

## INTRODUCTION & PURPOSE

Wheelchair basketball (WCB) is one of the most popular Paralympic sports. Shooting is the most common method to score in WCB matches. Shooting kinematic analysis is a common tool for coaches to improve in-game shooting performance for able-bodied basketball (1).

However, limited data exist regarding shooting kinematic characteristics within the WCB population. On average, approximately two-thirds of all field goals taken in a game were jump shots, making kinematic analysis of shooting within the population essential for performance assessments (2). **The purpose of the present investigation is to assess shooting kinematic differences in WCB athletes between successful and unsuccessful shots.**

## METHODS & MATERIALS

Seven male athletes ( $\bar{x} \pm SD$ ; age=33.6 $\pm$ 8.1 years; sitting height=74.8 $\pm$ 7.2 cm; body mass=81.6 $\pm$ 14.1 kg). Following a standardized dynamic warm-up, 10 two-point shots (5.10 m) while facing directly to the basket. A video camera recording at 60 frames per second (fps) is positioned 10 meters away, perpendicular to the subject's plane of motion, to record the shooting motion from a sagittal point of view. A video analysis software (Kinovea) was used to analyze two-dimensional kinematic parameter metrics, as shown in Figure 1 and Table 1. Median and interquartile ranges were reported because the data violated the assumption of normality. Mann-Whitney U-tests ( $p < 0.05$ ) were used to examine the differences for each subject. Hedges'  $g$  was used for effect sizes.

Coaches working with wheelchair basketball athletes should consider utilizing video analysis software to supplement on-court coaching of shooting accuracy and consistency.

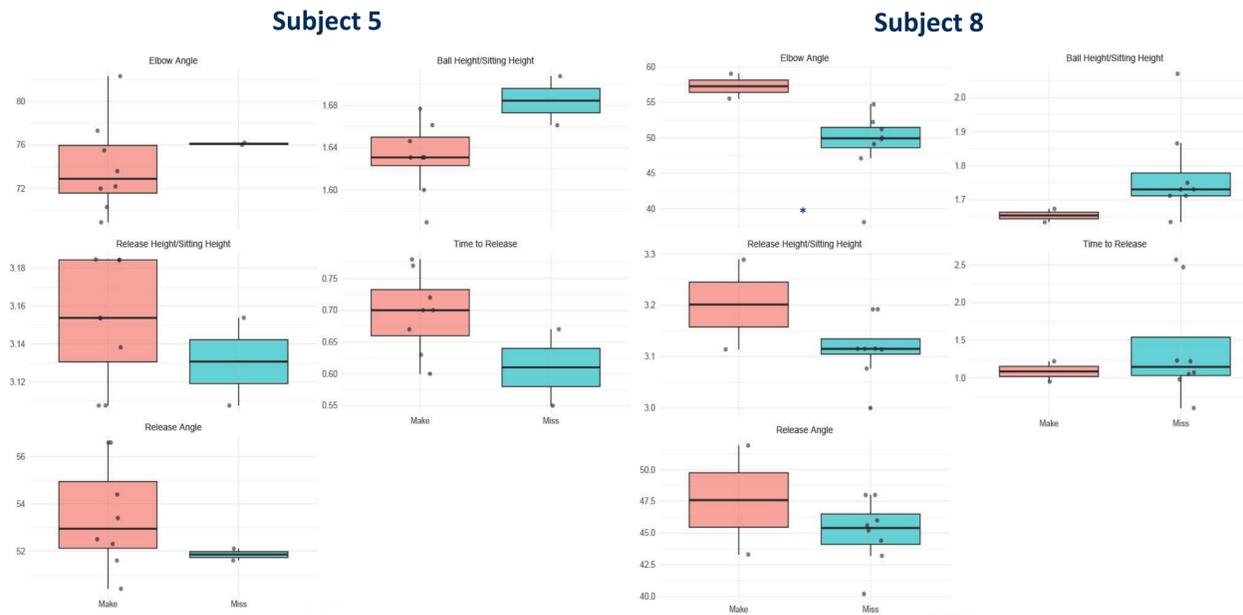


Figure 1. Boxplots for shot outcome comparisons of selected shooting kinematics in Subjects 5 and 8. \* denotes significant differences compared to missed shots ( $p < 0.05$ ).

Metric	Subject 5				Subject 8			
	Make	Miss	$p$	$g$	Make	Miss	$p$	$g$
Elbow Angle (deg)	72.9 (4.38)	76.1 (0.1)	0.40	-0.47	57.25 (1.75)*	49.9 (2.85)	0.04	1.58
Ball Height/Sitting Height (ratio)	1.63 (0.03)	1.68 (0.02)	0.11	-1.44	1.65 (0.02)	1.73 (0.07)	0.09	-0.87
Release Height/Sitting Height (ratio)	3.15 (0.05)	3.13 (0.02)	0.60	0.59	3.2 (0.09)	3.12 (0.03)	0.60	1.08
Time to Release (sec)	0.7 (0.07)	0.61 (0.06)	0.19	1.19	1.08 (0.13)	1.14 (0.51)	0.60	-0.42
Release Angle (deg)	52.95 (2.83)	51.85 (0.25)	0.29	0.69	47.6 (4.3)	45.4 (2.4)	0.69	0.71

Table 1. Median comparisons of key shooting mechanics by shot outcome for Subjects 5 and 8. \* denotes significant differences compared to missed shots ( $p < 0.05$ ).

## RESULTS

Except for the elbow angle for subject 8 ( $p = 0.04$ ), all two-dimensional kinematic parameters analyzed did not show significant differences ( $p = 0.089 - 1.00$ ) between made and missed shots.

## CONCLUSIONS

Based on the observations of this investigation, successful two-point shot attempts showed no difference in elbow angle, relative release height, release angle, release time, and relative initial ball height compared to unsuccessful ones. Successful field goal attempts in WCB may rely on upper-body and trunk joint kinetics in addition to upper-body joint kinematics analyzed in the present study.

## PRACTICAL APPLICATIONS

While our data did not successfully distinguish make shots and miss shots through two-dimensional kinematic parameters in WCB, using video analysis software, kinematic analyses can still provide detailed information regarding shooting motion characteristics in WCB athletes (3). Proper prescription of upper body exercises such as bench pulls by sports performance professionals may assist WCB athletes in shooting performance, as well as other key on court performance indicators.

## ACKNOWLEDGEMENT

This project was funded by the Clara Wu and Joseph Tsai Foundation.

## References

- Malone LA, Gervais PL, and Steadward RD. Shooting mechanics related to player classification and free throw success in wheelchair basketball. J Rehabil Res Dev 39: 701–709, 2002
- Wang YT, Chen S, Limroongreungrat W, and Change LS. Contributions of selected fundamental factors to wheelchair basketball performance. Med Sci Sports Exerc 37: 130–137, 2005.
- de Oliveira Silva HV, de Sa KSG, Gorla JI, Costa ESAA, and Bertoncello D. Analysis of the kinematic pattern of free throw by wheelchair basketball athletes: a systematic review. PLoS One 20: e0317495, 2025.