

COMPARISON BETWEEN KNEE-FLEXED AND KNEE-EXTENDED STYLES IN THE MAJOR OUTER LEG SWEEP

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The aim of this study was to compare the knee-flexed technique with the traditional knee-extended technique of Osoto-gari to determine which is the more efficient and powerful. The 12 participants were randomly divided into knee-flexed and knee-extended groups. Video analysis (60 Hz) of three trials per participant revealed significant differences ($p \leq 0.05$) in the maximum angle of legs, the body angle, and the force of sweep (Figure 1) between the knee-flexed and knee-extended groups. No significant differences were found in the movement time of Tsukuri (leg raising), kake (performing the whole movement) and the force of hands between knee-flexed and knee-extended groups.

KEY WORDS: judo, osoto-gari, knee-flexed, knee-extended

INTRODUCTION: According to Imamura's study about the major outer leg sweep (1996) "ankle position had very little influence on the power of the sweep. Knee position did have some influence, but there were no intuitive physical explanations for the strength of the correlations." Based on the suggestion of Imamura, this study tried to establish whether changing the knee from extended to flexed during the time of attacking will be able to make the sweep more powerful and effective. Therefore, the aim of this study was to compare the following essential factors of both Osoto-gari styles:

1. Tsukuri time (to get a proper position), the Kake time (includes both raise leg and leg sweep), the time to finish the whole movement (includes Kuzushi, Tsukuri and Kake) of Osoto-gari, and the maximum difference of the angle of legs, the body angle while doing Kake between knee-flexed and knee-extended styles.
2. Force of Kuzushi (hands) and Kake (sweeping leg) between knee-flexed and knee-extended styles.

Any differences between these techniques revealed by this investigation could be used as an index for training and competition for coaches and players.

MATERIALS AND METHODS: The 12 participants were beginners of judo team of junior high school. Each participant only has learned the basic courses in judo for one year. This study randomly divided them into two groups; knee-extended (Figure 2) and knee-flexed (Figure 3). Each group was trained for 5 times per week for 8 weeks, with each session lasting for one hour. Following the training period, participants were tested. Each participant had reflecting stickers on segment endpoints and performed five trials of the knee-flexed or knee-extended Osoto-gari. The 3 best trials—according the time of finish the whole movement which is the shorter the better, and the force of sweep which is the greater the better— were selected for analysis.

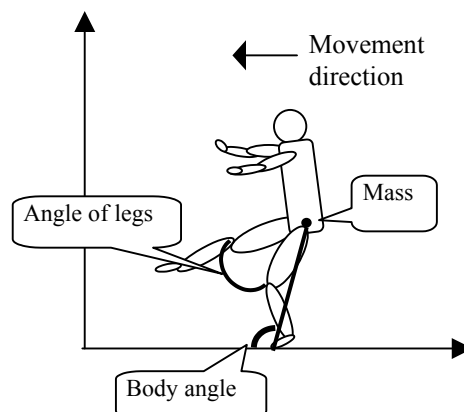


Figure 1 - Angle of legs and body angle.

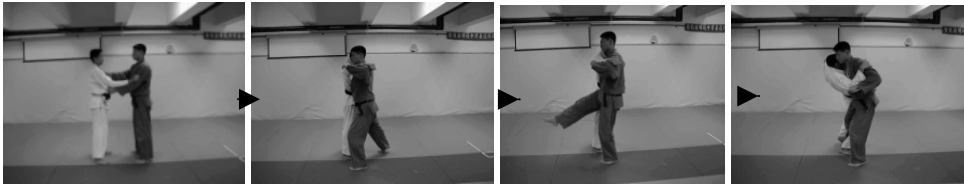


Figure 2 - Knee-extended.

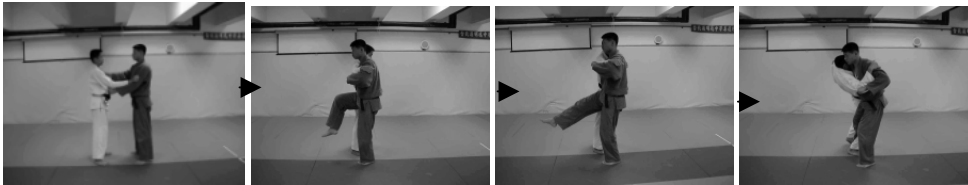


Figure 3 - Knee-flexed.

A Panasonic model AG-456UP high speed video camera (60 Hz) was placed on the left side in the sagittal plane at 45°, approximately 10 m away from the participant. All selected performances were digitized with the Peak Performance Motion Analysis System. Two tensilmeters were used to measure the force of hands (F1) and sweeping leg (F2) while tori performed Osoto-gari on a model target (Figure 4). Analogue data were converted to digital data, and were subsequently analyzed by Acqknowledge software. Pearson's Correlation Coefficient was used to analyze the corelationship between the force of Kake and the time to perform the whole movement of Osoto-gari. The independent t-test was used to examine statistical difference between two groups with significant level set at 0.05. All statistics were processed by SPSS for windows software.

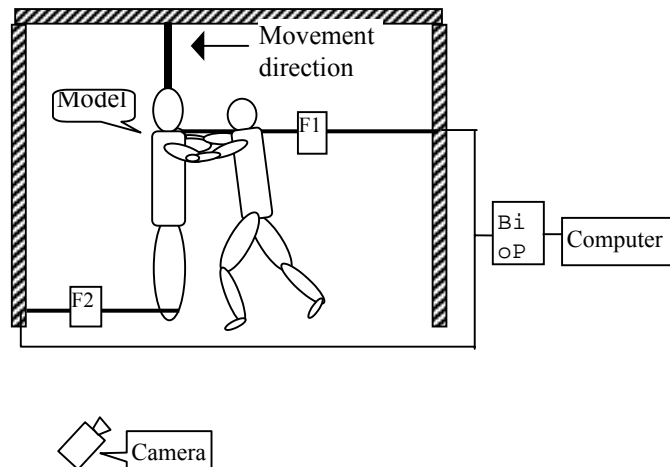


Figure 4 - Setting place.

RESULTS AND DISCUSSION: The results of this study showed there are significant differences ($p \leq 0.05$) in the maximum angle of legs, and the body angle between knee-flexed and knee-extended styles (Table 1). These results showed that the knee joint of the sweeping leg in the knee-flexed style is able to get a higher position while doing vertical displacement and to produce a higher potential energy and then to promote kinetic energy for the larger angle of legs. The smaller angle of the body increases its stability, which may increase the opportunity for win.

There were no significant differences in movement time of Tsukuri, Kake, and to do the whole movement of Osoto-gari between knee-flexed and knee-extended styles. The sweep time for the knee-extended technique is better (i.e. shorter) than with the knee-flexed. These results showed that, although the knee-flexed style takes a longer time to raise the knee to a higher

position, and it also takes more time to put down the leg to sweep through the longer distance, only the leg-sweep part takes longer than the knee-extended technique.

The force of Kake (sweeping leg) is significantly different ($p \leq 0.05$) between knee-extended and knee-flexed groups. The knee-flexed style has more kinetic energy due to the higher position of knee. There was no significant difference between the knee-extended and knee-flexed groups in the force of Kuzushi (hands).

Table 1 Mean, Standard Deviations, and t-test, Results for Movement Time and Force of Knee-extended Group and Knee-flexed Group

Items	Groups	Sample #	Mean	S.D.	t-value
Leg angle	Knee-extended	18	55.13	6.63	-7.27*
	Knee-flexed	18	88.60	18.36	
Body angle	Knee-extended	18	94.95	5.81	3.36*
	Knee-flexed	18	89.86	2.69	
Tsukuri time	Knee-extended	18	0.214	0.032	1.12
	Knee-flexed	18	0.202	0.031	
Raise leg time	Knee-extended	18	0.243	0.041	0.261
	Knee-flexed	18	0.240	0.019	
Sweeping time	Knee-extended	18	0.158	0.016	-2.179*
	Knee-flexed	18	0.170	0.017	
Kake time	Knee-extended	18	0.401	0.037	-0.816
	Knee-flexed	18	0.410	0.026	
Movement time	Knee-extended	18	0.616	0.054	0.178
	Knee-flexed	18	0.613	0.038	
Force of hands (F1)	Knee-extended	18	0.838	0.144	-0.131
	Knee-flexed	18	0.847	0.230	
Force of sweeping (F2)	Knee-extended	18	0.603	0.147	-2.235*
	Knee-flexed	18	0.696	0.099	

CONCLUSION: According to the results of this study, the knee-flexed style of Osoto-gari was more effective than the knee-extended technique. This included offering a more stable body position, producing a higher potential energy and kinetic energy, and increasing the force of sweep. Those conditions showed that knee-flexed style is more efficient and powerful than knee-extended style. Therefore, coaches and players of judo may take advantages of knee-flexed to reform Osoto-gari and improve performance. Related and further research should focus on trying to use more experimental setup to improve other skills of judo.

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