

BIOMECHANICAL EVALUATION OF OVERHEAD THROWING IN ABLE-BODIED AND WHEELCHAIR LACROSSE PLAYERS

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ABSTRACT

Previous research in the sport of lacrosse has focused on the epidemiology of injury and throwing mechanics in able-bodied athletes. Due to increasing national participation, it is imperative to investigate the biomechanics of throwing in wheelchair lacrosse players, whom may already be at an increased risk of overuse injury to the upper extremity. The purpose of this study was to evaluate differences in thoracohumeral kinematics during overhead throwing in wheelchair lacrosse players and able-bodied lacrosse players while standing and sitting in a wheelchair. Wheelchair Lacrosse USA aims to develop official rules to maximize player safety and decrease injuries in athletes, and we seek to contribute to these rules from a musculoskeletal perspective. Three able-bodied and five wheelchair lacrosse players with spinal cord injury participated. Participants were affixed with retro-reflective markers for biomechanical analysis using a 15-camera Vicon motion capture system and performed three overhead throws with a lacrosse stick and ball into a goal. Mean values for maximum and minimum dominant thoracohumeral joint angles, as well as range of motion, were determined three dimensionally. To the authors' knowledge, this was the first study to quantify thoracohumeral joint kinematics in able-bodied and wheelchair lacrosse players. Significant differences in thoracohumeral joint angles and range of motion were demonstrated in each plane of motion. Findings suggest wheelchair lacrosse players have significantly decreased range of motion when throwing overhead as compared to able-bodied players. Decreased range of motion is highly correlated with greater instances of pain; therefore, wheelchair lacrosse players with spinal cord injury may likely be at an increased risk of shoulder pain and potential for chronic injury. Additional research is underway investigating muscle activation patterns and joint kinetics to better understand internal mechanisms utilized in wheelchair lacrosse throwing.

Keywords: Biomechanics, Wheelchair, Lacrosse, Spinal Cord Injury, Rehabilitation, Range of Motion, Adaptive Sports

INTRODUCTION

Lacrosse is one of the most rapidly growing team sports in North America, as national participation in lacrosse has increased from 253,931 players in 2001 to 826,983 players in 2017 [1]. The increase in national participation has likely led to the noted increase in sport-related injuries occurring at the knee (20.3%) [2, 3], ankle (18.5%) [2, 3], shoulder (12.4%) [4], and elbow/forearm (7.6%) [5]. Previous work has found that approximately 49.4% of injuries occur in contact scenarios (i.e., external contact with another player or lacrosse stick), and 38% of injuries occur in non-contact scenarios (i.e., throwing/shooting, overuse, twisting, and changing directions) [6]. In able-bodied lacrosse, the most common sites of injury are the lower extremities, which are responsible for player movement during competition. Conversely, in wheelchair lacrosse, the most common sites for injury are likely the upper extremities, as they are the primary structures involved in player movement during competition. While research seeks to better understand the mechanisms of injury in able-bodied lacrosse, additional research must also be conducted to observe potential mechanisms of injury in wheelchair lacrosse as the sport continues to grow and gain popularity.

Wheelchair sports were developed as a means for soldiers to enjoy exercise and comradery following life-changing injuries sustained in World War II and have grown exponentially since the middle of the 20th Century [7, 8]. While the physical and mental health benefits of participating in adaptive sports