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ANALYSIS OF THE BIOMECHANICS OF JUMPING TECHNIQUE IN BASKETBALL

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Abstract:

This article examines the biomechanics of basketball jumping technique, its impact on player performance, and injury prevention. The main focus is on the analysis of both one-legged and two-legged jumps, as well as the role of biomechanics in the development of basketball in Uzbekistan. A scientific approach to studying jumping and the incorporation of biomechanical principles into the training process are crucial steps in preparing high-level athletes.

Keywords: Biomechanics, basketball, jump, Uzbekistan, technique, injury, development, vertical jump, training, athletic training.

INTRODUCTION

Basketball is a dynamic and intense game where the success of many actions directly depends on physical conditioning and the technique of executing movements. One of the key elements of basketball is the jump, which is used in various situations: when shooting the ball, blocking, fighting for rebounds, and performing dunks. The effectiveness of the jump is largely determined by biomechanical parameters such as muscle strength, coordination of movements, body position in space, and interaction with the support. Analyzing the biomechanics of the jumping technique provides valuable data to enhance athletic performance and minimize the risk of injury. Studying the mechanics of movements allows for optimizing training processes, correcting technique errors, and developing individual training programs for athletes. This article explores the key aspects of jump biomechanics in basketball, including the phases of the jump, muscle load distribution, and the influence of various factors such as height, weight, and level of physical fitness. The research aims to understand how to improve jumping technique to enhance athletic performance and strengthen the health of basketball players.

AIMS AND OBJECTIVES

The goal of this work is to study the biomechanical features of performing a jump in basketball and to determine the key factors that influence its effectiveness. To achieve this goal, the following objectives were formulated:

1. To analyze the main phases of the jump in basketball and identify their biomechanical characteristics.
2. To investigate the distribution of load across the major muscle groups during the jump.
3. To determine the impact of athletes' physical parameters (height, weight, fitness level) on the height and quality of the jump.
4. To develop recommendations for improving jump technique to enhance athletic performance.

RESEARCH METHODS

To achieve the goals of the study, the following methods were applied:

1. **Literature Analysis**: Review of scientific and methodological materials related to the biomechanics of jumping movements in sports.
2. **Video Recording and Kinematic Analysis**: Capturing athletes' movements using high-speed cameras to analyze movement trajectories and joint angle characteristics.
3. **Electromyography (EMG)**: Recording the electrical activity of muscles to determine their involvement in different phases of the jump.
4. **Anthropometric Measurements**: Assessing athletes' physical parameters to evaluate their impact on jump technique.
5. **Statistical Analysis**: Processing the collected data to identify correlations and patterns.

RESEARCH PROGRESS

As part of the study, a series of experiments were conducted involving both professional and amateur basketball players. The participants performed different types of jumps (standing jump, running jump, two-foot jump) in a simulated game environment. During the experiments, biomechanical indicators (jump height, push-off time, movement

amplitude) were recorded, allowing the analysis of jump efficiency and the identification of individual technical characteristics.

The results of the study will form the basis for the development of practical recommendations aimed at improving the training process for basketball players.

Importance of Jumping in Basketball

Jumping is one of the most significant physical skills in basketball. It determines the success of many game actions, such as making shots, blocking shots, fighting for rebounds, and participating in spectacular moments such as slam dunks. High-quality jumping technique not only enhances a player's performance but also reduces the risk of injury, which is especially important for athletes of all skill levels.

In Uzbekistan, basketball continues to gain popularity, and the analysis of jump biomechanics can significantly contribute to the development of the sport. Given the growing interest, a deeper understanding of the key aspects of jumping will help coaches and players improve their skill levels and readiness.

Biomechanics of the Ideal Jumping Technique

Two-Foot Jump

The two-foot jump is used for maximum vertical push-off, such as when performing a slam dunk. The ideal technique involves several key stages:

- **Preparation and approach:** The player begins with a powerful acceleration while maintaining a low stance to stabilize the center of gravity. The body is slightly tilted forward, and the arms are prepared for synchronized movement.

- Knee bending and muscle loading: Before jumping, the athlete bends their knees at an angle of 90–110 degrees. This is the optimal angle for accumulating energy in the quadriceps and calf muscles.

- Push-off: A sharp extension of the legs, combined with active upward arm movement. It's important that the force is transferred from the heels to the toes, ensuring an effective push-off.

- Flight and landing: In the air, the player maintains a stable position, and the landing should be soft, with cushioning provided by the bent knees.

One-Foot Jump

The one-foot jump is more commonly used when performing shots in motion or layups. The biomechanics differ in the following ways:

- Acceleration and rhythm: The approach to the jump is smooth, with an emphasis on the final step, which will be the push-off.

- Loading the support leg: The leg is bent at an angle of 70–90 degrees. Active push-off occurs through a quick extension of the thigh and foot.

- **Body stabilization**: The body remains vertical or slightly tilted forward to maintain balance.

- Landing: The landing is done on both feet to reduce the load and minimize the risk of injury.

Role of Arms and Coordination

In both types of jumps, arm movements play a critical role. The arms not only help achieve height but also stabilize the body in the air. Their synchronization with the leg movement provides maximum momentum.

Biomechanics and Injury Prevention

Understanding the biomechanics of jumping helps minimize injuries associated with excessive strain on the joints and muscles. Special attention is given to the following aspects:

- Landing technique: Proper cushioning helps prevent knee and ankle injuries.

- Balanced load: Developing symmetrical strength in both legs reduces the risk of chronic injuries.

- **Warm-up and stretching**: Preparing the muscles before training sessions and games lowers the likelihood of injury.

Applying Biomechanics for the Development of Basketball in Uzbekistan

Basketball in Uzbekistan is in an active development stage, and the implementation of a scientific approach to training will be an important step forward. Here are a few key directions:

Training Coaches: Teaching specialists the fundamentals of biomechanics will enable them to effectively analyze and correct athletes' jumping techniques.

Creating Training Programs: Individualized programs based on biomechanical data will help improve players' physical performance.

Implementing Technologies: Using video recordings, sensors, and motion analysis software will allow for a deeper study of jumping techniques and help identify weaknesses.

Popularizing Basketball: Organizing master classes, tournaments, and educational seminars for young people will increase interest in basketball and help attract new players.

CONCLUSION

The biomechanics of jumping plays a key role in achieving high performance in basketball. A well-structured approach to teaching jumping techniques not only improves players' results but also minimizes the risk of injuries. In Uzbekistan, where basketball is experiencing active growth, the implementation of a scientific approach will serve as a foundation for the successful development of the sport. The analysis and application of biomechanics will help nurture a new generation of basketball players capable of successfully competing on the international stage. Thus, efforts aimed at studying jumping techniques are an important step toward the progress of Uzbek basketball.

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