

## KINEMATIC STUDY ON SEOI-NAGE, TECHNIQUE COMPARISON OF PLAYERS WITH OR WITHOUT ELBOW JOINT INJURIES

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The purpose of this study is to clarify how to apply Seoi-nage to reduce the occurrence of injuries in elbow joints. Five participants were male college judo athletes, one as the Uke (receiver) and other four as Tori (thrower), two of them reported with pain in elbow and other two without pain. The players without pain in elbow flexed the elbow joints greatly and lifted the Uke by not bending the hip joint too much. Two considerations were noted for the players (Tori) with pain in elbow: 1) The movement of Nagekomi in elbow joints was different from the Uchikomi. Therefore, it assumed a greater load put on the elbow joints. 2) Hip joint bends after contacting with Uke and the upper body bends to throw with the power of the arm. In conclusion, players should use more strength of the lower extremities instead of the strength of upper body, which might cause injury.

**KEYWORDS:** Seoi-nage, elbow, injury, Uchikomi, Nagekomi

**INTRODUCTION:** There are many kinds of injuries in Judo. Some players have to retire and some have to change their adept techniques due to their severe the injury. In Judo injuries, the injuries in the knee joint, the ankle joint, the shoulder joint, the lumbar region, and the elbow joint are thought as the representative injuries. It is difficult for Judo athletes to prevent their leg joint injury due to accidents during contact and practice. On the other hand, it is thought that injuries in the elbow joint and the lumbar region are heavily affected by over using. Since it is difficult to reduce the load on lumber region due to the rotation of trunk and the weight of the opponent's weight, which is the competitive characteristic of judo. On the other hand at the elbow joint, since technical factors such as different Judo kumite are related to injuries, it seems that elbow joints can be prevented from prevent injury if usage and movement, restrictions can be done. There are many researches relevant to the performance enhancement of Judo, and the researches of Seoi-nage were studied as well (Koshida, 2010, Ishii, 2016, Ishii, 2017). It is reported that the elbow joint is easy to get injured in the Tsurite (lifting hand), (Onidani, 2017). Elbow joint injuries frequently occur during Seoi-nage (shoulder throwing) (Kamitani, 2017). Many Judo players suffered from elbow joint injury, such as degenerative elbow joint disease. However, the relationship between the technique of Seoi-nage and elbow joint injury is still unclear. The purpose of the study was to clarify the correct teaching method of Seoi-nage for reducing the occurrence of elbow joint injury.

**METHODS:** Uchikomi and Nagekomi were used in the experiments. Five participants were male college judo athletes (168±4cm, 65±3kg, 20±1y), one as the Uke (receiver) and other four as Tori(Thrower), two of them with pain in elbow and other two without pain. Participants were instructed to perform the two practice skill of Seoi-nage, Uchikomi and the Nagekomi. Three-dimensional coordinate data was obtained by using a motion capture system (VICON-MX, Vicon Motion Systems, 26 cameras, 250Hz). The phase that Uke was lifted by Seoi-nage was analysed in this study. The range of analysis was from the moment that Tori start to apply the Seoi-nage to the completion of lifting Uke.

**RESULTS:** Figure 1 and 2 show the stick pictures of motion. There is little difference in movement from 1st to third figures. The athletes with pain in elbow are trying to lift their opponent by lifting up their opponent without touching the trunk when contacting the Uke, in the fourth figure. With a painless player, you can turn your body and shoulder your opponent.

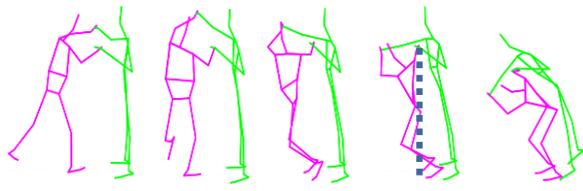


Fig 1 Seoi-nage stick picture Tori with elbow

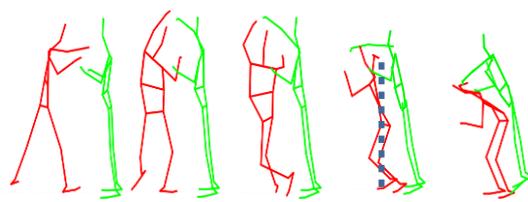


Fig 2 Seoi-nage stick picture Tori without pain on elbow

Figures 3 and 4 show flexion/extension angle of the elbow joint, the average value of two players in each group. The player without pain in elbow does not flex too much when contact the Uke ( $31^\circ$ ), and then bends when lifting the opponent. However, in a player with pain in elbow, it turns out that the elbow continues to bend after rotating the body ( $39^\circ$ ). Uchikomi is a repetition practice that takes the skill and lifts the opponent without lifting. For that reason, Figure 5 represents one cycle from movement start to the original position. The player without pain in elbow applied the technique by bending their elbows ( $24^\circ$ ), while player with pain in elbow did not bending their elbow too much ( $65^\circ$ ). In the result, the techniques are different between Uchikomi and Nagekomi, in the player with pain in elbow.

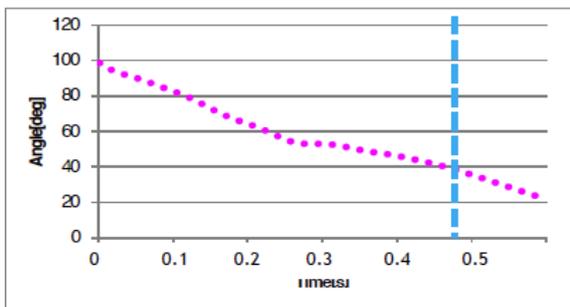


Fig 3 The angle of elbow joint of the tori with elbow injury in Nagekomi

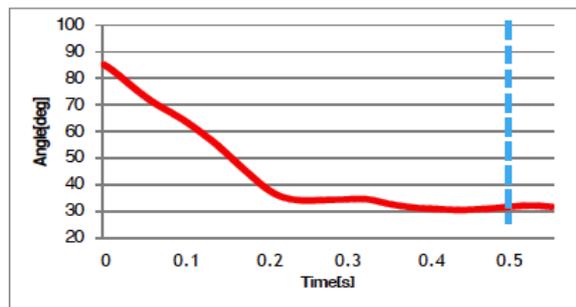


Fig 4 The angle of elbow joint without pain in elbow in Nagekomi

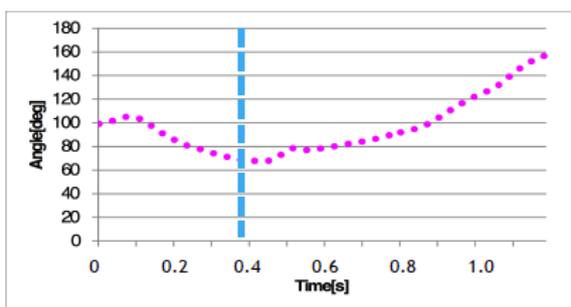


Fig 5 The angle of elbow joint of the tori with elbow injury in Uchikomi

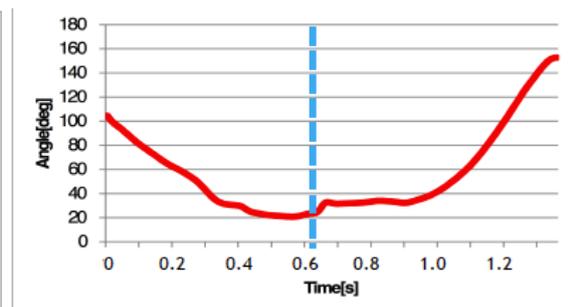


Fig 6 The angle of elbow joint without pain in elbow in Uchikomi

Figures 7 and 8 show the flexion/extension angle of hip joints, and these results graphed the average value of each group. The player with/without pain in elbow lifted the opponent by using the extension of the hip joint when contacting the Uke ( $108^{\circ} \pm 1$ ), but the player with pain in elbow did not keep the extension of the hip joints to lift the opponent ( $84^{\circ} \pm 1.2$ ).

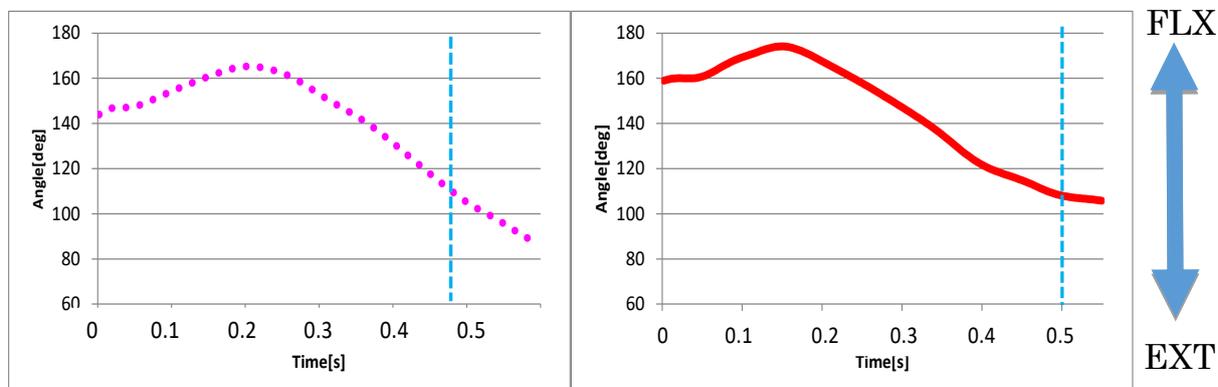


Fig 7 The angle of hip joint of the tori with elbow injury in Nagekomi

Fig 8 The angle of hip joint without pain in elbow in Nagekomi

**DISCUSSION:** Competitors with elbow pain were different from those who did not have pain, but the technique of Uchikomi and Nagekomi. Uchikomi is the technique which applies to contact opponent with back instead of lifting the opponent. However, it is necessary to put up the opponent on the back and throw in Nagekomi. If not the opponent can not be thrown. It is considered the same movement is not applied to Uchikomi and Nagekomi. The player with pain in elbow does not turn the trunk and put up the opponent on the back. Furthermore only uses the upper limbs to throw the opponent, which might be the reason causing great load on the elbow. At the flexion/extension angle of the elbow, the player with pain in elbow whose does not bend too much in Uchikomi, and bend the elbow to apply the Nagekomi. It might be that the player gets used to bend the elbow to apply the technique in general repeated training. On the contrary, the player without pain in elbow flexes the elbow to apply the technique in Uchikomi and Nagekomi in order to throwing properly in training. The player with/without pain in the elbow lifts the opponent by using the extension of the hip joints. But the player with pain in elbow doesn't keep the extension of the hip joints. Both of them have same movement in the knee joints. It is thought that the player with pain in elbow put great load on the elbow by only using upper limbs when trying to lift the opponent. Contrary the player without pain uses whole body to complete the motion. In this experiment the trials were conducted under the condition which the Uke didn't resist, therefore, the player with pain in elbow could throw without pain. In real competition the opponent resists to avoid being thrown which causes the Tori gets great loads repeatedly. Actually, it is not clear that how to hand combine the force to throw the opponent and how energy flow. Therefore, if the judo cloth sensor can be developed, the tension of the hand gripping the judo cloth could be calculated and the timing and power of throwing the opponent could be understood.

**CONCLUSION:** It is thought that the player with pain in elbow is able to use whole body strength to apply the correct Seoi-nage without putting overload on the elbow even in repeated training. The player with pain in elbow only uses upper limbs to apply the Seoi-nage repeatedly, which puts great load on the elbow and causes the injury.

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