A MOTION ANALYSIS OF A FEMALE JAPANESE DRUM PLAYING EXERCISE

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The purpose of this study is to obtain the fundamental data involving symmetry index (SI) of the Japanese drum playing exercise. Five subjects participated in this study, in order to compare the motion between the experienced and the inexperienced players. Digital videography method was applied to each subject, striking the Japanese drum with his or her maximal efforts during a 15-second exercise. The results showed that the strike number of the first trial test was 32 and the second trial test was 34; in other words, the strike number of the left-hand starting (L.S.) was greater than that of the right-hand starting (R.S.). Therefore, it is suggested that the non-dominant arm and hand link system are crucial for developing the skill of the novice Japanese drum players.

KEY WORDS: Japanese drum, female drum player, SI, skill, drum playing exercise

Photo1 The huge Japanese drum, what is called, "Ohdaiko" in Japanese, has about 2.60 m in diameter.

INTRODUCTION: Since ancient times, the drums have been one of the most common percussion instruments in the world. However, there has been little to no study of the playing motion by the human body on the drum. The charm of Japanese drum is that the player presents a dynamic motion, and while playing selects either the right or left hand in a creative melodic bond. Hence, there is a great importance to manifest the kinetic motion with Biomechanical techniques to improve the player's skill. It is essential to obtain the fundamental data on the motion of the right hand (RH) and left hand (LH), to compare the number of strikes between the experienced (A) and the inexperienced (B) subjects, and to study SI. The purpose of this study is to analyze the motion required to play the Japanese taiko drum.

METHODS: Five subjects (three male and two female) participated in the study. One was an experienced player (A), the others were inexperienced players (B), and all were right-handed. This study was conducted in a laboratory at Kanazawa University for two days in December of 2004. The instrument used was Okedoudaiko, which is 1.00 m in diameter, and the sticks used were standard Ohdaiko sized (diameter 3.5 cm, length 48 cm,

weight 246 g). Following a warm-up, the subjects attempted four trial procedures. The task had 5 points: the first was to make the dynamic strike as wide as possible; the second was to be as fast as possible during the 15-second exercise while achieving maximum effort; the third procedure was four trials by the R.S. and the L.S. method, and the playing style was the forward striking method. Finally, upon completion, the players stood in a neutral resting position. During the transaction time, the motion was analyzed at 30 Hz by a digital video camera. The stick motion of player (A) is presented in Figure 1. The strike number of the playing exercise by the R.S. and the L.S. methods was recorded in Table1. SI was calculated in Table 2, and each subject is charted in Figure 2. T-test was used to compare the difference of mean values, and the level of significance was set at 5%.

RESULTS:

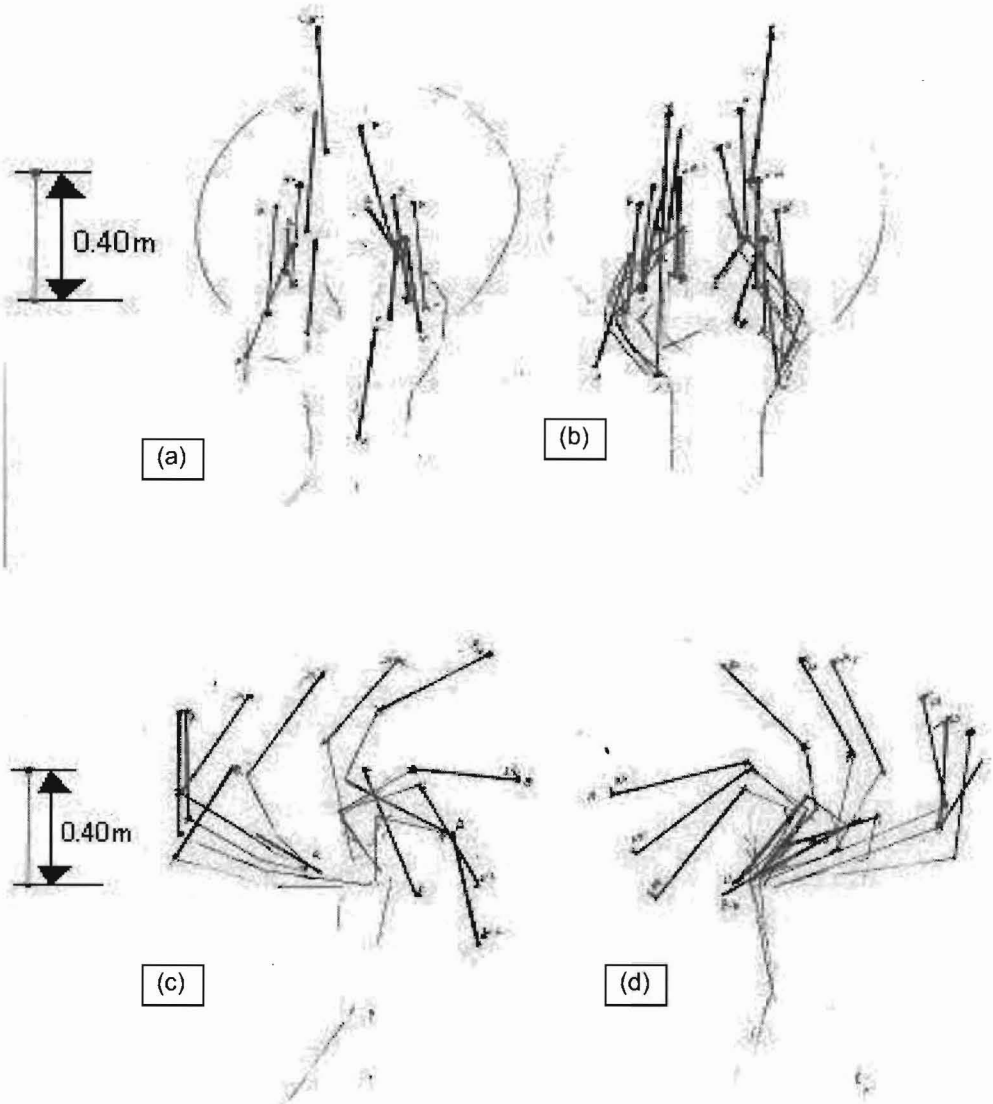

Figure 1 Stick picture of the experienced subject (A).

Figure1 represents the stick picture in relation to the traced motion, which was recorded by 6 temporal variable traces manually pertaining to the calibration frame. (a) The motion traced from the rear by the L. S. (b) The motion traced from the rear by the R. S. (c) The motion traced from the left side by the L. S. (d) The motion traced from the right side by the R. S.

Table 1 Strike number of Japanese drum playing exercise during the 15-second.

Subject	Trial			
	First		Second	
	R. S.	L. S.	R. S.	L. S.
M.Y (f)	34	36	30	32
M.Y 2(f)	36	38	34	35
exper.(n=2) Mean	35	37	32	33.5
S D	1	1	2	1.5
T .S (m)	32	34	32	33
T .N (f)	25	28	30	30
M.H (m)	35	40	35	40
S .N (m)	27	28	—	—
inexper.(n=4) Mean	29.8	32.5	32.3	34.3
SD	3.96	4.97	2.05	4.19

Table 1 shows the recorded strikes; however, only the strike number of the starting hand was examined. The subjects raised their hands one after the other. Therefore the actual strike number might be twice the number given or minus 1. In addition, mean and SD are calculated to compare. In the case of (A), n = 2; in the case of (B), n = 4. There was no significant difference between (A) and (B) or between the RH and the LH ($p < 0.05$). (Note: The table uses initials for the subjects' names. M. Y's data is recorded for the first and second day under M.Y and M.Y 2, respectively)

Table 2 SI (%) on strike number of each subject.

Subject	Trial			
	First		Second	
	R.S	L.S	R.S	L.S
M.Y	-5.71	5.71	-6.45	6.45
S .N	-3.64	3.64	—	—
M.Y 2	-5.41	5.41	-2.90	2.90
T .S	-6.06	6.06	-3.08	3.08
T .N	-11.32	11.32	0.00	0.00
M.H	-13.33	13.33	-13.33	13.33

Table 2 shows SI between the RH and the LH. SI shows that the data is symmetric when the index is less than ±10%, and asymmetric when the index is greater than or equal to ±10%.

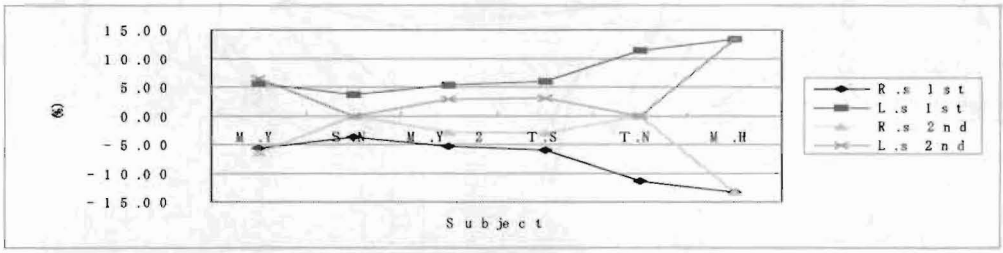

Figure 2 A comparison of SI on strike number of Japanese drum playing exercise.

Figure 2 represents the difference of each subject between the RH and the LH, which is charted in Table 2.

DISCUSSION: Figure1 shows the upward (dynamic) motion. The stroke of the stick by the L. S. is wider than the R. S. The motion of the RH is more stable than the LH, which accounts for the ellipse in (a) and (b). The motion of each hand accounts for the semicircle in (c) and (d). The data suggests that the RH displays the primary contributing factor relating to the effective motion in comparison with the LH. The data in Table 1 shows that the strike number of the L. S. is more than the R. S. The data suggests that the subject can swing down the RH faster than the LH because the subject is right-handed. On the contrary, the velocity of the LH was greater than the RH. The LH was more active in comparison to the RH, and was shown to move more accurately according to the movement requested, especially while setting the tempo. In (A), the strike number of the second trial was less than the first. This may be directly related to fatigue that the subject may have experienced. In (B), the strike number of the second trial was more than the first. In (A), the strike number of the second day was more than the first. It may be because of the effect of the practice.
In the execution an important parameter is to set the tempo, so exercising the LH is crucial. The result of each subject on SI is as follows in Table 2. Almost every subject showed symmetric motion while striking the drum as fast as possible, regardless of experience. However the SI of subject M.H was greater than ± 10%, which may be because M.H strikes unsteadily while both legs are parallel. The LH may be able to play the drum as well as the RH, but the stance is also important. Hence, it is necessary to exercise the LH to counter the dominant right hand while keeping a good stance. SI (A) of the second trial was greater than the first. The combined work of both hands may have caused fatigue. The data suggests that concentrating on the motion itself causes the motion to slow. SI (B) of the second trial was less than the first. According to the SI results, the asymmetry between the RH and the LH decreases with practice. The data suggests that fast motion causes less concentration. SI (A) of the next day was less than the first. It may also be because of the effect of practice.

CONCLUSION: It is important to exercise the LH in order for the player to set the tempo. It is also necessary to exercise the motion of the strike and to move both hands quickly. The equal playing ability of both hands is greatly affected not only by practice, but also by the velocity and the stance of the subject. Future study is required to fully understand the extent of the effect that a proper stance has on a subject's playing ability. It is clear that there is a great need to analyze the kinematic motion of playing exercise to move efficiently for dynamic motion and a lively performance.

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