SSC
SPORTS SURGERY CLINIC
Specialists in Joint Replacement, Spinal Surgery, Orthopaedics and Sport Injuries

A 3D Kinematic Analysis of a Simulated Horse Riding Task

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Introduction

The prevalence of injuries in horse racing has been well reported with unseating of the jockey from their mount being the most common incident resulting in injury (1,2,3). While fractures, breaks and concussions are commonplace, soft tissue injuries are by far the most common, of which, knee ligament derangement result in the longest periods off riding with an average of 130 days (2). The percentage of injuries per fall vary from 12.3% - 40.4% across jockey populations of Great Britain and the Republic of Ireland depending on the type of racing be it jump or flat (2). The aim of this work was to analyse the 3D kinematics of a jockey during a simulated horse riding task in order to better understand the movement characteristics involved in the sport. By understanding the ranges of motion involved it could help to inform exercise selection and training plan design for injury prevention and performance enhancement for jockeys.

Methods

A single experienced jockey was asked to simulate riding in their race position using their own saddle set over the top of an elevated platform and asked to simulate riding in their race position (Fig. 1). They performed 3 trials of 10 seconds in their simulated race position. A six camera 3D motion analysis system (Vicon - Bonita B10, UK), was used to collect kinematic and kinetic data. Reflective markers (14mm diameter) were placed at bony landmarks on the lower limbs, pelvis and trunk according to Plug in Gait marker locations: toe, heel, lateral malleolus, shank, knee, thigh, anterior superior iliac spine, posterior superior iliac spine, clavicle, sternum, shoulder, C7 and T10. Variables of interest were hip internal/external rotation, abduction/adduction and flexion/extension, knee flexion/extension and ankle dorsiflexion/plantarflexion ranges.

Results

Joint	Movement	Angles(°)	
Right Hip	Flexion/extension	97.5	85. 8
	Adduction/abduction	-10.5	-16.1
	Internal/external rotation	9.1	4.9
Left Hip	Flexion/extension	90.4	77.8
	Adduction/abduction	-2.5	-8.0
	Internal/external rotation	11.6	6.8
Right Knee	Flexion/extension	85.2	52.3
Left Knee	Flexion/extension	76.7	42.5
Right Ankle	Plantarflexion/dorsiflexion	33.3	5.3
Left Ankle	Plantarflexion/dorsiflexion	48.1	25.6

Table 1: Joint ranges throughout the trials

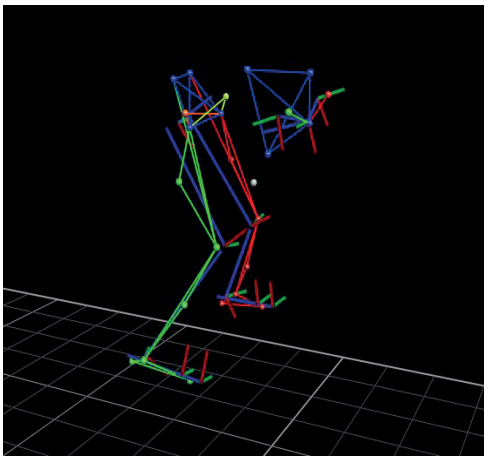

Figure 1: Vicon data of the jockey

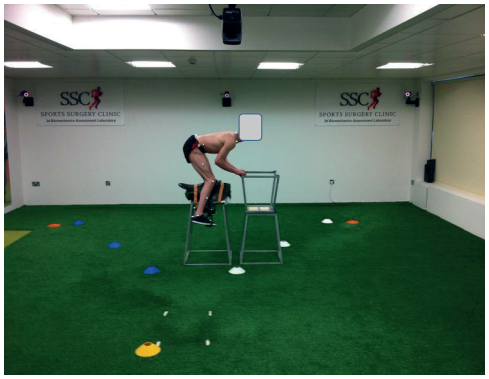

Figure 2: Marker setup used during testing

Discussion

A number of interesting points are raised by the analysis of this data. The consistent angles of hip flexion, adduction and internal rotation throughout the movement are of particular interest to strength and conditioning coaches. Common practice in other sports is the reduction of these movements and positions for injury prevention as a link between knee valgus positions and ACL injury has been established (4). A relatively high proportion of injuries to jockeys are related to falls where hip internal rotation and adduction movements could contribute to knee ligament derangement. The nature of a dismount from a horse would perhaps suggest limited control on the part of the jockey as to their body position in landing, especially whether a lower limb landing is bilateral or unilateral in nature. Given the prevalence of injuries related to falls, it may be possible to reduce the risk of such injures by spending time training landing mechanics that reduce load on the ligaments of the knee bilaterally and unilaterally. It could also be argued that strengthening musculature responsible for controlling those landing mechanics has the potential for reducing injury risk. While the limitations of the study are plain it does highlight some areas of interest for those involved in the physical preparation of jockeys. Future areas worthy of consideration would be the landing mechanics of jockeys and the establishment of validity of horse riding simulations.

References

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