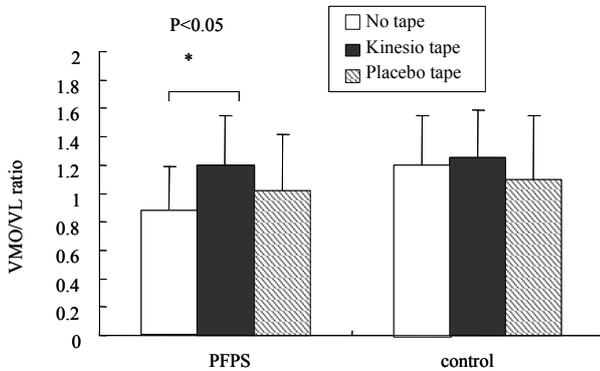


Fig. 1. the vertical ground reaction force during ascending and descending stair.

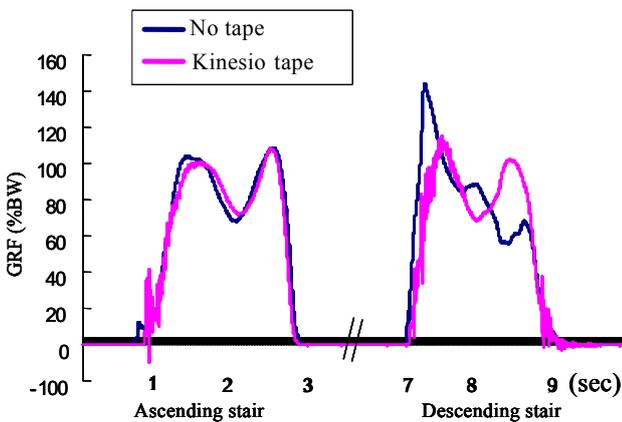


Fig2. the peak vertical GRFs among three taping conditions during ascending and descending stair.

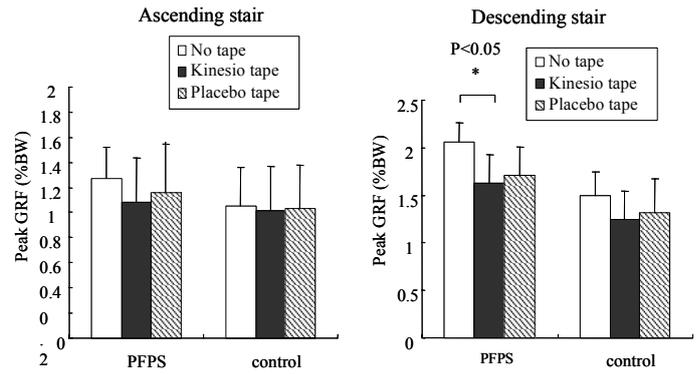


Fig. 3. the EMG activity ratio (VMO/VL) in the three taping conditions for control and PFPS groups.

Fig. 3 showed the EMG activity ratio (VMO/VL) in the three taping conditions for control and PFPS groups. The results showed there were significant differences Kinesio taping compared to no taping condition in the PFPS group ($p < 0.05$), and no differences between taping conditions in the control group.

IV. DISCUSSION

There was larger peak GRFs for persons with PFPS during descending stair. Previous studies found that knee flexion reduction appears to be a logical mechanism to reduce the PFJ reaction force. However, such a mechanism results in reduced quadriceps activity (Hsu et al., 1993; Perry et al., 1975) and consequently decreased active shock attenuation from the eccentric quadriceps contraction during stair descent. Therefore, patients with PFP may be subjected to increased vertical ground reaction forces as well as greater loading rates experienced by the lower extremity (Gerritson et al., 1995).

The VMO is the dynamic medial stabilizer of the patella and is considered functionally important in aligning the patella within the trochlea of the patellofemoral joint. Previous studies have examined external means (tapes or braces) to decrease pain and increase the activity of the VMO in patients with PFPS (Cowan et al., 2000; Gilleard et al., 1998). The findings of this study were consistent with these studies. It is possible that kinesio taping provided the needed mechanical support to the medial ligaments of the patellofemoral joint. Another possible explanation is that tape blocked the transmission of nociceptive information to the spinal cord via cutaneous stimulation (Crossley et al., 2000). The Kinesio taping applied to the skin surface apparently provided tactile input, which interact with motor control by altered the excitability of the central neuron

system (Simonea et al., 1997). The tactile input generated by Kinesio taping might be strong enough to modulate muscle power. The earlier activation of the VMO should allow for a more optimal positioning of the patella into the trochlea (Fulkerson and Hungerford, 1990). It may help to improve the timing of force distribution and decrease the pressure placed on a particular portion of the articular cartilage. Therefore, the VMO/VL ratio is increasing by the use of kinesio taping during stair climbing.

There was not difference between taping and no taping for control group during stair climbing. Healthy knees are believed to have the appropriate balance between the medial and lateral components that assist the patella to glide within the trochlear groove of the patellofemoral joint. The kinesio taping assists the medial components of the patellofemoral joint, then the strategy utilized by the nervous system to activate the quadriceps muscles may be different for healthy compare with injured knees.

V. CONCLUSIONS

The results showed Kinesio taping can reduce pain and improve the ratio of VMO/VL for the mechanism of patellar stability during stair climbing.

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