KINEMATIC CHARACTERISTICS OF SPECIFIC WUSHU MOVEMENTS: A CASE STUDY

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INTRODUCTION: In this study, biomechanical characteristics of specific long shadow boxing routine actions, namely, 'cechuai', 'qiansaotui' and 'xuanfengjiao', were examined by biomechanical analysis. These actions start with thrust left heel sideways balance, followed by a downward sweeping leg and then a jump up whirlwind step (see figure 1). For most wushu athletes, these actions are difficult to accomplish perfectly. Providing some preliminary biomechanics information may help novices to accomplish all these actions.

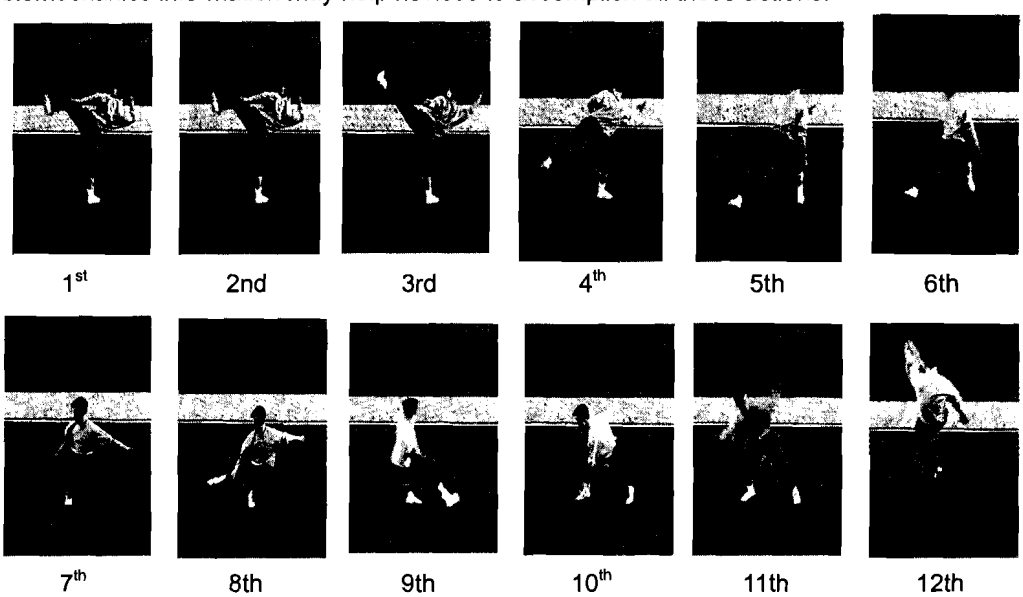

Figure1 - Photos of the action course.

(The 1st frame –3rd is the action of "cechuai' balance; the 4th-9th frame are actions of "qiansaotui"; 10th-12th are actions of "xuanfengjiao")

METHODS: A wushu master aged 22 and with the height and weight of 171.6 cm and 62.5Kg served as the subject in this study. When he was training, his performances of cechuai, qiansaotui and xuanfengjiao were recorded from the side and front of the athletes by two video cameras with the speed of 50 frames/s in training base. They were placed 13m from the side to athlete and 10m from front. The height of each camera is 1.05m. Inside synchronization is set in both cameras.
The video tape of one master performance was analyzed with Motion Analysis System (Eimg70, Beijing).

RESULTS AND DISCUSSION:

Table 1 Data of Athletes' Attitude Doing Cechuai Balance

TL	LL	FF	VH	VS	SH	CG (Px, Py)	ST (Px, Py)	SH (Px, Py)
114°	121.5°	-6.5°	-6.3°	36.8°	43.1°	2.41 -1.16	2.51 -1.3	0.76 -0.17

TL: the angle between trunk and support leg; LL: angle between two leg; FF: angle between feet extension line; HH: angle between vertical and hip axis; VS: angle between vertical and shoulder axis; SH: angle between shoulder axis and hip axis; CG: level project of center gravity; ST: toe of support foot; SH: heel of support foot.

Table 2 Biomechanical Data of Qiansaotui Action

Phase	VT	CG	LT	LA	SL	FL	AVH	LVF
Begin (76 frame)	163.2°	1.76-1.02-0.4	1.35-0.73-0.08	1.5-0.83-0.09	170°	112.9°	12.1	2.2
Half circle (87 frame)	165.3°	1.45-0.48-0.27	1.4-0.96-0.17	1.38-0.28-0.09	117°	68.1°	19.5	17.3
One circuit (98 frame)	164.3°	1.34-0.8-0.35	1.5-0.75-0.15	1.4-0.68-0.18	130°	79.7°	12	7.9
End (109 frame)	123.6°	1.17-0.75-0.4	1.53-0.85-0.17	1.57-0.78-0.02	90°	30°	18.9	13.3

VT, angle between spine and vertical; CG, coordinates of center of gravity (Px, Py, Pz); LT, coordinates of left toe (Px, Py, Pz); LA, coordinates of left ankle (Px, Py, Pz); SL, angle between left shank and level; FL, angle between left foot and level; AVH, angular velocity of hip (rad/sec); LVF, linear velocity of right foot (m/sec)

Table 3 SH Change While Cechuai Balance Followed Qiansaotui

Phase	62th frame	67th frame	70th frame	75th frame	79th frame	89th frame	108th frame
SH	-67.2°	-40°	5°	6°	52°	-18°	-92°

SH see abbreviation in table 1.

1. Cechuai balance is a specific action required in long shadow boxing (chang quan) routines. It can be seen from Fig 1 that body figure looked like "Y" shape in which a supporting leg (right) appears to be vertical with ground and the head keeps vertical with respectively, LL 121.5°TL 114.4, SH 43°, (table 1). After CG moves gradually from the supporting foot edge to the center horizontally, CG remains on the foot straight upon one third of midline when keeping balance, therefore, prolonged balance could be maintained.
2. Table 2 shows that time elapsed was 1.32s for completion of qiansaotui action. CG is always maintained by position of a supporting foot slightly apart while the action being done. In other words, CG is in the centripetal direction. The knee of supporting leg and anklebone continues to bend deeply in the 1st and 3rd half circles and then extends in the 2nd and 4th half circles. These actions form a centripetal torque of rotation as well as showing the characters of half circle accelerating and peg-top movement of the knee.
3. Table 3 shows that the actions demonstrate the characteristics of the up body screw-down and open-up that could be helpful to the production of rotational torque.

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