

The effect of Knee Pads on Volleyball Athletes

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INTRODUCTION

Knee pads are worn by volleyball players to prevent injury during impact. This study investigated whether or not knee pads restrict movement whilst playing volleyball, as this is debated by players and coaches but has never been assessed.

AIMS & OBJECTIVES

The aim was to assess the effect of two commonly used styles of volleyball knee pads. Objectives were:

- Discover if knee pads reduce pressure on the knee upon striking the floor
- Assess the effect on kinematics whilst wearing knee pads in order to determine which player positions will benefit from knee pad use
- Identify different characteristics of the Rucanor® and McDavid™ knee pads (Figure 1).

METHODS & MATERIALS

Experienced volleyball players were assessed. Lower body labelling and Vicon® motion analysis software were used to collect data. Participants were asked to run, squat and perform an outside attack hit (Figure 2) whilst wearing each pair of knee pads and repeated with bare knees. With pressure sensors (Novel Pedar® in-shoe system) between the knee pad and knee, participants performed a controlled fall to the ground.



Figure 1: Rucanor® (on left) pads are less expensive with a circumscribed area of padding and McDavid™ (on right) pads are more expensive and contain a larger volume of padding.

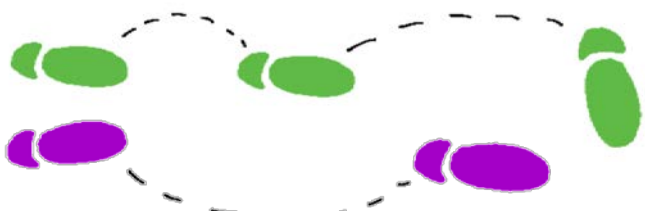


Figure 2: The step sequence for the outside hit approach: left, right-left. 2 feet off jump and land on both feet.

RESULTS

Most changes were seen between bare knees and knee pads. The most important results are displayed.

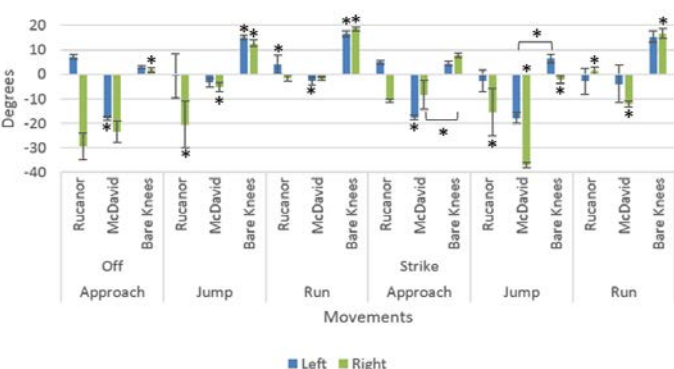


Figure 3: Foot strike and Foot off angles for adduction-abduction of the foot during running and the approach and jump of an outside hit. Left = blue; right = green. $p < 0.05$ displays statistical significance*. If one * is present then that situation is significantly different from the two others, if two situations are connected by a line and * it means they are significantly different from each other and if all three have * then they are all significantly different. Same format for all Figures.

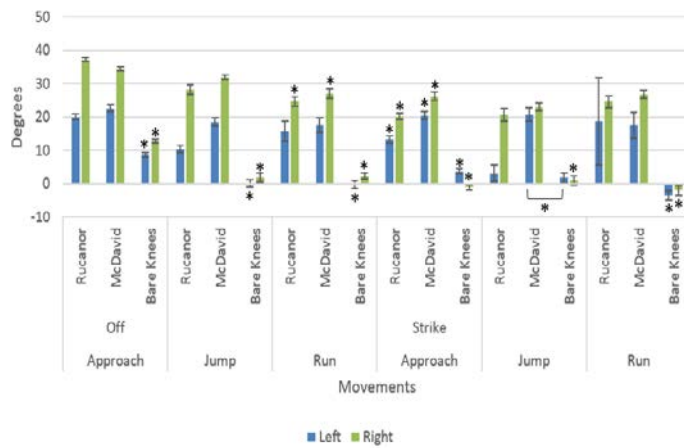


Figure 4: Foot Strike and Foot off angles for internal-external rotation of the hip during running and the approach and jump of an outside hit.

The use of knee pads increases abduction of the foot due to the padding between the legs (Figure 3), which leads to an increase in internal rotation of the hip (Figure 4) as the knee pads compensate for the abduction of the foot. This places athletes in a position of higher risk for non-contact ACL injury (Ireland, 1999).

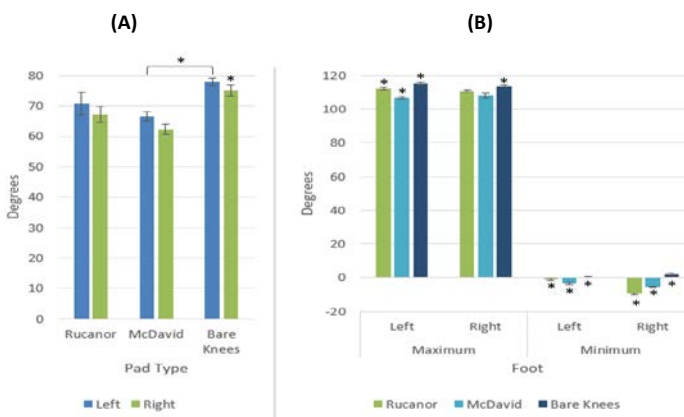


Figure 5 (A): Maximum Flexion Landing Angle - Knee. Blue = left; green = right (B) Flexion-Extension Maximum & Minimum Squat Angles - Knee. Green = Rucanor; light blue = McDavid; dark blue = bare knees.

The use of knee pads reduced flexion at the knee during landing from an outside approach hit (Figure 5A). This has been shown by Bisseling et al. (2007 & 2008) to increase an athlete's risk of developing patellar tendinopathy.

During squatting the angle of flexion at the knee was also reduced (Figure 5B). This reduction was larger for McDavid knee pads. Subsequently there was also a reduction in dorsiflexion of the ankle when McDavid pads were worn (Figure 6). This implies that using knee pads will increase the need to dive for the ball as the athlete cannot flex to a low enough position, thus increasing the frequency of the knee pad use.

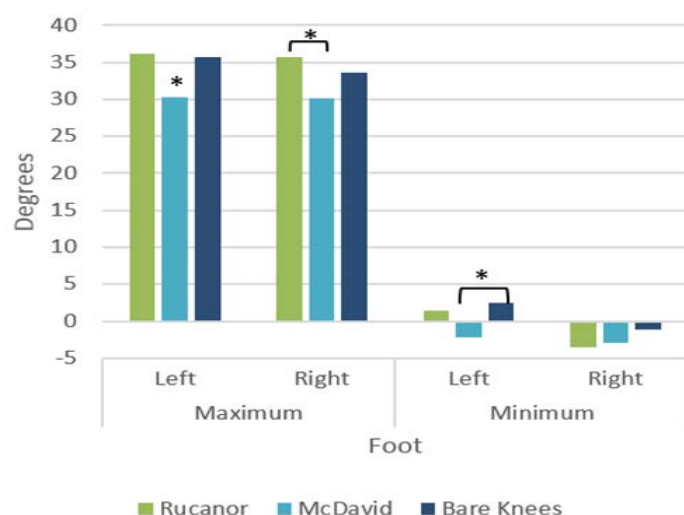


Figure 6: Flexion-Extension Maximum & Minimum Squat Angles - Ankle. Green = Rucanor; light blue = McDavid; dark blue = bare knees.

Inversion of the ankle was increased when knee pads were worn, particularly on the right side (Figure 7). This will increase an athlete's risk of the most common acute volleyball injury, Reeser et al. (2006), an inversion ankle injury.

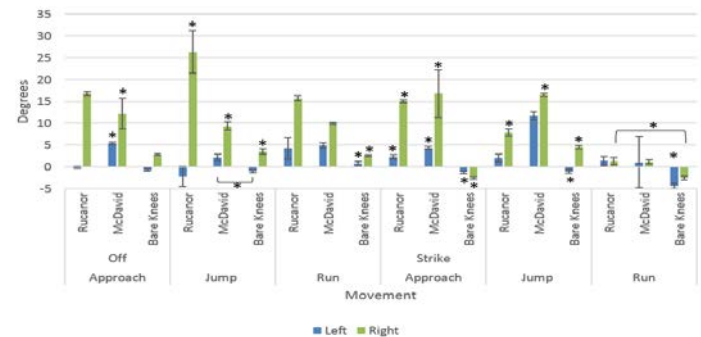


Figure 7: Foot Strike and Foot off angles for inversion-eversion of the ankle during running and the approach and jump of an outside hit.

Pressure analysis showed a lower pressure with the McDavid pads, however, the difference was only significant on the left knee (Table 1).

Measure	Peak Mean Pressure (kPa)	Std. Error	95% Confidence Interval		p value	
			Lower Bound	Upper Bound		
Left Knee	McDavid	353.30	13.57	326.36	380.24	0.001
	Rucanor	397.47	14.86	367.97	426.98	
Right Knee	McDavid	354.16	16.63	321.14	387.18	0.339
	Rucanor	371.67	18.84	334.25	409.09	

Table 1: Peak Mean Pressure Values for left & right wearing McDavid & Rucanor knee pads.

DISCUSSION

The increased risk of patellar tendinopathy is most relevant to high level players who attack the ball and therefore jump frequently and high. These players will also be at a higher risk of crossing under the net at the centre line (a common site of inversion ankle injuries) and therefore will be more at risk for this acute injury also.

The reduction in flexion at the knee and ankle during squatting implies that McDavid knee pads will affect defensive players more than Rucanor pads. However, as the pressure data shows a reduction in pressure on the knee whilst wearing McDavid pads in comparison to the Rucanor pads when falling onto the knees. Further research to map exact pressure distribution is required to make a definitive conclusions.

CONCLUSIONS

If an athlete decides to wear knee pads they should train consistently with them to optimise performance despite hindering their movements. Players who do not defend (mainly middle hitters) will not benefit from the padding provided and experience the detrimental effect of knee pads on movements, and therefore should not wear knee pads.

Further analysis is needed to determine whether athletes who play other netball positions should wear knee pads. A different design of knee that improves cushioning without hindering movements should be assessed.

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