

RELIABILITY OF INVERSE DYNAMICS OF THE WHOLE BODY IN THE TENNIS FOREHAND

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INTRODUCTION: Reliability of joint moment calculation using inverse dynamics is critical for evaluation of joint function and has been investigated for locomotion and lifting tasks, but not for sport movements in which the trunk can not be assumed to be rigid. The tennis forehand was studied in this paper because many biomechanical studies on the movement have been performed (Elliott et al., 1989) and the trunk twists substantially in the forehand. The purpose of this study was to investigate the reliability of the inverse dynamic analysis of the whole body in a tennis forehand using different segment inertial parameter (SIP) sets.

METHODS: Six high speed video cameras and two force plates were used to determine the moment acting on the pelvis during closed stance tennis forehands performed by six male tennis players. The difference between the pelvic moments determined by the top-down and bottom-up approaches was determined to evaluate the reliability (Plamondon et al., 1996). The effects of the different SIP sets (Zatsiorsky et al., 1983) on the RMS differences in the pelvic moments between the two approaches were tested using one-way repeated measures ANOVA ($p < 0.05$). MC was adjusted by Dumas et al. (2007) and ZA was by de Leva (1996).

RESULTS: The RMS differences in the lateral flexion moment for AE and ZA were significantly smaller than that for MC (Table 1). The RMS difference in the axial rotation moment for AE was significantly smaller than the differences for MC and ZA.

Table 1 RMS differences in the pelvic moment components between the top-down and bottom-up approaches using the different SIP sets (Nm)

| | AE | | MC | | ZA | |
|-------------------|------|------|------|------|------|-----|
| | Mean | s | Mean | s | Mean | s |
| Lateral flexion | 20.7 | 4.9 | 46.9 | 7.2 | 23.8 | 7.8 |
| Extension/Flexion | 29.1 | 10.1 | 43.3 | 12.8 | 26.4 | 6.5 |
| Axial rotation | 16.6 | 3.2 | 23.7 | 2.5 | 20.2 | 3.9 |

DISCUSSION: The RMS differences were not negligible for all components of the moments determined by all SIP sets while overall AE provided better results than MC and ZA.

CONCLUSION: The reliability of the pelvic moment in a tennis forehand determined in this study was not so high for any SIP set used.

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