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	.(1986 Hudson and Hills	45	55	
(2000) Marshal		47		
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		(1982 Owen)		
		(1998) Yella et al		
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$$\begin{aligned}
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 & \times + = : \\
 & \mathbf{V_f = V_i + at} \\
 & \mathbf{d = V_i t + 1/2 at^2} \\
 & \mathbf{V_f^2 = V_i^2 + 2at^2}
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Krieghbaum Barthels and

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2005 -2004

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59					

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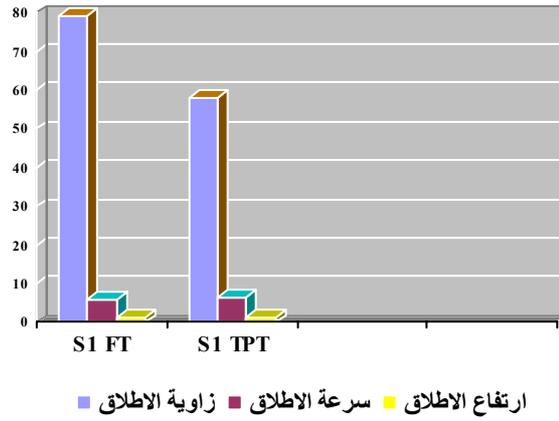
.2

(6.25)

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(6)

() DY	()	v3D(/)	() Vy, Vx	
1.38	1.35	6.03	79	S1 FT Release=0.30
1.44	1.35	6.67	58	S1 TPT Release=0.26



(1)

(1)

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58°

79°

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1981

1993

1.38

/ 6.67

1.44

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1999 Malone et al 59°

1.62 / 7.43

(1.44 / 6.67)
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Saturn,1993

3.4°+

(79)

(1970) Penrose and Blansky

1981

1993

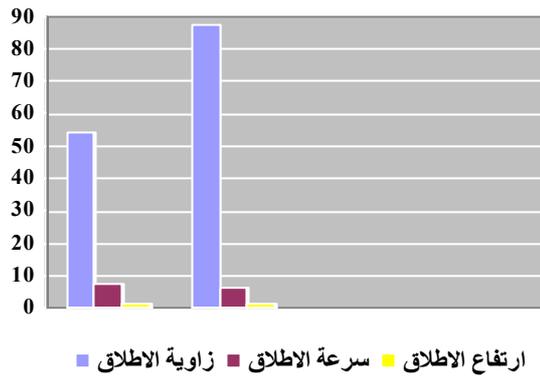
1.38

1981 Brancazio

. 1.44 49°

(7)

() DY	()	v3D(/)	() Vy, Vx	
1.37	1.35	7.47	54	S2 FT Release=0.16
1.35	1.35	6.32	87	S2 TPT Release=0.20



(2)

(2)

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54°

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1981 Brancazio

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1.60

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58°

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54)

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3.4°-+49°

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(1976) Penrose and Blanskby

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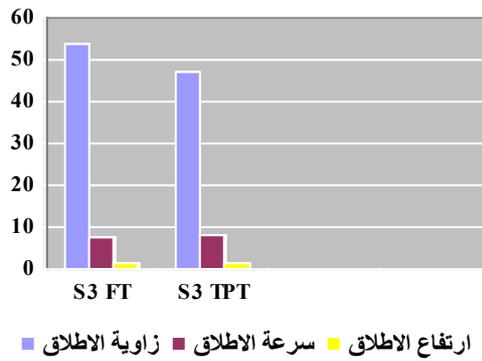
(1.37)

Satern, 1993 (1993)

. 1.35 1.37

(8)

() DY	()	v3D(/)	() Vy, Vx	
1.35	1.27	7.40	54	S3 FT Release=0.52
1.40	1.27	7.9	47	S3 TPT Release=0.28



(3)

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{ 1.79

47°

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	1981 Brancazio	1993 Hay		(9)
(53)	3.4°-+ 49°	1981	42°	53°
			/ 7.85	/ 6.82
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	(1976) Blanskby and Penrose			(1999)
			/ 6.99	55°
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		. 1.68 1.58	} (2004)	
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	.5			{52.94°
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			-7	(42° 53)
	()			(1.68 / 7.85)
				(1.58 / 6.82)
		Satern, 1993 (1993)	-8	
			-9	

- Research and Development*, 39(6): 701-710.
- Miller, S.A., Bartlett, R.M. 1993. The Effect of Increased distance in the Basketball Jump shot, *Journal of Sport Science*, 11,285-293.
- Marshall, R.N. 2000. Application to throwing of recent research on proximal -to-distal sequencing. In: Y.Hong and D.P. Jones (Eds.) *Proceedings of XVIII International Symposium on Biomechanics in Sports*. Hong Kong: Chinese University Press.
- Miller, S. and Bartlett, R. 1996. The Relationship between Basketball Shooting Kinematics, Distance and Playing position, *Journal of Sport Medicine*, 243-253.
- Penrose, T. and Blanksby, B. 1970. Film Analysis: Two Methods of Basketball Jump Shooting Techniques by Two Groups of Different Ability Levels, *Australian Journal HPER*, 14-23.
- Owen, E. 1982. *Playing and Coaching Wheelchair Basketball*, Urbana (IL): University of Illinois Press.
- Sakurai, S. 2005. Biomechanic and Adapted Physical Activity, Japan, *Proceedings of XXIII International SYMPOSIUM of Biomechanics in Sports*, 1, Beijing, China.
- Saturn, M.N. 1993. Kinematic Parameters of Basketball Jump Shot Projected from Varying Distances, *Proceedings of the XI SYMPOSIUM IBSI*, University of Massachusetts, University Campus center Printings.
- Schwark, Brayan, N., Makinzy, Sa Shong, Springings, and Erick, G. 2004. Optimizing the Release Conditions for free Throw in Wheelchair Basketball, *Journal of Applied Biomechanics*, 20(2): 153, and 14.
- Schmidt, R.A., and Lee, T. 1999. *Motor Control and Learning*, Champaign, IL: Human Kinetics Publisher, Illinois.
- Tsarouchas, E. 1985. Optimizing of the Kinematic Chain in Human Movements As it relates to Training, *Proceedings of ISBS Biomechanics in Sports*, 11 Research center for sport academic publishers, Del Mar California USA.
- Walters, M., Hudson, J., and Bird, M. 1990. Kinematic Adjustment in Basketball Shooting at three Distances, *Proceedings of the VIII Symposium ISBS*. P219- 223, Prague, Czechoslovakia: Conex Company.
- Yilla, A. B., LaBar, R. H., and Dangel, M. 1998. Setting up a wheelchair for basketball, *Sports, N Spokes*, 3, 63- 65.
- Courbariaus. 2002. Typical Shooting Functions by IWBF Classification.
- Goosey, T.V., Butterworth, D. and Morriss, C. 2002. Free Throw Shooting Technique of Male Wheelchair Basketball Players, *Adapted Physical Activity Quarterly*, 19(2): 238, 13 pages.
- Hamilton, G., R. and, Reinshmidt, C. 1997. Optimal trajectory for basketball free throw, *Journal of Sport Science*, 15(5): 149-504.
- Hay, J., G. 1993. *The Biomechanic of Sport Techniques*, fourth edition. Englewood Cliffs (NJ) Prentice-Hall.
- Hudson, J.L. and Hills, L. 1986. Coordination of Segments in Vertical Jump, *Medicine and Science in Sport and Exercise*, 18(2): 242-251.
- Krause, J.V., Mayer, D., Mayer, J. 1999. *Basketball Skill and Drills*, Human Kinetic.
- Krighbaum, E. and Barthels, K. M. 1990. *Biomechanic: A Qualitative Approach for Studying Human Movement*, fourth edition, Nodham Heights, MA: Allyn and Bacon.
- Lanka, J., Konrads, A. and Shalmanov, A. 2005. Evaluation Methodology for Assessing the Effectiveness of Sports Techniques, *Proceedings of XXIII International SYMPOSIUM of Biomechanics in Sports*, 1, Beijing, China.
- Malone, L.A., Gervais, P., L., Baudin, P., J. and Steadward, R., D. 1995. Kinematics of Free Throw Shooting By Class 1.0 Wheelchair Basketball Players, *Proceedings of ISBS Biomechanics in Sports*, X111, Lake Head University, Thunder Bay, Ontario, Canada.
- Malone, L.A. 1999. Relationship between performance characteristics and player classification in Wheelchair Basketball Shooting of Elite Male Players, *Unpublished Doctor of Philosophy Thesis*, University of Alberta, Edmonton, Alberta.
- Malone, L.A., Nielson, A., B. and Steadward, R., D. 2000. Expanding the Dichotomous Outcome in Wheelchair Basketball Shooting of Elite Male Players, *Adapted Physical Activity Quarterly*, 17:37-43.
- Malone, L.A., Pierre, L. and Steadward, R.D. 2002. Shooting mechanics related to player classification and free throw success in wheel chair basketball, *Journal of Rehabilitation*

The Kinematic Analysis of Basketball Clean Shot (Free-Three Point Shots) For Handicapped Basketball Players in Jordan

*Hashem A. Kilani, Norma A. Slim and Maher A. Kilani**

ABSTRACT

The purpose of this study was to investigate basketball shooting free-throw and three-point throw (clean shot), to investigate some kinematics variables for ball at release in shooting performance in free throw and three point throw in wheelchair basketball, and to investigate the relationship between the shooting distance and the kinematic variables for each player from different classification class. The descriptive approach was used in this study. This study sample consisted of the best (4) players from the National team of wheelchair Basketball in Jordan, and were chosen intentionally from the population of (59) players in which representing the four classes in the functional classification system for Wheelchair basketball players. Ariel performance Analysis System (APAS) had been used to analyze one clean shot for each player on both throws in order to answer the questions of this study, 3-D analysis has been done to the data collected from four high speed video cameras, (captured, trimmed, Synchronized then digitized, filtered, transformed by using DLT into 3D and finely having the data of raw position and linear displacement, velocities, and acceleration for all digits and the ball for all joints of the upper arm for the sample of this study in both throws.

The most important conclusion of this study was that each case has its own kinematic uniqueness and should be viewed individually.

It was suggested to utilize the high technology with APAS system to analyze other skills using three dimension analysis in wheelchair basketball such as dribbling or passing in future research and to use these results as criteria for evaluation of other wheelchair basketball in Jordan.

Keywords: The Kinematic Chanres, Handicapped Basketball Players, Clean Shot.

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