

Study of Body Movement (体捌き) in Kendo Men-Strike

Myōjō (明星) University Research Treatise, March 2012, author Imafuku Ichiju(今福一寿), translated by Ted Imoto, 04/03/2014

- Summary -

Characteristics of body movement (Taisabaki) in Kendo Men Uchi were analyzed, in particular, the use of Okuri-Ashi (送り足) and Fumikiri-Ashi (踏み切り足) for those champions who have kendo rank of 6-dan. As the result of this study two types of body movements (Taisabaki, 体捌き) were found based on the foot works (Ashi Sabaki, 足捌き) as follows:

- 1) Piston type: who jumps in with left foot, Fumikiru (踏み切る) by raising right knee high
- 2) Swing type: who steps in with right foot, Fumikomu (踏み込む) using Okuri Ashi (送り足) without raising right knee high.

Characteristic of the Swing type is the use of Okuri-Ashi technique which does not show spring reaction; therefore, this is suitable for old age with a smaller step. On the other hand, the Piston type uses Fumikiri-Ashi technique which shows weight pullout and spring reactions; therefore, this may be cool for young Kenshi and magazine picture. Miyamoto Musashi (宮本武蔵) refers this technique to as "Tobi-Ashi (跳び足)" or "Taka-Ashi (高足)" or "Uki Ashi (浮き足)" and criticize this technique. This technique was not recommended in prewar time. The conclusion is given at the end of this research.



I FORWARD

Morita Bunjūrō (森田文十郎)¹⁾ defines a complete process (Kanzen Sōsa, 完全操作) of kendo Datotsu (剣道打突) as operations of the following three things executed simultaneously: 1) rotation of the hip, 2) diagonal movements and 3) body advance movement. Repeatedly he points out an importance of left half body, left leg, left hip and left hand. Based on these guideline/concepts he and his student Hashimoto (橋本) brought up many champions who are now playing an active role in All Japan Kendo Senshūken Taikai (全日本剣道選手権大会). The author Imafuku Ichiju(今福一寿) who was lead by Hashimoto Akio(橋本明雄)²⁾ made the following three experimental hypotheses. If you turn your left hip toward forward as you strike, then, 1) It helps hip to make parallel movement with floor easier, 2) It helps you move forward by the hip rotation and the diagonal body motion, 3) It reduces spring reaction on left leg, and the strike action is not noticeable to opponent. According to these hypotheses Kaneko Keiji (金子敬二)³⁾ who was the same study group performed experiments and concluded the same results. Also, the author reported⁴⁾ that making this Okuri-Ashi with the left hip in, produces hip's parallel movement with the floor by generating stiffness at left knee, developing muscles at left groin area and thigh. It was confirmed that the theory of Datotsu using left half body (left leg, left hip, left arm) as an axis is important as Morita (森田) and Hashimoto (橋本) have pointed out.

The purpose of the study this time is to determine whether the third hypothesis is right or wrong and to analyze the characteristic of those champions who use Fumikiri-Ashi (踏み切り足) for Kendo Men strike. The trend for today's modern kendo is as shown here in the above picture "Tobi-Ashi (跳び足)" or "Taka-Ashi (高足)." You will see on YouTube the images of body flying in the air when Men is struck showing Fumikiri (踏み切り) motion of the left leg. On the contrary, the Okuri-Ashi (送り足) technique is not popular nowadays. It is only phenomenal and not based on the proper teaching of kendo. In teaching proper kendo the questions of which foot works, Fumikiri Ashi (踏み切り足) or Okuri-Ashi (送り足) be used are discussed.

II METHOD OF STUDY

1. Examinee

Listed in Table 1 is characteristics of examinee experienced kendo, all males from age group 30 to 37-year-old. These people were selected among teams of outstanding records in championship tournaments.

2. Test Procedures and Equipment

Each examinee was tested for practical Sho Men Uchi three (3) times from Issoku Itto no Kamaye (220cm from left foot toe tip to bottom of Datotsubu of dummy equipment) using dummy equipment as shown in the below picture.

Name	Gender	Age (Yr)	Height (cm)	Weight (kg)	Rank (Dan)	Exp. (Yr.)
S.A	M	34	163	65	6	25
S.Y	M	36	178	80	6	27
H.K	M	37	170	68	6	28
T.Y	M	30	172	70	6	22

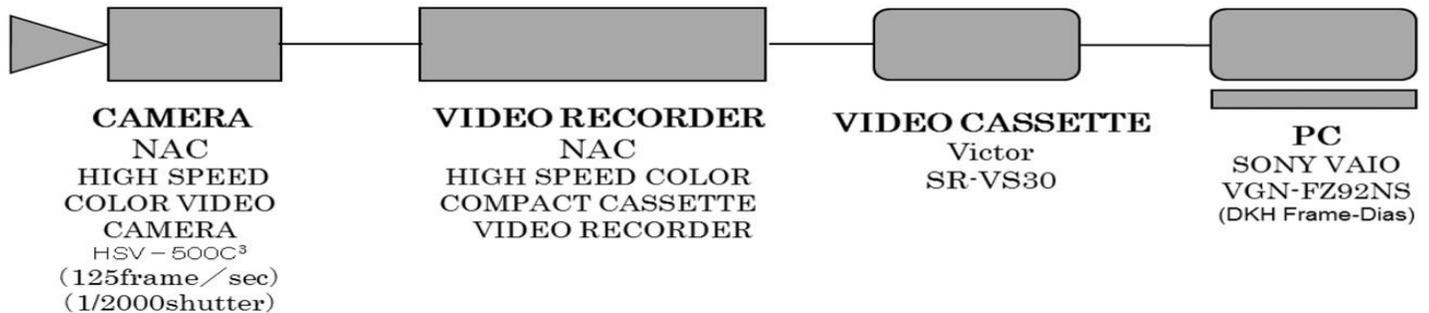
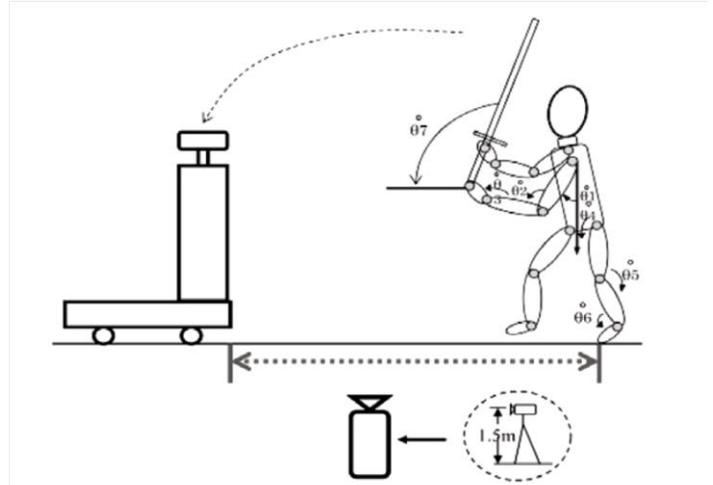
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Carbon Shinai (Hasegawa, size 39, 120cm, and 560g) was used. Height to strike was made same as the examinee's height. Examinee wore black polyester tights, top and bottom and attached digital reflect sensing markers at the ear, shoulder, foot, leg, hand, knee joints, etc. Also attached markers to the tip of Shinai and Tsuka Gashira.

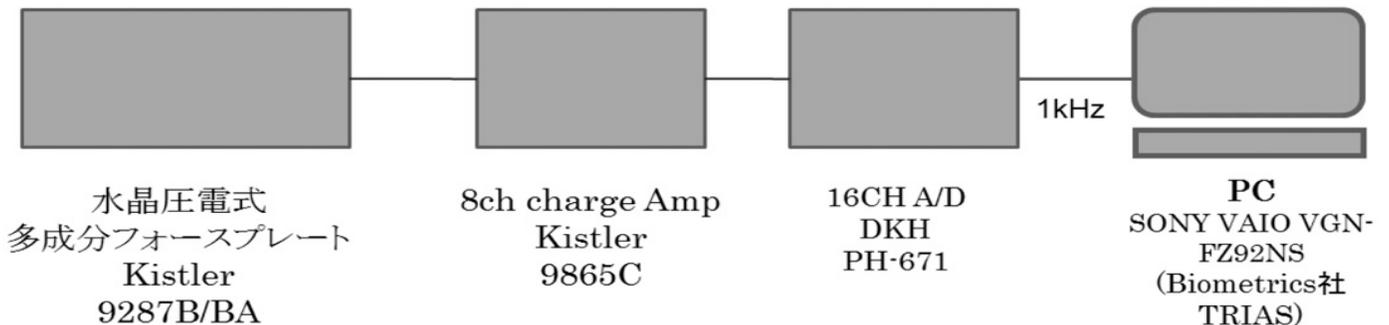
3. Snap-Shot and Analysis

NAC high-speed video system HSV-500C³ was used to take a snapshot of each examinee on his left side 10 meters away. NAC Video recorder (High-Speed Color Compact Cassette Video Recorder) was used with 125 frames/sec speed and 1/2000 shutter speed settings. Used DKH video, Movement Analysis System Frame, Dias 4 for Windows digitized and analyzed each frame for each joint speed, pressure on left leg joint, center gravity movement, Fumikiri angle and so forth. Characteristic of movement and floor spring reaction were discussed.



4. Measurement of Floor Reaction

Kistler-9287B/BA Force Plate was used to discuss characteristic of individual's Fumikiri and the relation between muscle and body movement. It was measured in three directions; namely, Up/Down(Fz), Left/Right(Fx) and Forward/Back (Fy) and the results were compared and discussed. The floor reaction was converted to digital using Charge Amp, and it was captured in PC using DKH Trias System. Refer to the block diagram below.



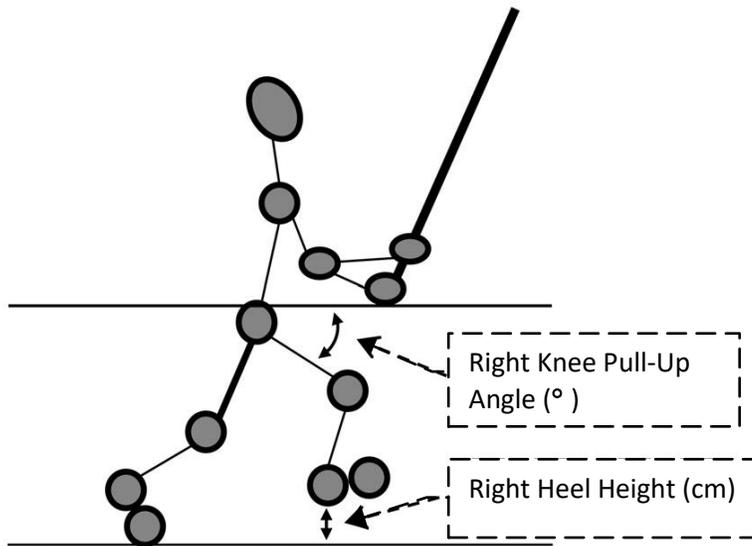
III RESULT AND CONSIDERATION

1. Examinee's Pull-Up Movement of Right Foot and Knee

Next picture shows measured locations of right knee and right foot heel when the examinee strikes Men Datotsu. The angle of the right knee pull-up is measured from the thigh to horizontal level at the hip. The right foot pull-up is measured from floor to right foot heel.

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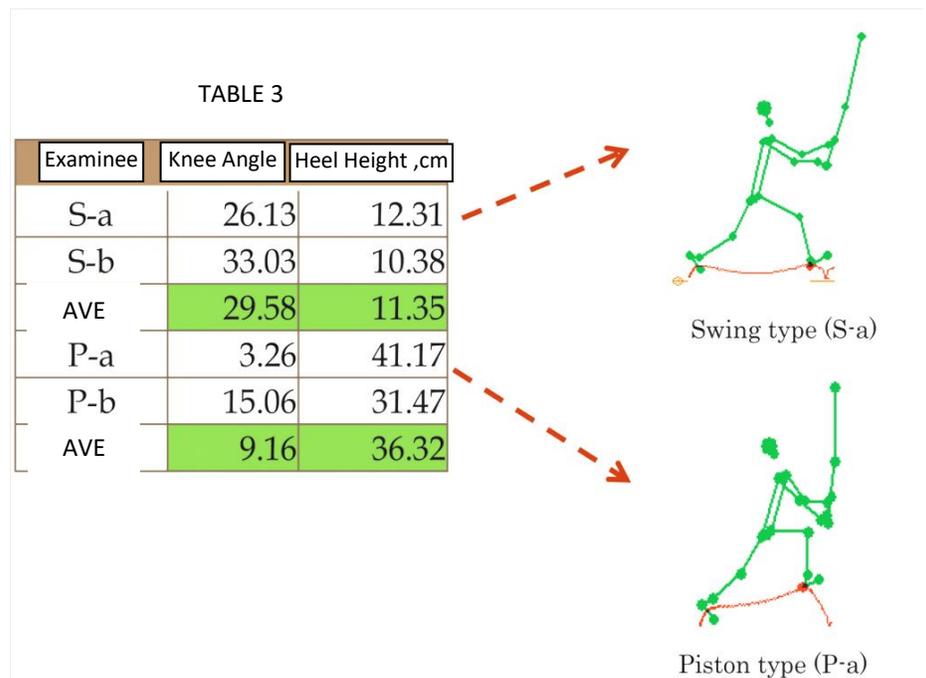
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Examinee	Right Knee Angle (°)	Right Foot Heel Ht (cm)
S.A	26.13	12.31
S.Y	33.03	10.38
H.K	3.26	41.17
T.Y	15.06	31.47

Table 2 shows test data for measurements of right knee angle and right foot heel height for the four examinees. Clearly, H.K and T.Y have lifted up right knee high as compared to S.A and S.Y when they strike Men. Table 3 summarizes these test results with average values and separates Swing type (designated with S-a & S-b) and Piston type (designated with P-a & P-b).

Swing type raises his right foot heel 11.35 cm and Piston type 36.32 cm from the floor and moves forward. The Piston type Datotsu movement matches with an expression of "Tobi Ashi (跳び足)" or "Taka Ashi (高足)" that is described in Miyamoto Musashi (宮本武蔵)'s "Gorin Sho (五輪書)"⁵⁾. Miyamoto Musashi (宮本武蔵) criticizes this movement as "Fumi Yusuru Ashi (Step&Shake Foot)." There is a warning for those who practice this Datotsu movement that the force that you create when right foot hit floor may cause a problem on your right heel in harm's way. As Musashi (武蔵) pointed out and also those, who were before war criticized the Datotsu movement of "Tobi Ashi (跳び足)" or "Taka Ashi (高足)" or "Uki Ashi (浮き足)." Therefore, it is necessary to consider not to recommend this Datotsu movement. It is natural to see a big difference between the kendo of Musashi's era and today's. Today, the sword was replaced with Shinai and the Shinai Kendo was revolutionalized the Datotsu movement with high speed and new techniques!

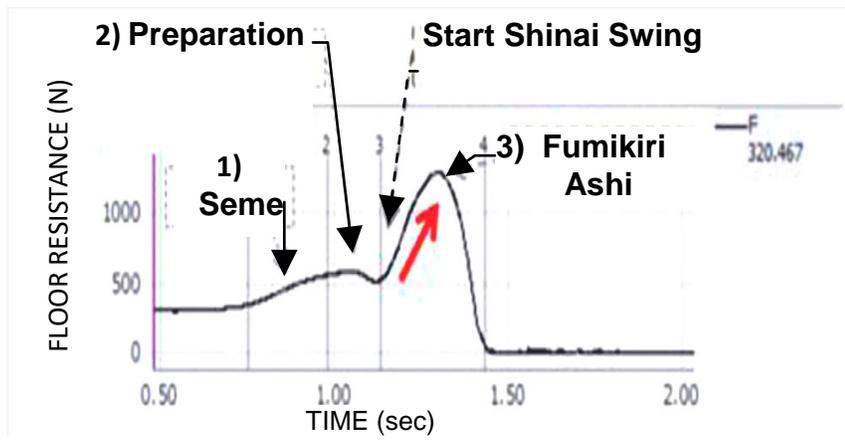
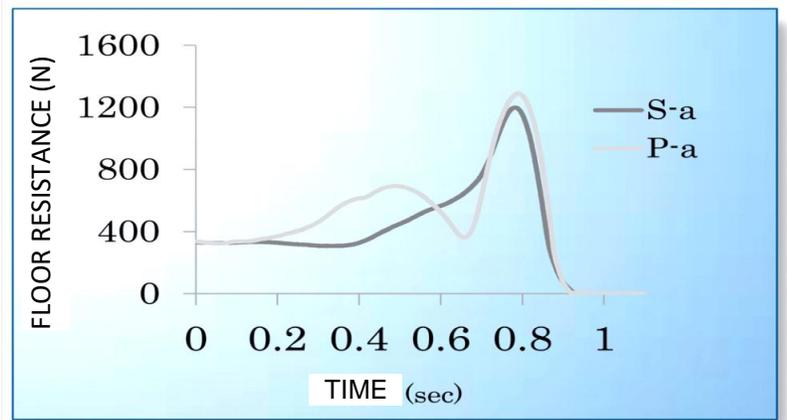


2. Comparison of Left Foot Floor Resistance between Swing and Piston Types at Datotsu Movement

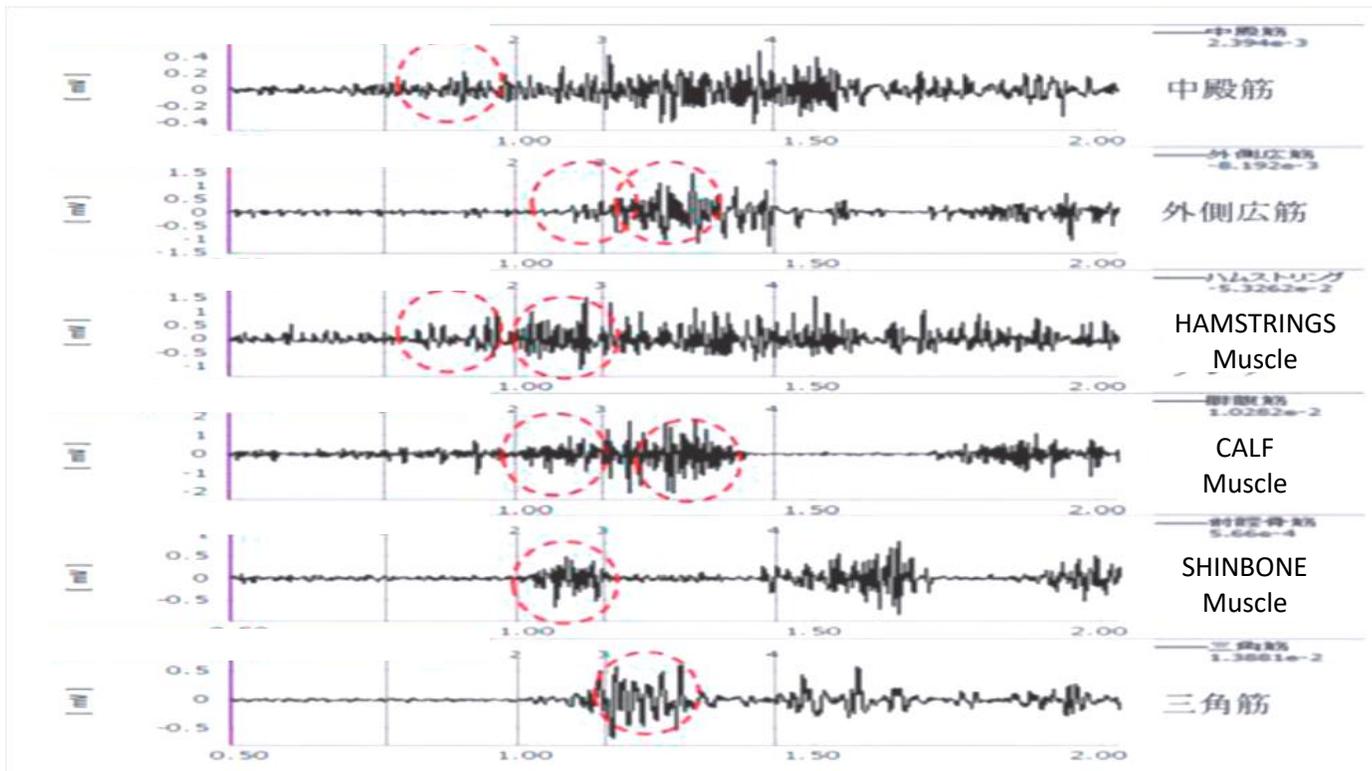
The Figures below show the comparison of floor resistance and functional characteristics of the left foot, Okuri Ashi. The sequence of the functional characteristic of the left foot is divided as, first 1) Same, second 2) Preparation and third 3) Okuri Ashi or Fumikiri Ashi. Only Piston type functional diagram is depicted here for illustration. Note that the Piston type have a moment for weight pullout and spring reactions on left leg; whereas the Swing type does not have.

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Left Leg Muscle Movement at Fumikiri (Piston Type)



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3. Characteristics of Left Leg Joint Pressure for Piston and Swing Type

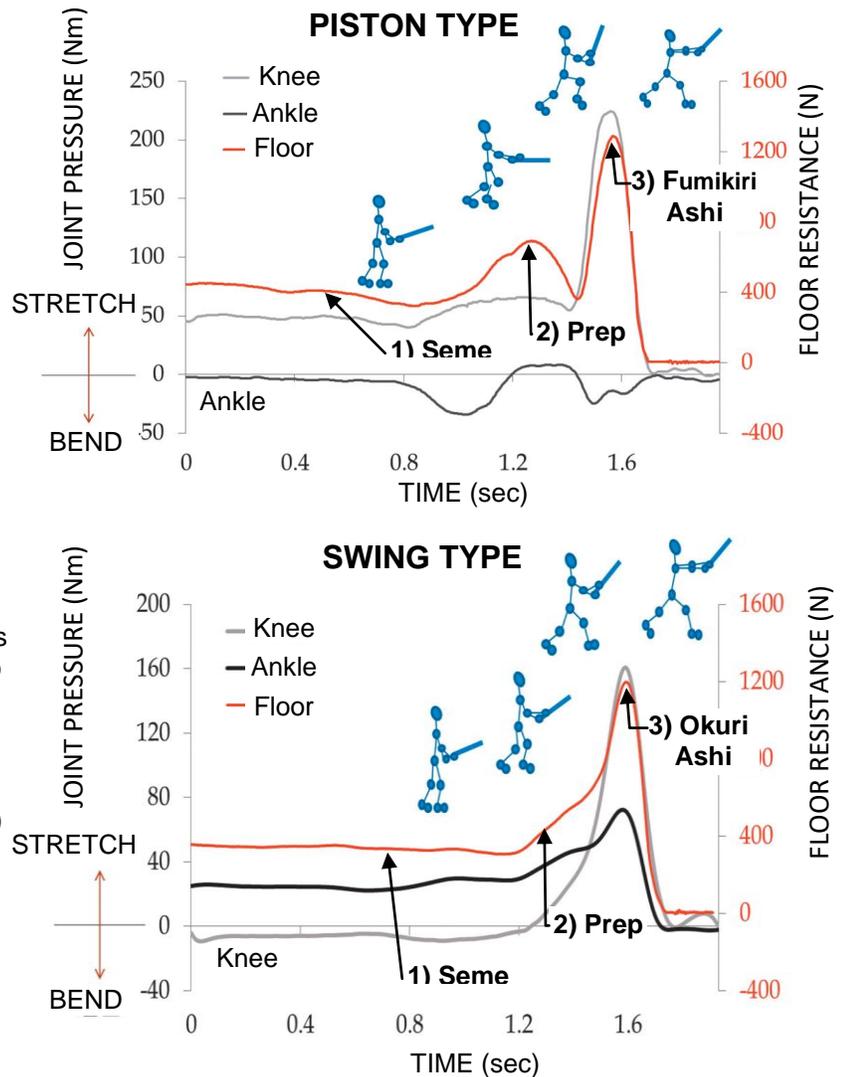
The Figures on the right show pressures applied on left leg joints, knee and ankle, for Piston and Swing type examinees on their floor resistance. The top is for Piston and bottom is for Swing type.

Characteristic of the floor resistance for Piston type shows weight pullout and spring reactions to jump forward with Fumikiri Ashi; whereas, Swing type does not have this weight pullout and spring reactions to move forward with Okuri Ashi.

Piston type has a unique characteristic of the pressure applied to the ankle. It shows slight bending to provide the steeper angle to leg to get ready for push off and clearly shows the spring reactions to jump forward with Fumikomi Ashi. Apparently, knee and calf muscle are used to jump forward just like a 100 meter Olympic runner is ready at starting line.

Swing type's ankle, on the other hand, shows smooth stretch condition and knee is slightly bent, relaxed. That is his left heel is closer to the floor. Apparently, hamstring to the ball of the foot is acting as a piece of solid stick with muscles and ready to push off / kick forward with Okuri Ashi. That is not a jump.

The knee action has in both case(Piston and Swing types) quickly elevated to move the body forward.

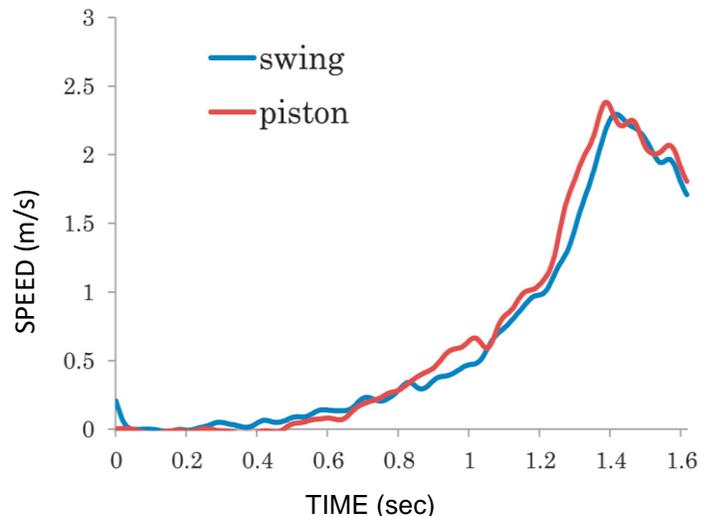


4. Speed of Center of Gravity & Vertical position

The Figure on the right shows a comparison of horizontal speed between Swing and Piston type. The average speed of Swing type was 0.64 m/sec (2.30 m/sec maximum) and Piston type was 0.68 m/sec (2.38 m/sec maximum).

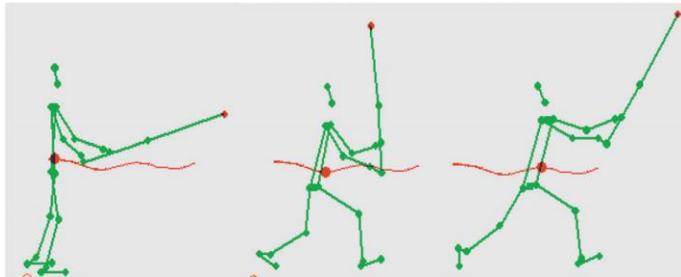
Since Piston type jumps with spring reactions per the floor resistance as was shown, higher speed is expected. However, slightly higher speed was observed for Piston type. That is because the direction of speed is up forward and up direction does not contribute forward movement.

Next, let's compare vertical position change (the center of gravity change) during the Datotsu movement between Swing and Piston type. Left picture on next page is for Swing type, and the right is for Piston type.

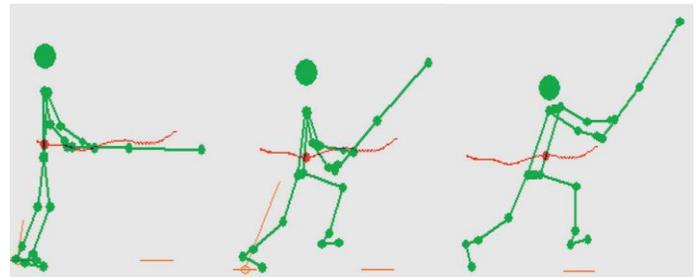


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SWING TYPE



PISTON TYPE

Swing type has the height position 83.47 cm from the floor at starting (Kamaye), 76.52 cm minimum and 80.75 cm maximum. Piston type has 89.5 cm at starting, 82.97 cm minimum and 89.34 cm maximum. Swing type falls 6.95 cm and rises 4.23 cm when strike. Whereas, Piston type falls 6.53 cm and rises 6.37 cm when strike. It was noted that Swing type has $6.95 - 6.53 = 0.42$ cm more fall, and Piston type has $6.37 - 4.23 = 2.14$ cm more rise.

There is an expression "Ride and Strike" in kendo imaging to strike over & above opponent's shinai. Conversely, this image is floating body and not stable Datotsu form; therefore, it is a cause of negative characteristic. The form that Piston type jumps with the left foot, raising right foot high, is criticized as "Tobi-Ashi (跳び足)" or "Taka-Ashi (高足)" or "Uki Ashi (浮き足)."

In either case, there are hidden techniques for body movement in Kendo Men strike. In fact, these two types (Swing & Piston) are seen in All Japan Kendo Senshuken Taikai (全日本剣道選手権大会), and they are competing with their kendo styles. If we want to evaluate effective body movements for best performance, diversified examination/verification is considered necessary in actual tournament site.

5. Compare Timing of Datotsu movement in Kendo Men Strike.

Figure on the right compares the timing of Swing and Piston type for their Rise, Move, Pull-In and total time they took.

"Rise" is time taken from left foot on the floor (wt>0) to the preparation of Okuri Ashi or Fumikiri Ashi for moving.

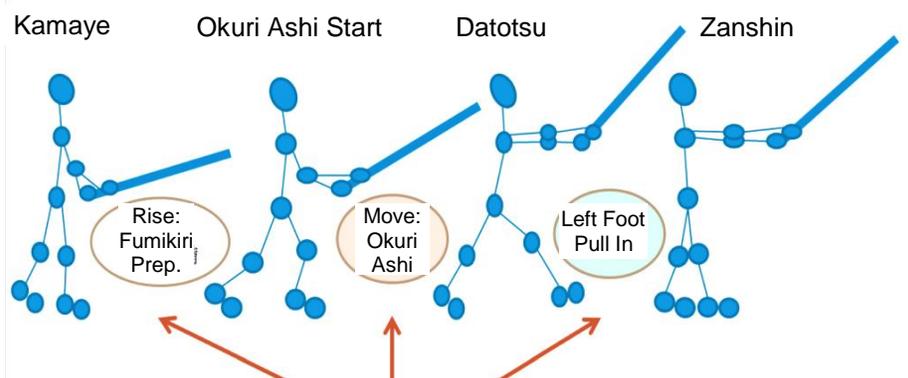
"Move" is the time from starting Okuri Ashi or Fumikiri Ashi till right foot hit the floor (landing).

"Pull-In" is a lapse of the time between the right foot landed and the left foot is pulled into the right foot.

"Time" is total time lapse from "Rise" to "Pull-In" time This is Datotsu Time.

Average value of the two examinee's data was also listed to study the results.

Swing type shows 0.30 sec for "Rise," 0.23 sec for "Move" and 0.21 sec for "Pull-In" and the Datotsu time was 0.74 sec.



Examinee		Rise	Move	Pull-In	Time (sec)
Swing type	S-a	0.29	0.22	0.20	0.72
	S-b	0.30	0.25	0.21	0.76
AVE		0.30	0.23	0.21	0.74
Piston type	P-a	0.60	0.28	0.25	1.14
	P-b	0.46	0.30	0.27	1.02
AVE		0.53	0.29	0.26	1.08

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Piston type shows 0.53 sec for "Rise," 0.29 sec for "Move" and 0.26 sec for "Pull-In" and the Datotsu time was 1.08 sec. Piston type took 0.34 (= 1.08 - 0.74) sec longer time which is very significant. As compared to Swing type, Piston type shows time delay of 0.23 sec (=0.53 - 0.30) during "Rise" time. That is 67.6% of the total Datotsu time. That is a big disadvantage for Piston type because the opponent can strike Debana Waza such as Debana Men (出ばな面) and Degote (出小手) during the "Rise" time. It is desirable to learn the Datotsu movement that shows the least "Rise" time by moving parallel to the floor and directly toward the opponent. Fumikiri (踏み切り) movement implies consciously to move or rather jump as far as and as high as possible. Therefore, proper footwork for efficient Datotsu is Okuri Ashi (送り足), and this is not for jumping. Before the war, kendo Datotsu was taught to use Okuri Ashi without raising right foot high, but as close as to floor (paper thin distance apart from the floor). And, they said, send your right foot forward with your left foot as if you step opponent's foot. The teaching is still effective today based on the above test. Mastering correct Okuri Ashi movement for kendo Datotsu is necessary for teaching beginner.

III SUMMARY

This study laid out basic data to discuss two types of body movement in kendo Datotsu movement; namely, Okuri Ashi (送り足) and Fumikiri Ashi (踏み切り足). The two types of footwork were clarified. Today, the word Suri Ashi (すり足) is often used in place of Okuri Ashi. But this is oversimplified. The Proper word is Okuri Ashi movement. In teaching proper kendo footwork, whether "Okuri Ashi" or "Fumikiri Ashi" (same as "Tobikomi Ashi") listed below is results found in this study:

1. Two types of body movement in Kendo Men strike were found in those champions who represent kendo at the high skill level. They are Piston type who jumps in with left foot, Fumikiri (踏み切る) by raising right knee high and Swing type who steps in with right foot, Fumikomu (踏み込む) without raising right knee high.
2. The form that Piston type jumps in with left foot, raising right knee (angle 20.42 deg.) and right foot (floor to heel=24.97 cm) high are criticized as "Tobi-Ashi (跳び足)" or "Taka-Ashi (高足)" or "Uki Ashi (浮き足)."
3. From the floor resistance test, it was found that Piston type jumps forward with weight pullout and spring reactions using Fumikiri Ashi; whereas, Swing type moves forward using Okuri Ashi without this weight pullout and spring reactions.
4. Left leg joint (knee and ankle) pressure test on Swing type shows stretch whereas Piston type shows bending on ankle joint. That leads to the weight pullout and spring reactions at the time of Datotsu moment.
5. There was not much difference in speed of horizontal forward movement between Swing and Piston type
6. Piston type moves 2.14 cm higher than Swing type in Datotsu movement
7. Piston type has longer time (slower movement) as compared to Swing type for Datotsu movement. The cause of this delay may be due to preparation for weight pullout and the spring reactions to jump.

On kendo's body movement (体捌き) the expression of Okuri Ashi (送り足) has an image of sending right foot forward with left foot using Suri Ashi (すり足) on right foot such that ball of right foot slides floor with a thin paper space. Conversely, the expression of Fumikiri Ashi (踏み切り足) has an image of jumping high and Tobikomu (踏み込む) with left foot with right foot high in the air away from the floor. The former was categorized as Swing type and the latter as Piston type. The disadvantage of Piston type described in the 7 above lead to a conclusion that Okuri Ashi (送り足) should be chosen and learned for a beginner, but it may be necessary to discuss diversified factors for further study.

[references]

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