Kinematic Analysis Guizhou Province Outstanding Young Man Weightlifter Clean and Jerk Technique

CHONG JIA and YUN GUO

ABSTRACT

Our advantage is weightlifting athletic sports, Guo Linhong Gui Zhou Province outstanding young man weightlifting athlete, but there is still a gap to his clean and jerk motion technology and national elite athletes. In this paper, three-dimensional video analysis method to obtain kinematic parameters of athletes in motion the process of analyzing the operation of the technical characteristics of the athletes, evaluation and diagnosis of the athlete's movement technology to provide a reference for improving the athlete's movement technology to improve athletic performance.

KEYWORDS

Literature, Experiment, Video analytic method, Data analysis.

INTRODUCTION

Our advantage is weightlifting athletic sports, Guo Linhong Gui Zhou Province outstanding young man weightlifting athlete, but there is still a gap to his clean and jerk motion technology and national elite athletes. In this paper, three-dimensional video analysis method to obtain kinematic parameters of athletes in motion the process of analyzing the operation of the technical characteristics of the athletes, evaluation and diagnosis of the athlete's movement technology to provide a reference for improving the athlete's movement technology to improve athletic performance.

RESEARCH OBJECTS AND METHODS

Research objects

Take Gui Zhou Province’s outstanding young weightlifting athlete Guo Linhong as the object of study, as shown in Table 1.
Research Methods

DOCUMENTARY ANALYSIS

According to the needs of the research, through computer and manual searching, reviewed the books and document literature of the Journal of Physical Education Institute, the excellent master's thesis, sport training, sports biomechanics and sports technology diagnosis. And logged in China HowNet, Guizhou Digital Library and other related sites, access to relevant information.

EXPERIMENTATION

With two SONY HDR-CX440 HD cameras made in japan (frequency is 50 frames per second), filming the whole process (Three-dimensional frame first, shown in Figure 2) of Guo Linhong’s clean and jerk from different angles (Two camera axis angle of 90 degrees, site seats shown in Figure 1) simultaneously.

VIDEO ANALYTIC

Using the Beijing Senmiao Xin's 3-D Star High Titanium 3D analysis system, analyze and process the captured image data (a successful and best jerk). The selected body model is Japanese Matsui Xiuj body model closest to the weightlifter (21 joints, 16 links), analyze twenty-one points on the human body point-to-point, analyze the picture piece by piece, use the low pass digital filtering to smooth the raw data of star picks, reducing the error and obtaining kinematic parameters required by the analysis of snatch technique.

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**Figure 1. Three-dimensional shooting site placement diagram.**

TABLE 1. OBJECT OF STUDY.

<table>
<thead>
<tr>
<th>Name</th>
<th>gender</th>
<th>age</th>
<th>height (cm)</th>
<th>weight (kg)</th>
<th>Sports class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guo Linhong</td>
<td>man</td>
<td>18</td>
<td>175</td>
<td>80</td>
<td>master sportsman</td>
</tr>
</tbody>
</table>
DATA ANALYSIS

After completing video analysis, the parsing system automatically generates the original coordinate data of all the joints of the human body, use the low pass filtering to smooth the raw data of the kinematic parameters obtained, and draw accurate data. Study, analyze, and compare the data obtained, and then obtains the result.

RESULTS AND DISCUSSION

Division phase of Clean and jerk stage

According to the operating characteristics of jerk technology, Jerk action will be divided into five stages, one is the leading stage, two stages is the force, three squat support stages, four is the rise stage, and five is the very stage. The jerk action links up with each other. Although there are many differences in the methods of action, athletes have different characteristics, but they must follow some common technical principles [5]. This article mainly carries on the research and analysis to the four stages of lifting bell, force, squat support and upper support.

Kinematic analysis of jerk stage

ACTION ANALYSIS OF LIFTING BELL STAGE

The first step in jerk is to pose reasonably, so that all parts of the body are in a good position to mention the bell [6]. Owing to the jerk is a continuous action, previous action will have a direct impact on the quality of the last action, the success of jerk action is affected by the posture of the body when the bell is started.

Squat depth in jerk is smaller than that in snatch [6], and the size of the load has a direct effect on preparatory squat depth. As shown in Table 1, Guo Linhong’s knee angle in lifting bell stage is 83.1 °. Huangzhong’s is 79.9 °. Scholars [8] believe that the knee angle of 85 °±7.07 °is suitable. The knee angles of Guo Linhong and Huangzhong in lifting bell stage are both within this range. Preparatory squat depth in jerk is shallower, that is to say the knee angle is a bit bigger, Guo Linhong's knee angle is larger than Huangzhong's in lifting bell stage.

ACTION ANALYSIS OF FORCE STAGE

The force is carried out on the basis of the knee lift, and is to give full play to the maximum strength in a limited time, make the barbell move up to the maximum speed, and rise to a very suitable height, so that lay a solid foundation for the next stage of squat support. Force stage is a key stage in the whole process of the jerk.

<table>
<thead>
<tr>
<th>Name</th>
<th>Knee Angle(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guo Linhong</td>
<td>83.1</td>
</tr>
<tr>
<td>Huangzhong</td>
<td>79.9</td>
</tr>
</tbody>
</table>
TABLE 3. COMPARISON OF RELATED PARAMETERS OF GUO LINHONG AND HUANG ZHONG’S IN FORCE MOMENT.

<table>
<thead>
<tr>
<th>Name</th>
<th>Hip angle(°)</th>
<th>Hip angle(°)</th>
<th>Elbow angle(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guo Linhong</td>
<td>159.4</td>
<td>169.2</td>
<td>148.3</td>
</tr>
<tr>
<td>Huangzhong</td>
<td>176.3</td>
<td>163</td>
<td>144.5</td>
</tr>
</tbody>
</table>

According to table 3, Guo Linhong’s hip angle in force moment during jerk is 159.4 °. Huang Zhong’s is 176.3 °, larger than Guo Linhong’s. There are some differences between them. The knee angle of Guo Linhong is 162.9 °, Huang Zhong’s is 163 °, which is relatively larger, showing that the ground distance is more adequate and the distance to do work has been extended. Guo Linhong’s knee angle is bigger than Huang Zhong's in force moment, which shows Guo Linhong's ground distance is quite adequate. From the perspective of the elbow, Guo Linhong’s elbow angle in force moment during jerk is 148.3 °. Huang Zhong’s is 144.5 °, there are no obvious differences. As can be seen through the video Guo Linhong in the process of force, makes the barbell close to the body upward, whose movements are very neat.

ACTION ANALYSIS OF CLEAN AND JERK STAGE

The clean and jerk stage is the final exertion stage in the whole jerk, whether the result of jerk is effective or not is affected by the jerk technology.

According to table 4, In the process of split jerk, Guo Linhong’s right leg (foreleg stride) knee angle is 129.6 °, Huang Zhong is 133.3 °. Guo Linhong’s knee angle is smaller. Guo Linhong right hip angle is 133.7 °, Huang Zhong is 166.5 °. Guo Linhong's right hip angle is very different from Huang Zhong's. The right hip angle of Guo Linhong is smaller. Guo Linhong’s left leg (stride hind leg) knee angle on the very stage is 160.1 °, hip angle is 157.0 °. Huang Zhong’s left leg knee angle on the very stage is 142.7 °, hip angle is 143.8 °. It can be seen from the data, in the clean and jerk moment, Guo Linhong's leg squats stride is too high, the hind leg extension is too short, so that the barbell can’t be firmly supported easily, which is not conducive to the next stride legs. It will often fail in the process of jerk, whether it is successful or not is affected by many aspects. The angle of the back support of the knee joint is too large, and the touchdown area of the front support foot is too small. Which all can lead to failures. Guo Linhong’s foreleg stride knee angle is bigger than that of Huang Zhong, during upper stage Guo Linhong lean slightly forward. According to the kinematics principle, in the whole process of technical acts in clean and jerk, body bending at knees and hips too much are not conducive to the force split the feet and legs strideto complete.

TABLE 4. COMPARISON OF RELATIVE PARAMETERS BETWEEN GUO LINHONG AND HUANG ZHONG IN CLEAN AND JERK.

<table>
<thead>
<tr>
<th>Name</th>
<th>Joint angle in upper stage(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guo Linhong</td>
<td>left hip angle</td>
</tr>
<tr>
<td>Name</td>
<td>157.0</td>
</tr>
<tr>
<td>Guo Linhong</td>
<td>left hip angle</td>
</tr>
<tr>
<td></td>
<td>143.8</td>
</tr>
</tbody>
</table>
CONCLUSION

(1) In lifting bell stage Guo Linhong’s knee angle is 83.1 °. Scholars believe that the knee angle of 85 ° ± 7.07 ° is suitable Guo Linhong in bell stage knee angle is within this range, a more appropriate action. The starting position is relatively reasonable. By the video it can be seen Guo Linhong’s total swing is smaller in lifting bell stage.

(2) During force moment in jerk, Guo Linhong’s hip angle is 159.4 °. Hip angle is small, the force to lift the bell is unfavorable, easily leading to a failure of jerk movement. In force moment Guo Linhong’s knee angle reaches a relatively good state, knee angle of 162.9 ° is more appropriate, elbow angle of 148.3 ° is a little big, which is not conducive to the next phase of the squat. Force support is completed. As can be seen from the data and video Guo Linhong in the process of force, makes the barbell close to the body upward, whose movements are very neat.

(3) In clean and jerk Guo Linhong’s left hip angle is 157.0 °, the knee angle is 160.1 °. On this stage Guo Linhong’s left hip and knee angles are larger. Guo Linhong’s right hip angle is 133.7 °, knee angle is 129.6 °, right hip and knee angles are relatively small. The body is slightly forward, not very good to stretch waist and straighten the hip, so that waist and leg strength power has not been put to good use, reducing the driving force of jerk. Guo Linhong’s left angle is larger, and the rear leg is much too straight. The knee and hip angle of the right leg are smaller, so is the split jerk. It is not conducive to support barbell firmly and hold back the leg.

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REFERENCES