

AN EXAMINATION OF THE BIOMECHANICAL FACTORS THAT PRODUCE SPIN ON A VOLLEYBALL IN THE SKILL OF SPIKING

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INTRODUCTION: Spiking is the most important attacking skill in the sport of volleyball and its effectiveness is in large part determined by the amount of topspin it has after leaving the attacker's hand. A spinning volleyball, because of the lift forces produced by the Magnus effect, has the advantage of being able to be hit with greater velocity, higher above the net, and at flatter angles over the net than balls with little or no spin while still landing in the court on the opposite side. For spin to be produced on the volleyball a torque must be applied by some external force not acting through the axis of rotation found at its center of mass. The technique that produces this in a volleyball spike seems to be agreed upon in the instructional literature (Howard, 1996; Scates, 1993). It is described as being produced by the heel or palm of the hand contacting first and then the fingers wrapping over top. However, very little research done on spiking has examined the hand contact with the ball (Alexander and Seaborn, 1980; Maxwell, 1982) and none has examined the actual torque production mechanism. Therefore, it was the purpose of this study to determine the biomechanical factors that produce the spin on a volleyball during the spiking action.

METHOD: Participants for the study were 7 men and 11 women's members of a university volleyball team with many years of training and experience. The subjects first warmed up and then performed 5 standing spikes each of a volleyball that they themselves tossed into the air. High-speed video of the subjects was collected using standard two-dimensional videography methods using a high-speed digital video camera operating at 500 Hz. The camera was positioned to allow a close sagittal view of the forearm and hand of each subject and the ball as it was struck. The video record of each of the 90 spikes was analyzed with the APASTM motion analysis system using a 3-segment spatial model to represent the arm and hand. Spatial data smoothed with a second-order Butterworth digital filter was then used in the kinematic analysis of hand segments and the ball. Descriptive statistics were used to present the kinematic data.

RESULTS: The study reveals that two different hand contacts produce spin on the volleyball by a spiker's hand. The first technique, agrees with the literature, showing that the spin is produced by the palm of the hand first contacting the middle of the ball followed by a wrapping action of the fingers over top creating the torque. A second technique, not previously reported, was also seen in which the fingers of the hand contact first at a point high on the ball to create torque. This was then followed by the palm of the hand striking the middle of the ball. Of the 90 trials, 47 were classified as palm first contact and 43 were finger first contact. The palm first contact technique produced a mean ball angular velocity of 39.02 rad/s that was not significantly different from the finger first technique that produced a mean ball angular velocity of 41.42rad/s.

CONCLUSION: The results indicate that experienced volleyball players use two different but equally effective techniques of hand contact to produce spin in a spiked volleyball.

REFERENCES:

- Alexander, M.J., & Seaborn, S.J. (1980). A kinesiological analysis of the spike in volleyball. *Volleyball Technical Journal*, 5(3), 65-69.
- Howard, R.E. (1996). An understanding of the fundamental techniques of volleyball. Allyn & Bacon.
- Maxwell, T. (1982). A cinematographic analysis of the volleyball spike of selected top-calibre female athletes. *Volleyball Technical Journal*, 7(1), 43-54.
- Scates, A.E. (1993). *Winning Volleyball*. Fourth Edition. Wm. C. Brown Communications, Inc.