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Published online Jan 2021

**To cite this article:** Naserpour, Hamidreza, Amir Letafatkar and Hadi Habibi (2020) IMMEDIATE EFFECT OF MULLIGAN TAPING ON JOINT POSITION SENSE AND MUSCLE STRENGTH IN AMATEUR WRESTLERS International Journal of Wrestling Science, 10 (2), 49-53.



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# IMMEDIATE EFFECT OF MULLIGAN TAPING ON JOINT POSITION SENSE AND MUSCLE STRENGTH IN AMATEUR WRESTLERS

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## ABSTRACT

The knee is one of the most frequent sites of injuries in wrestling. Taping techniques are commonly used in order to reduce the pain and incidence of knee injuries in physical activities. This study aimed to investigate the immediate effect of mulligan taping on joint position sense and muscle strength in amateur wrestlers. Twelve Amateur freestyle wrestlers (Mean age  $23\pm 3$  years old, weight  $68\pm 12$  kg and height  $176\pm 12$  cm) volunteered to participate as subjects in this study. The reproduce angle and dynamometer speed test was considered  $60^\circ$  and  $5^\circ/\text{sec}$  respectively and peak torque of concentric and eccentric of quadriceps muscle groups tested at  $90^\circ/\text{sec}$  by using an isokinetic dynamometer (Biodex Model, System 3, Made in USA) Before and after Mulligan taping. Data were analyzed by using Origin Pro (2019) and SPSS software (version 25). The Shapiro-Wilk test was used to check the normality distribution of the data, and a paired t-test was adopted to compare the results before and after taping at a significant level ( $P\leq 0.05$ ). The statistics showed significant differences between active ( $p=0.001$ ) and passive ( $p=0.002$ ) Repositioning errors before and after taping. Also, there were significant differences between the Maximum concentric ( $p=0.003$ ) and eccentric ( $p=0.002$ ) torque of the quadriceps muscle group before and after taping. It seems that Mulligan taping could improve the knee proprioception and increase maximum concentric and eccentric extensor torques. It is highly recommended that to provide more comprehensive information by conducting more sample research size about the use of taping (Mulligan method) during the treatment of knee injuries in wrestling.

**Keywords:** Mulligan taping, Proprioception, Muscle Strength

## INTRODUCTION

The lower extremities are one of the most frequent sites for injuries in wrestling (Pasque and Hewett 2000). The knee injuries involved approximately 37 percent of all wrestling injuries (Agarwal and Mann 2016). Many factors contributed to knee incidence injuries such as lack of proper proprioception, muscle fatigue, imbalance of strength in agonist and antagonist muscle (Khaleghi Tazji et al. 2020). Proprioception is defined as the ability to detect the movement and position of a limb in space which is an essential factor for joint coordination in appropriate sports performances. The proper joint position sense reduces the risk of injuries and improves performance (Naserpour and Sadeghi 2017). joint position sense is the interaction of muscle and joint receptors with the efferent output of the muscles that control the joint which is likely to provide stability and stiffness to the joint (Edin 2001). The change in the afferent input during sports activities compromised the neuromuscular control of the lower extremities, may lead to an inability to dynamically stabilize the knee (Hiemstra, Lo, and Fowler 2001). The injuries or local fatigue altered knee joint proprioception due to damage of joint sense receptors (Wilson and Lee 1986). Proprioceptive deficits are found in anterior cruciate deficient knees (Ghaderi et al. 2020), patellofemoral pain syndrome (Ahmadi et al. 2020), and in the osteoarthritic knee (Al-Dadah, Shepstone, and Donell 2020).

From another point of view, a good muscle strength ratio between agonist and antagonist muscles which are working on the joint is one of the crucial factors of stability and prevention of knee joint injuries in athletes (Khaleghi Tazji et al. 2020). There is an increased risk of knee injury in athletes due to an imbalance in quadriceps and hamstring ratio (C.-G. Kim and Jeoung 2016). Weak quadriceps strength was associated with knee pain and poor balance ability (D. Kim et al. 2018).

During wrestling or competition and following the collision or performs various actions, uncontrolled pressure may apply to the lower extremities of the wrestlers, which in some cases require medical treatment. One of common treatment techniques is the taping method (Naserpour, Habibi, and Sadeghi, 2017). Taping technique contributes to minimizing pain, increasing muscle strength, modifying the unwanted movements, and enhancing functional outcomes in athletes with sports injuries (Fu et al., 2008; Hadadnezhad, Zarea, & Amro, 2020).

Previous studies have shown that mulligan taping could affect joint position sense and muscle strength, but so far there is no comprehensive research to show the simultaneous effect of Mulligan taping on the strength and knee joint sense in wrestlers, Therefore, the purpose of the present study was to determine the immediate effect of Mulligan taping on joint position sense and muscle strength in amateur wrestlers.

## METHODS

### A) Participants

Twelve amateur freestyle wrestlers (Mean age  $23\pm 3$  years old, weight  $68\pm 12$  kg and height  $176\pm 12$  cm) volunteered to participate as subjects in this study. They were checked in terms of posture and lower extremities abnormalities by an expert physician and excluded if they have any lower extremities abnormality or injury history for at the latest 6 months. The information and purpose of the study were explained by the researcher to all subjects before data collection. Informed consent got from all the participants and procedures conducted corresponding to the declaration of Helsinki.

### B) Instruments- Test

The joint proprioception and muscle strength of knee joints were evaluated by using the isokinetic dynamometer (Isokinetic Dynamometer, Biodex Model, System 3, Made in USA).

### C) Procedures and Research Design

First, the subjects were instructed to do their best to struggle during the test. In other to prevent injuries before performing each test, the subjects warm up themselves on a stationary bike for five minutes, then the subject sat on a dynamometer seat and his torso and thigh were stabled with tightened bands to control the other joint muscle interference. The attachment assembled on the shaft of the dynamometer, so that center of the shaft was exactly placed in front of the lateral epicondyle of the subject's knee. The subject performed the test with five repetitions of maximum concentric and eccentric contraction. At the end of the testing process, if the output coefficient variability of the test was less than 15%, the test was approved (Khaleghi Tazji et al. 2020). The tests were performed at  $90^\circ/\text{sec}$  speeds, and Verbal encouragement was used to perform the maximum effort of the subject during the test.

Second, for proprioception assessment, reproduction angle and dynamometer speed test was considered at  $60^\circ$  and  $5^\circ/\text{sec}$  respectively, and the dominant limb was used for the same conditions. Initially, each subject was asked to move his knee to the target angle with open eyes three times and remain for five seconds in that situation and maintain this position in his short-term memory. Then, to eliminate visual interference during measurement of the test, the eyes were closed by a blindfold and he was asked to hold his knee with a stop button at  $60^\circ$  in active and passive form (Naserpour, Habibi, and Sadeghi 2017; Naserpour and Sadeghi 2017). Error angle defines as the difference between the target angle and the angle created by the participants reproduced, regardless of whether the error was positive or negative. Each movement was repeated three times, and then the average error angles for each movement were taken as the main record.

Following that, the rigid tape applied to the dominant knee of each subjects by a physical therapist experienced in the application of the Mulligan knee taping procedure. The tape was applied while participants stood with the dominant leg in full tibiofemoral internal rotation and 20 of knee flexion (Mackay et al., 2020). The tape began at the neck of the fibula and was applied spirally in an anteromedial direction inferior to the tibial tuberosity and medial knee joint line, across the popliteal fossa to the anterolateral thigh, then all tests were repeated.

### D) Statistical Analyses

Data were analyzed by using Origin Pro (2019) and SPSS software (version 25). The Shapiro-Wilk-test was used to check the normality distribution of the data, and a paired t-test was adopted to compare the results before and after intervention at a significant level ( $P\leq 0.05$ ).

### Results:

The result of repositioning error on knee flexion in active and passive form are presented in table 1. The statistics showed that the significant differences between active ( $p=0.001$ ) and passive ( $p=0.002$ ) Repositioning error before and after applying taping.

Table 1. The effect of Mulligan taping on joint position sense in amateur wrestlers

Variable name	Pre-test	Post-test	t (11)	P-value	Variation(%)
Repositioning error of active knee Flexion ( $\Theta$ )	$6.25\pm 1.6$	$5.38\pm 1.56$	4.75	0.001*	13.92 ▼
Repositioning error of Passive knee Flexion ( $\Theta$ )	$5.66\pm 1.6$	$5.16\pm 1.49$	4.18	0.002*	8.83 ▼

\* Differences are significant at the 0.05 level.

Furthermore, the result of maximum eccentric and concentric torque of quadriceps muscle group are available in table 2. The statistics showed the significant differences between maximum concentric ( $p=0.003$ ) and eccentric ( $p=0.002$ ) torque of quadriceps muscle group before and after applying taping.

Table 2. The effect of Mulligan taping on muscle strength in amateur wrestlers

Variable Name	Pre-test	Post-test	t (11)	P-value	Variation (%)
Maximum Concentric Torque of Quadriceps Muscle group (N.M)	165.58±38.83	174.58±36.57	-3.78	0.003*	5.4 ▲
Maximum Eccentric Torque of Quadriceps Muscle Group (N.M)	162.16±36.09	174.25±35.66	-4.16	0.002*	7.4 ▲

\* Differences are significant at the 0.05 level.

## DISCUSSION:

The current study aimed to investigate the immediate effect of Mulligan taping on joint position sense and muscle strength in amateur wrestlers. The results indicated that the Repositioning error of the knee at 60° flexion were decreased significantly the following taping in both active (13.9%) and passive forms (8.83%). Taping may increase the knee joint proprioception through the stimulation of cutaneous mechanoreceptors and enhance the feedback from the muscle spindles, soft tissue, and skin in the skin (Edin, 2001). The finding corresponded to the Heit et al. (1996), and Spanos et al. (2008) findings, which reported a significant decrease in repositioning error of knee after taping (Heit, Lephart, & Rozzi 1996; Spanos, Brunswic, & Billis, 2008); and was in contrast to Wong et al. (2012), Keenan et al. (2017) that report no significant differences on repositioning error after taping (Keenan et al., 2017; Wong et al., 2012). These conflicting statements may have derived from utilizing various joint or taping methods.

Lastly, taping increases the concentric (5.4%) and eccentric (7.4%) torque of the quadriceps muscle group. There are several assumptions that supported why the taping increase the torque, such as stimulation of cutaneous mechanoreceptors in the skin (Edin, 2001), Biomechanical modification of muscle fascia direction (Hadadnezhad, Zarea, & Amro, 2020; Vithoulka et al., 2010), increase muscle tone, stiffness and improve the overlap of actin and myosin fibers (de Jesus et al., 2016). Our finding corresponded to the Elif et al. (2021), Kim et al. (2020), and Tomruk et al. (2020) which reported significant improvements after the interference (Altaş, Uçurum & Kaya, 2021; Kim & Kim, 2020; Tomruk et al., 2020). On the other side, our finding was in contrast to Thiago et al. (2018) and Chang et al. (2010) that reported no significant increase in muscle strength (Chang et al., 2010; Lemos et al., 2018). This diversification in results of taping effects on muscle strength is due to the various forms of taping, such as inhibitory and facilitatory or different subject and joint that the investigator used in their surveys.

The authors declare that there is a limitation in our study which the isokinetic dynamometers does not assess the muscle group power in actual situation and contraction with stable pace is not functional.

## CONCLUSIONS

According to the results of present study, it implies that Mulligan taping could improve the knee proprioception and enhance maximum concentric and eccentric extensor torques. It is highly recommended that to provide more comprehensive information by conducting more research about the use of taping (Mulligan method) during the treatment of knee injuries in wrestling activities.

## PRACTICAL IMPLICATIONS/ADVICE FOR ATHLETES AND COACHES

Athletes or coaches can use positive aspects of taping in other to reduce their pain, injury incidence and proprioception deficit under supervision of an expert physician.

## Acknowledgement

The authors are grateful to the subjects who participated in the study.

## Declaration of Interest Statement

The authors declare that there is no conflict of interest in this research

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