

5-1. THE ANALYSIS OF BASIC POSTURE IN JUDO

—Especially in *Shizentai* and *Seiza*—

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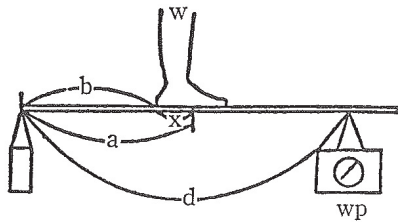
[I] SHIZENTAI

Concerning *Shizentai* in Judo, Professor J. Kano³⁾ describes in his book *Judo Kyohon* that it is “a posture standing straight with your feet a foot’s length apart”. In *The Lectures of Judo I* Mifune, Kudo, and Matsumoto⁶⁾ state that the most advisable posture in Judo must be: 1) a starting posture ready to make a quick reaction with inner and outer stimulations, 2) a posture with high stability, 3) a posture with less fatigue, 4) a posture with good spirit and emotion to meet the purpose of Judo practice, as a way of self-expression, and 5) a healthy posture. They state that *Shizentai* is an ideal posture to fill these conditions. Also Yoshizo Matsumoto⁵⁾ describes an ideal posture in *Judo with Photographs and Illustrations* (p. 19) as follows: “*Shizentai* is a posture to stand balancing the weight equally on the both legs, the stomach receives the strength naturally, the waist is kept straight, the chest receives no pressure, the head is kept straight up, the legs, arms and shoulders are left as they receive some pressure, the mouth is lightly closed, the eyes are kept as if looking at a big tree in the distance but not gazing at anything intensively. Anyway, it is a posture to stand naturally”. Kenji Tomiki⁸⁾ mentions in *Physical Education and Martial Arts* as follows: to briefly define *Shizentai* it is a natural standing posture in detachment and calm state without inclining (front and back, right and left). Both the feet should keep a stance about a foot length wide and the toes are opened naturally. The legs are stretched freely with no pressure on the knee joints. The body weight should be put equally on both feet but not on heels. The weight should be put rather closer to the toes. You should not stand on tiptoes. The upper body should be kept upright so that the center of gravity of the body remain in the lower abdomen, or *tanden*. The arms are kept dangled naturally without putting pressure on the shoulders. He mentions that there should be balanced distribution of the body weight and the center of gravity of the body should stay in *tanden*.

It has been emphasized that *Shizentai*, which puts the strength in *tanden* below the navel, is the basic posture in Judo. In this survey the measurement of the center of gravity in basic *kamae* and standing postures as well as the position of *tanden* of Judoists and Kendoists has been made. Also the examination has been made of the relations between *Shizentai*, the center of gravity, and *tanden*, and of the influence of the characteristic movements of martial arts on the upright posture and *kamae*.

I. Method

The measurement of the center of gravity of back and front (Y axis) gravity in standing posture was measured by Akita System, Center-of-Gravity Measurement Aparatus consisting of a homogeneous board, a weight measure, and a wedge-shaped supporting stand. The measuring method and the formula are shown in Fig. 1. The distance from the fulcrum to the center of gravity (a) is measured, and the distance from the fulcrum to the heel (b) is subtracted from (a). The difference is shown as



w=Body weight
 wp=Reading on weight measure
 a=Distance from fulcrum to center of gravity
 b=Distance from fulcrum to heel
 d=Distance from fulcrum to weight measure
 x=Distance from heel to center of gravity
 $wp : w = a : d$
 $a = \frac{wp \cdot d}{w}$
 $x = a - b$

Fig. 1 Method of determining of gravity.

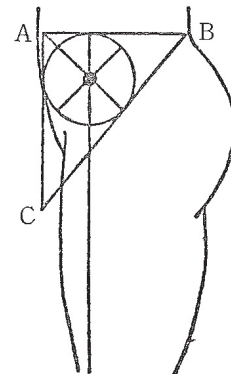


Fig. 2 Drawing figure of Tanden (standing posture)

(x) which is the distance from the heel to the center of gravity. The position of *tanden* was measured from the nude picture by using Hasegawa's²⁾ method of drawing figures. As shown in Fig. 2, a horizontal line was drawn connecting the abdomen (point A) and the point between the 4th and 5th lumbar on the upper crista ilium (point B). The intersecting point where the extension of a diagonal straight line from point B toward symphysis and the vertical line from point A meet is point C. In

Table 1 Center of Gravity of Judoists and Kendoists.

N		Age	Experience year	Dan	Height	Weight	Foot length	Recumbent posture		Standing posture		Attitude posture		Natural standing posture	
					cm	kg	cm	cm	%	cm	%	cm	%	cm	%
26	X	20.3	8.0	2.4	173.2	78.0	25.7	98.1	56.6	11.9	46.5	18.7	43.1	10.0	40.5
	S.D.	±1.2	±2.2	±0.5	±5.5	±9.6	±0.9	±3.3	±1.0	±2.1	±7.6	±1.9	±8.1	±1.4	±5.3
	min	19	4	2	163.5	65.0	23.8	89.3	55.1	7.6	29.0	4.0	10.0	5.95	24.3
	max	23	15	3	186.0	105.0	28.0	105.2	59.6	15.9	58.5	26.7	55.8	12.5	52.0
30	X	20.5	9.6	3.3	172.2	65.4	25.1	97.5	56.5	12.9	51.4	26.4	60.6		
	S.D.	±1.3	±2.6	±0.6	±4.7	±5.8	±1.0	±3.4	±1.1	±1.9	±7.2	±3.0	±6.0		
	min	18	4	2	162.0	55.5	23.0	90.8	54.0	8.4	34.5	19.5	43.9		
	max	23	16	5	182.5	84.5	26.5	105.7	58.3	16.5	65.1	33.8	75.1		

this way a triangle can be drawn. The center of the inscribed circle in this triangle is the *Seika-Tanden*. The subjects are 26 Judo club members of a college in Tokyo (the average age is 20.3 years old, the average year of Judo experience is 8.0, and the average *dan* is 2.4). Also the same measurement was made of 30 Kendo club members for the comparison (the average age is 20.5 years old, the average year Kendo experience is 9.6, and the average *dan* is 3.3).

II. Results

The average values, standard deviation, and maximum and minimum values of Judoists' and Kendoists' height, body weight, foot length, the center of gravity of recumbent posture, of standing posture, of attitude posture, and of *Shizenhontai* (natural standing posture) are shown in Table 1.

The average vertical gravity line in still standing posture was 11.9 cm (from the heel) in the case of Judo players and 12.9 cm in the case of Kendo players. In the ratio of foot length the vertical gravity line of Judo players was 51.4%, which was slightly forward, and that of Kendo players was 46.5%, which was slightly backward. In the measurement of the vertical gravity line of Judo players

Table 2 Comparison of height and vertical line in the "Tanden"

		Tanden (height)	Tanden (vertical line)
Judo 26	\bar{X} S. D.	91.4 cm 3.10	75.5% 81.4
Kendo 30	\bar{X} S. D.	90.4 cm 4.28	71.0% 10.2

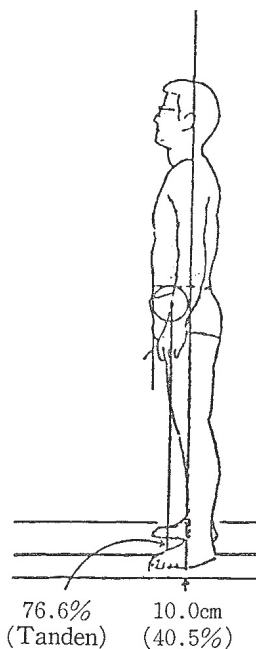


Fig. 3 Comparison of the gravity line and the Tanden line in the "Shizenhontai".

in the posture of *Shizentai*, standing with the subject's feet a foot-length apart, the line was at 10.0 cm from the heels (40.5%) as shown in Table 1, showing the shift of the line farther backward than upright posture.

The reason why the center of gravity of Kendo players was rather forward and that of Judo players was rather backward in upright posture should come from the difference of regular practice postures and *kamae*. In the measurement of vertical gravity line by having the subjects take their best *kamae* (posture) of regular practice, the center of gravity line of Judo players in left and right *Shizentai* was 18.7 cm away from the back step heel (43.1%, setting the distance from the front step tiptoe to the back step heel as 100%), which showed the center of gravity was located slightly backward. In Kendo players the center of gravity went through line 60.6%. They took *kamae* posture without holding a *Shinai*, so that their back step heel was not touching the floor (because they always stand with the body weight on the front step (left foot) tiptoe).

As to the relation between the positions of *tanden* and the center of gravity (See Table 2), the *tanden* height of Judo players in static standing posture was 91.4 cm, which was much lower than the height of center of gravity. The *tanden* vertical line was 75.5% away from the heel (setting the foot length as 100%) and 29% forward from the vertical gravity line. As shown in Fig. 3, *tanden* vertical line and the center of gravity line were not at the same distance away from the heel in *Shizen-hontai*. *Tanden* vertical line was 36.6% forward. In Kendo players *tanden* height was 90.4 cm and *tanden* vertical line was 71.0% away from the heel, which showed a similar tendency to Judo players.

In this way it was found that the center of gravity and the position of *tanden* were not the same and that the dynamic center of gravity was not at *tanden*. The further studies seem to be required as to whether these results show that college Judo players have not yet obtained the ideal posture or there is a problem to find *tanden* by a triangle drawing method, or *tanden* and the center of gravity are essentially different.

[II] SEIZA [Correct Sitting]

The diffusion of *Seiza* seems to meet with the period when the use of *tatami* was spread in Japan. It was at most 250 to 300 years ago (in the middle of the Tokugawa Period). In martial arts, it has been customary to sit *Seiza* before, after, and even at a rest period. Especially in Judo it has been emphasized, for they practice on *tatami* mats. Concerning the manner of *Seiza*, Jigoro Kano⁴⁾ mentions that *denza* is the most stable form among *denza*, *shiza*, and *sokushinza*, but it is not suitable for the quick action, and that *sokushinza* is free to convert the position of body but it lacks of stability, therefore he recommends *shiza* best which is not to the extremes. We made a comparative study of *shiza* (sitting with one's chin down, chest out, abdomen sticked out, nates backward, big toes crossed, and body slightly inclined forward) and regular *seiza* (which is called *tanza*—natural sitting), *choza* (sitting long stay), *agura* (sitting crossed legs), and *hankafuza* (sitting crossed leg).

I. Method

The subjects were the above-mentioned 26 college Judo club members in Tokyo. Also we made a survey of a college PE instructor (age 32) who has been practicing *zazen* for three years, by measuring the center of gravity, EMG (muscles of rectus abdominis, muscles of erector trunci, muscles of gluteus maximus, muscles of rectus femoris), and his respiration curve.

II. Results

The ratio of the center of gravity and the length of supporting legs which are touching the floor in *choza*, *agura*, *hankafuza*, *tanza*, and *seiza* are shown in Table 3. As a result, the following were found: the center of gravity line was far backward in *choza* (20.4%), *agura* (33.1%), and *hankafuza* (33.4%), and in *tanza* it was closer to the middle (40.7%), and in *shiza* it was even more closer to the

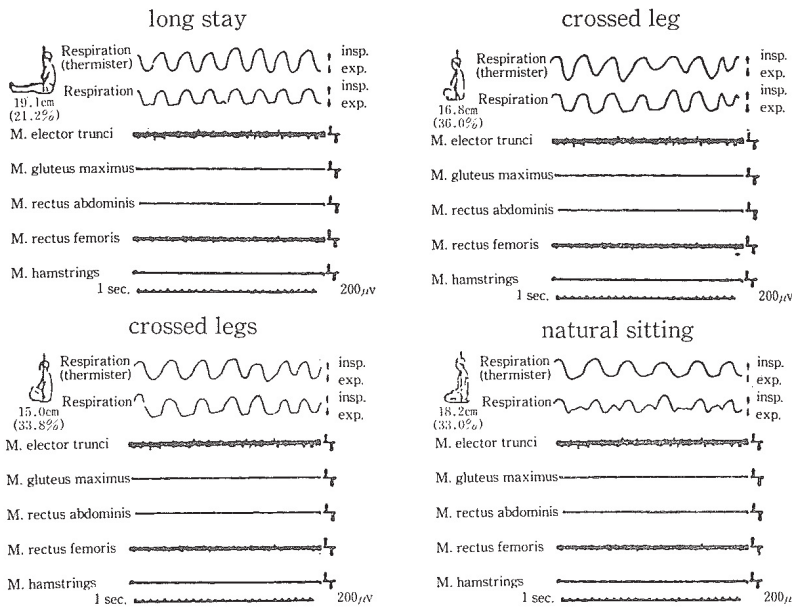


Fig. 4 EMG and respiration curve in long stay, crossed legs, crossed leg and natural sitting.

Table 3 Center of gravity of various sitting posture.

		Long stay		Crossed legs		Crossed leg		Natural sitting		Correct sitting	
		cm	%	cm	%	cm	%	cm	%	cm	%
		26	20.0	20.4	17.0	33.1	16.6	33.4	25.0	40.7	29.3
Judoists	(Max - Min)	±2.3	±2.0	±2.2	±3.9	±2.3	±5.1	±3.1	±4.8	±3.5	±5.7
	S.D.	16.1	17.3	13.2	22.9	12.8	25.1	17.7	29.7	21.0	35.9
		26.6	26.5	22.3	40.5	23.6	45.9	30.0	48.6	39.6	64.9

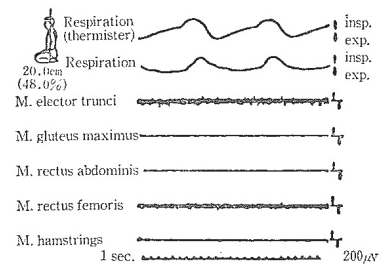


Fig. 5 EMG and respiration curve of correct sitting (Seiza).

middle (48.0%). It is considered that in *Seiza* manner of Judo the body weight is put equally on the back and front parts of supporting legs. Hematogenous disturbance is not created since there is less partial pressure on the leg arteries as in the case of *tanza*, when the center of gravity goes back and the body weight is not put around the ankles alone, therefore the legs seldom go to sleep.

As shown in Fig. 4, 20-30 µV of a small amount of muscle discharge was seen in muscles erector trunci in *choza* but in other muscles only 5 µV was seen. In *agura* about 50 µV of discharge was observed in muscles erector trunci, but in other muscles the discharge was not observed. In *hankafuza* the discharge of the muscles erector trunci increased to 80-100 µV but no increase of discharge was observed in other muscles. In *tanza* the 50-60 µV of discharge in muscles erector trunci was observed but no discharge was observed in other muscles. In *seiza*, as shown in Fig. 5, the 100-120 µV of discharge in muscles of erector trunci was observed, and the 50-60 µV of discharge in muscles of rectus femoris was observed.

The increase of discharge in the muscles erector trunci that the sail ropes to support the spine is stretched tightly, as Asmussen indicated.¹⁾ The muscles rectus femoris are the two-joint muscles containing lots of pale muscles fibre, and suitable for the phasic muscle activities but not for tonic contractive activities. M. Sato⁷⁾ describes in *Shintai-ron* that *seiza* (in Japanese-style) is static and at the same time always the starting point of dynamic action, therefore, it has both static and dynamic factors together in the posture. The increase of discharge proved this theory.

III. Conclusion

1. The center of gravity line in static standing posture of Judo players was slightly backward from the center of foot length (46.5%) from heel, (setting the foot length as 100%) and that of Kendo players was lightly forward (51.5%).

2. The center of gravity line in *Shinzen-hontai* of Judo players was 40.5% from the heel, which showed the body weight was more backward than static posture.

3. By setting the *tanden* position by the method of drawing figures, and comparing it to the center of gravity, it was found that *tanden* height was lower than the height of gravity in both Judo and Kendo players, and *tanden* vertical line was far forward from the center of gravity line.

4. We measured the center of gravity in the five sitting postures, setting the length of supporting legs side as 100%. It was 20.4% from back in *choza*, 33.1% in *agura*, 33.4% in *hankafuza*, 40.7% in *tanza*, and 48.0% in *seiza* in Judo, which was about in the middle of the supporting legs.

5. In the case of the subject who has been practicing *zazen*, the discharge of muscles erector trunci increased in the order of *choza*, *agura*, *hankafuza*, *tanza*, and in *seiza* the discharges of muscles rectus femoris, the two-joint muscle containing a lot of pale muscle fibre was observed besides the muscles erector trunci. It indicates that *seiza* is not only a simple static sitting posture but also a dynamic sitting posture containing active elements.

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