THREE-DIMENSIONAL ANALYSIS OF ARM IMPACT DURING GYMNASTIC BACK HANDSPRINGS IN CHILDREN

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INTRODUCTION: Many gymnastic activities involve weight-bearing impacts onto the hands, and these repetitive compressive forces have been found to lead to both acute and chronic injuries to the wrists (Howse, 1994). In an earlier study, we modelled saggittal motion of arm impacts for children performing gymnastic handsprings and dive rolls using a rheological model (Davidson et al, 2005). We are in the process of conducting a 3-dimensional analysis of impact to further refine our model.

METHOD: Eleven female gymnasts, ranging in age from 9 to 17 years, were recruited from two gymnastics clubs in Dunedin, New Zealand to participate in this study. Spherical reflective markers were positioned to define the gymnast's torso and limb segments. Fifty four trial markers were used, along with 20 calibration markers which were removed prior to the commencement of the activity. Two force plates were covered with either a 30-mm closed cell foam-carpet topped mat or the same mat with a 35-mm shredded rubber underlay. The gymnast's movement was tracked by 12 Motion Analysis ® cameras .Three trials of each activity (back handspring performed with legs together / legs apart; hands landing on mat alone / mat with underlay) were recorded at 250Hz for each gymnast.

RESULTS: Segment motions in the trials are currently being digitized and will be analysed using Simmechanics © and Matlab © software. The intention is to produce estimates of wrist and shoulder stiffness and damping values in 3 planes of motion.

DISCUSSION: We are interested in wrist impacts and in the motions that occur between limb segments during these events. This will provide us information on the relationship between the gymnastic technique used and the degree of hand impact. The standard rigid-link model of impact cannot be used to address this issue. Using a rheological model allows us to gain a better understanding of how the gymnast's body deals with the impact forces it is subjected to.

CONCLUSION: The information obtained from the current study will be used to refine the model, so we can more accurately predict the response of the arm joints to impact in a variety of situations, better explore the effects of potential injury prevention measures and help gymnastic coaches develop safer techniques for gymnastic hand landings.

REFERENCES:

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