

太极拳“升降桩”对肩胸夹角的运动学特征分析

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摘要：目的：太极拳是中华武术的精髓，是以人体生命的整体观以及人与社会、环境的和谐统一，集导引、呼吸吐纳、拳技于一体而建立和发展起来的一项绵缓健身运动。众所周知“无极桩”是太极拳里面最基础的基本功练习方法，它是采用静站的姿态，使人体在松静自然的状态下，注重内向性地运用意识，通过调身、调息和调心等方式，达到端正身体姿态，协调身心关系的一种静功的练习方法。而在太极拳功法运动中也有动功的练习方法“升降桩”，它是建立在“无极桩”的基础上，按照太极拳升、降、开、合、出、入的基本规律所进行的各种综合性练习，它能够培养练习者在运动过程中“意”、“气”、“形”的整体运动能力，掌握弧形运动的基本规律和技巧，通畅任督二脉和调节“十二经”气血，然而许多练习者在练习过程中，由于意识不够，动作不明确，动作幅度过大或过小，导致动作不够规范，锻炼效果不是很理想。本文通过实验法，统计数据，分析组别间和练习前后肩胸夹角的数据差异，并结合太极拳项目动作特点和基本规律，研究受试者系统训练后在“升降桩”演练过程中肩胸夹角的运动学特征。为练习者在练习过程中找到自己的不足以及对其进行改善与纠正提供一定的参考，力求为练习者练好太极拳提供一定的科学理论指导依据，同时也为太极拳桩功的推广贡献一点力量。**方法：**本文运用 Motion Analysis Raptor-4 红外高速运动捕捉系统，测试三名太极拳专业运动员和三名普通练习者。第一次实验在北京体育大学实验室内进行测试，收集受试者的相关信息，让受试者观看徐伟军教授的网络视频，按照要求自由练习 15 分钟，然后开始对“升降桩”整套动作进行测试，要求受试者在录好的节奏下连续不间断的进行三次完整动作演练。之后给受试者讲解“升降桩”的动作规格要求并给予徐伟军教授的网络视频，要求受试者在教练及其本人的监督下按照动作要求进行为期四周的系统练习。四周结束后在同样的地点对受试者进行实验测试，首先对受试者的三个定式动作进行测试，这三个动作也是“升降桩”中的动作，分别是“升降桩”的预备式、两手与胸同高、全蹲，然后让受试者走出测试场地休息一分钟调整状态再进行“升降桩”整套动作的测试，要求受试者在录好的节奏下连续不间断的进行三次完整动作演练。之后统计数据，分析组别间和练习前后肩胸夹角的数据差异，并结合太极拳项目动作特点和基本规律，研究受试者系统训练后在“升降桩”演练过程

中肩胸夹角的运动学特征。**结果：**（1）升降桩特征画面的划分：根据“升降桩”的运动特点主要体现在“升降”两字，所以将其特征画面划分为五个时相：预备式（无极桩）、臂升期（手与胸平）、臂降期（无极桩）、腿降臂升期（全蹲）、腿升臂降期（无极桩）。臂升期是在两腿基本保持不动的情况下，两手臂由腹前缓缓向上、向外分举至与胸同高并且两手臂保持环状、两腋下保持虚空的运动过程；臂降期是两腿基本保持不动的情况下，两手臂徐徐向下，向内合于腹前并且两手臂保持环状、两腋下保持虚空的运动过程；腿降臂升期是双腿屈膝慢慢全蹲，同时两手臂缓缓分开并保持环状、两腋下保持虚空的运动过程；腿升臂降期是双腿蹲地慢慢站起，同时两手臂缓缓合于腹前并保持环状、两腋下保持虚空的运动过程。（2）定式状态下肩胸夹角的数据统计及特征：六名受试者的肩胸夹角最大值是 165.92° ，最小值是 111.05° ，都没有超过 180° 。（3）“升降桩”特征画面肩胸夹角方差分析结果：不同水平练习者在练习前关节角度存在边缘显著性差异， $F=91.885$ ， $P=0.078$ ；在练习后无显著性差异， $F=0.635$ ， $P=0.722$ 。这种差异性的形成无非是运动学各指标的差异所导致，所以进一步进行了重复测量方差分析。经过重复测量方差分析前后测结果表明受试者在练习前后肩胸夹角存在显著性差异， $F=26.414$ 、 $P=0.007$ 。从交互作用来看，肩胸夹角的 $F=46.323$ 、 $P=0.002$ 。（4）肩胸夹角运动轨迹的分析结果：受试者的肩胸夹角运动轨迹都有着一定的规律性，出现了两次波峰，肩胸夹角有个很明显的由小到大，再到小，再到大，最后变小的过程，还可以看到峰值的最大值都没有达到 180° 。并且很明显的看到吕同学的肩胸夹角曲线在出现波峰时有十分清晰的倒“山”字型，第一次出现倒“山”字型发生在“升降桩”的两臂升期结束（手与胸平）、第二次出现倒“山”字型发生在腿降升期结束（全蹲），并且第二次比第一次的倒“山”字型更为明显。**结论：**

（1）升降桩特征画面划分：根据“升降桩”主要的动作特点“升降”两字将其分为预备式（无极桩）、臂升期（手与胸平）、臂降期（无极桩）、腿降臂升期（全蹲）、腿升臂降期（无极桩）。（2）从定式状态肩胸夹角的特征结果看：六名受试者的肩胸夹角都没有超过 180° ，这验证了太极拳“含胸拔背”的动作特点，而出现了角度值的不一，说明肩胸夹角并不是一直不变的，它遵循两手臂的“开合”以及太极拳呼吸吐纳的特点，两手臂的分开加之吸气的运动使得胸廓扩大，即含胸幅度减小，两手臂的合拢加之呼气的运动使得胸廓缩小，即含胸幅度增加。（3）从方差分析结果来看：不同水平练习者在练习前关节角度存在边缘显著性差异，在练习后无显著性差异；从交互作用来看，普通练习者的直线陡峭，而高水平运动员的直线都比较平缓。说明普通练习者的水平慢慢的向高水平运动员靠近。（4）从肩胸夹角的运动轨迹来看：肩胸夹角的运动轨迹都是有规律的变化，比较区间差值

的大小反映了练习者对关节稳定性的控制能力，吕同学的肩胸夹角出现倒“山”字是“蓄劲”、“呼吸加深”的一种体现。

关键词：太极拳；升降桩；肩胸夹角；运动生物力学

Analysis of kinematics characteristics of "Sheng Jiang Zhuang" in Tai Ji Quan to the Shoulder-Chest Angle

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Abstract: Objective: Tai Ji Quan is the essence of Chinese martial arts. It is a slow fitness sport established and developed by integrating the whole view of human life, the harmony and unity of human, society and environment, and by integrating guidance, breathing and breathing and boxing skills. Known as "Wu Ji Zhuang" is the basis of Tai Ji Quan in the basic skills practice, it is to use static standing posture, make human body in the static nature of the state, pay attention to use consciousness introversion, through adjustable body, such as pranayama and self-aligning way, to achieve correct posture, coordinate the relationship between body and mind of a static work practice. There is also a kind of dynamic exercise method "Sheng Jiang Zhuang" in the exercise of Tai Ji Quan, which is based on the "Wu Ji Zhuang" and carries out a variety of comprehensive exercises according to the basic laws of Tai Ji Quan rising, falling, opening, closing, coming out and entering. It can cultivate the overall exercise ability of "meaning", "Qi", "shape" in the process of movement, Master the basic rules and skills of arc movement, smooth the two channels of supervision and regulate the Qi and blood of the twelve classics. However, many practitioners in the practice process, due to lack of awareness, unclear movements, too large or too small, lead to the lack of standardization of movements, exercise effect is not very ideal. This paper analyzes the difference of shoulder chest angle between groups and before and after the exercise by means of experimental method and statistical data. Combined with the characteristics and basic rules of Tai Ji Quan project, the kinematics characteristics of shoulder chest angle during the process of "Sheng Jiang Zhuang" drill are studied. It provides some reference for practitioners to find their own deficiencies and improve them in the process of practice, and to provide some scientific theoretical guidance for practitioners to practice Tai Ji quan, and also contribute some strength to the promotion of Tai Ji Quan stake skill. **Methods:** In this paper, the Motion Analysis Raptor-4 infrared high-speed Motion capture system was used to test three professional athletes and three ordinary practitioners of Tai Ji Quan. First experiment in Beijing sport university were tested in the laboratory, collect information of the subjects, subjects were asked to watch an online video of Professor Xu Weijun, 15 minutes free practice in accordance with the requirements, and then start testing "Sheng Jiang Zhuang" a complete set of movements, participants were asked in recorded

pace nonstop for three consecutive complete movement exercises. After that, the subjects were explained the action specifications of "Sheng Jiang Zhuang" and given a online video of Professor Xu Weijun. The subjects were required to conduct systematic exercises according to the action requirements for four weeks under the supervision of the coach and myself. Around the end of the experiments conducted on the subjects in the same spot test. The subjects were first tested on three routine movements in the "Sheng Jiang Zhuang", respectively is the "Sheng Jiang Zhuang" the preparation of type, hands with chest high, full squat down, and then let the participants out of the test sites take a minute to adjust status to "Sheng Jiang Zhuang" action of a complete set of tests, subjects were asked to perform three complete motion drills in a recorded rhythm without interruption. After statistics and analysis of group differences and Shoulder-Chest Angle data before and after the practice, and combining with the characteristics of Tai Ji Quan project movement and the basic rule, the kinematics characteristics of Shoulder-Chest Angle during "Sheng Jiang Zhuang" exercise after systematic training were studied. **Results:** (1) Picture division of "Sheng Jiang Zhuang" features: according to the main action characteristics of "Sheng Jiang Zhuang", it can be divided into preparation type (Wu Ji Zhuang), arm lifting stage (hand and chest level), arm dropping stage (Wu Ji Zhuang), leg dropping and arm lifting stage (full squatting), leg lifting and arm dropping stage (Wu Ji Zhuang). The arm lifting period is a movement process in which the legs are basically immobile, the arms are lifted up and out from the abdomen to the same height as the chest, and the arms keep ring and the armpit keep empty; The descending period of arms is the movement process of keeping the legs still, the two arms slowly downward, inward in front of the abdomen, and the two arms keep ring and the armpit keep empty; The leg lowering arm rising period is the movement process of legs bending knee slowly and fully squatting, while the two arms are separated slowly and keep ring and empty under the armpit; The leg lift arm descending period is the movement process of legs squatting and slowly standing up, while the two arms slowly close in front of the abdomen and keep the ring and the armpit empty. (2) The statistical data and characteristics of the angle of shoulder chest included in the fixed state: the maximum value of the angle between shoulder and chest in six subjects was 165.92° , the minimum value was 111.05° , and none of them exceeded 180° . (3) The results of variance analysis of Shoulder-Chest Angle in the feature picture of "Sheng Jiang Zhuang" showed that there was significant difference in the joint angle between different levels of practitioners before exercise, $F = 91.885$, $P = 0.078$; There was no significant difference after the exercise, $F = 0.635$, $P = 0.722$. This difference is caused by the difference of kinematic indexes, so the variance analysis of repeated measurement is carried out. The results of repeated variance analysis showed that there was significant difference in Shoulder-Chest Angle between the subjects before and after the exercise, $F = 26.414$, $P = 0.007$. From the perspective of interaction, $F = 46.323$ and $P = 0.002$ of the angle between shoulder and chest were observed. (4) The results of the analysis of the movement track of Shoulder-Chest Angle: the subjects' Shoulder-Chest Angle movement track has certain regularity, and there are two wave peaks. The Shoulder-Chest

Angle has a very obvious process from small to large, then to small, then to large, and finally smaller, the maximum value of peak value can be seen not reaching 180 °. It is obvious that the angle curve of shoulder chest of Lu classmate has a clear inverted "mountain" type when the wave peak appears. The first time the inverted "mountain" type occurs at the end of the two arm lifting period of " Sheng Jiang Zhuang " (hand and chest level), and the second inverted "mountain" type occurs at the end of leg descending and rising period (squatting completely), and the second time is more obvious than the first inverted "mountain" type. **Conclusion:** (1) Picture division of "Sheng Jiang Zhuang" features: according to the main action characteristics of "Sheng Jiang Zhuang", it can be divided into preparation type (Wu Ji Zhuang), arm lifting stage (hand and chest level), arm dropping stage (Wu Ji Zhuang), leg dropping and arm lifting stage (full squatting), leg lifting and aim dropping stage (Wu Ji Zhuang). (2) According to the characteristic results of the fixed state of Shoulder-Chest Angle, the six subjects' Shoulder-Chest Angle was not more than 180 °, which verified the movement characteristics of Tai Ji Quan "including chest pulling back". The angle value was different, indicated Shoulder-Chest Angle was not always unchanged, which followed the characteristics of the "opening and closing" of the two arms and the breathing and breathing of Tai Ji Quan. The separation of the two arms and the inspiratory movement make the thorax expand, that is, the chest range decreases, and the closing of the two arms and the expiratory movement make the thorax narrow, that is, the chest range increases. (3) From the analysis of variance, there was marginal and significant difference in the Shoulder-Chest Angle between different levels of subjects before exercise, but no significant difference after the exercise. In terms of interaction, the straight lines of the average practitioner but the straight lines of the elite athlete are gentle. It shows that the level of ordinary practitioners is slowly approaching to the high level athletes. (4) From the perspective of the trajectory of the Shoulder-Chest Angle: the trajectory of the Shoulder-Chest Angle changes regularly, and the difference between the comparison intervals reflects the exercisers' ability to control the stability of the joint. The appearance of the pour word "mountain" in the Shoulder-Chest Angle of Lv is a reflection of "energy retention" and "breathing deepening".

Key Words: Tai Ji Quan, Sheng Jiang Zhuang, Shoulder-Chest angle, Sports biomechanics