

CONSIDERATIONS FOR THE SHOULDER JOINT IN THE TENNIS SERVE

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This presentation takes an historical approach by looking at key findings from research at the University of Western Australia into the shoulder joint during the tennis serve. Since Elliott et al. (1995) identified the importance of shoulder internal rotation as the primary contributor (~40%) to racquet velocity in the serve; the shoulder has received special attention from players and coaches alike.

Biomechanical analyses in the 1990s typically employed multiple (cine or video) cameras with interlocking fields of view to create 3D displacement data using the DLT approach. The upper limb was modelled as a rigid system, where shoulder, elbow and wrist joint centres were linked. These centres were calculated from digitising externally placed markers, typically on easily identifiable bony landmarks. The following topics with respect to shoulder movement and loading were completed using this approach:

1. Does technique affect shoulder range of motion (ROM) and loading? (Elliott et al., 2003; Fleisig et al., 2003; Reid et al., 2007a, b; 2008)
2. Does the reliance on internal rotation to produce racquet velocity alter shoulder ROM, and glenohumeral internal rotation deficit (GIRD)? (Kibler et al., 1996)
3. Does timing play a role in shoulder mechanics? (Elliott et al., 1999)
4. Does velocity alter shoulder loading in the serve? (Elliott et al., 2003)

The new century saw great changes in technology and automatic digitising using online marker tracking systems (e.g. Vicon, Motion Analysis, Qualisys) was more commonly used in sport biomechanics research. Improved hardware and musculoskeletal modelling methods were developed concurrently. Extensive efforts from a number of research groups set about to improve the accuracy and reliability of upper limb 3D modelling approaches. Particular emphasis was placed on the difficult task of recording and reconstructing the shoulder (Campbell et al., 2009 a, b) during overhead sporting activities and the integration of kinetics to assess shoulder loading during the tennis serve (Reid et al., 2008).

Performance optimisation and injury reduction in sport is a challenging task, particularly where the shoulder is concerned. We hope that this brief journey has motivated you to better understand shoulder pathology by looking at different ways to analyse the tennis serve, so this lifetime activity may be enjoyed in an injury free environment.

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