

falls with direct hip impact have most risk for hip fractures. It has been shown that martial arts techniques (MA) reduce hip impact force in sideways falls in experienced fallers (Groen et al., 2006; Sabick et al., 1999), as well as in young adults with no prior experience after a short MA fall training (Weerdesteyn et al., 2006). The amount of reduction was larger in the experienced group, indicating the presence of experience-related differences in the performance of MA techniques. The purpose of the present study was to identify experience-related differences in movement pattern of MA fall techniques.

Methods: Nine young females (non-judo), who received a 30-minutes fall training and 6 female experienced martial artists (judo) performed sideways falls from kneeling position onto a force plate covered with judo mats. Falls started after voluntarily release of a grip that supported the subjects at 21 degrees lean angle from the vertical. Each subject performed 12 MA falls. In MA falls, the fall is changed into a rolling movement. Subsequently, the arm is used to break the roll. In addition, the non-judo group performed 12 falls imitating the technique most elder people use spontaneously. The latter is called the block technique because the outstretched arm is used to block the fall. Kinematic data were collected with a 3D-video system (Primas) and forces were measured with a Bertec force plate (size: 1.2 by 1.2 m).

Results: In agreement with previous data (Weerdesteyn et al., 2006), hip impact force was 12% lower in MA than in Block falls ($p=0.004$) in the non-judo group. In the MA falls, hip and shoulder impact forces were not significantly different between the judo and non-judo group. Arm impact was larger for the judo group ($p=0.014$), reflecting a more powerful use of the arm to break the fall. In the judo group, impact occurred first at the hip impact, then at the arm impact and finally at the shoulder as found for people experienced in aikido (Sabick et al., 1999). However, shoulder impact occurred prior to arm impact in 4 of 9 subjects of the non-judo group. After release the judo group moved the trunk gradually downward to a more horizontal orientation. In contrast, the non-judo group started with an upward trunk movement prior to the downward movement of the trunk. At hip impact, trunk orientation in MA falls was more horizontally in the judo than in the non-judo group ($p<0.001$). After hip impact, the vertical trunk velocity was generally bi-modal in shape, with the second peak less pronounced in the judo group, indicating a smoother hip landing.

Conclusions: In conclusion, to further improve MA fall techniques training should focus on the timing of hand impact, a reduction of an upwards trunk movement, a horizontal trunk orientation at hip impact and a smoother hip landing.

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The impact of anticipating slippery floors on spatial and temporal variability during gait

A. Chambers and R. Cham

Bioengineering, University of Pittsburgh, Pittsburgh, PA, USA

Introduction: Falls are a major cause of injury, death, and disability in the elderly. Proactive strategies generated to maintain balance in the face of an anticipated external disturbance have been investigated using testing paradigms involving repeated exposure to a known perturbation [1,2]. The goal of this study,

which has not been previously addressed, is to investigate the impact of anticipating real slippery floors on the spatial and temporal variability during gait on dry surfaces. Gait variability has been linked with falls [4].

Methods: Eighteen young (20-33 yrs) and thirteen older subjects (55-67 yrs), screened for neurological and orthopedic abnormalities, were instructed to walk at a self-selected pace across a vinyl tile walkway, while whole body motion data were sampled at 120 Hz. Subjects were informed the first few trials would be dry, 'baseline dry' (BD). Without the subjects' knowledge, a glycerol solution was applied at the left/leading foot-floor interface, generating an 'unexpected slip'. Subjects were then alerted that all remaining trials might be slippery, 'alert dry' (AD). General spatiotemporal gait characteristics and spatial/temporal gait variability were derived and compared between BD and AD conditions using mixed-linear regression models. Statistical significance was set at 0.05.

Results: In general, anticipation resulted in shorter mean durations of the temporal aspects of gait. Older adults tended to have increased temporal variability (root mean square (rms) values of single support and stance duration) when compared to young adults. Both cadence and gait speed increased in AD trials with young adults showing the greatest increase in gait speed during anticipation. Additionally, changes in spatial variability were noted during AD with decreased rms and increased rms of step width and step length, respectively.

Conclusions: In summary, anticipating slippery floors is associated with a few gait adaptations that are beneficial, e.g. increased cadence reduces the risk of experiencing a hazardous slip [3]. Only older adults demonstrated a tendency toward increased temporal variability when anticipating a slippery surface; both age groups increased step length variability, suggesting the generation of proactive strategies is perhaps not as "automatic" as normal gait. Finally, anticipation resulted in decreased step width variability potentially due to the increased cadence results previously mentioned. Previous research has reported that step width variability is an important factor in fall risk and fall history [4]. References 1. Cham R et al. *Gait and Posture*, 15:159-71, 2002. 2. Marigold DS et al. *J Neurophysiol*, 88(1):339-53, 2002. 3. Moyer BE et al. *Ergonomics*, 49(4):329-343, 2006. 4. Brach JS et al. *J NeuroEng & Rehab*, 2(21): 2005.

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Do judo athletes utilize ukemi falling techniques during unexpected sideways falls?

F. Feldman and S.N. Robinovitch

School of Kinesiology, Simon Fraser University, Burnaby, BC, Canada

Introduction: Certain sports activities provide participants with training in safe falling strategies that might be utilized to advantage during unexpected real-life falls. A notable example is training of "ukemi" in judo, which involves impacting the ground with a rolling motion, to distribute impact energy and contact force (Groen et al., 2006; Sabick et al., 1999). However, it is not known whether judo athletes utilize ukemi during unexpected falls. To test this, we compared the falling patterns of judo athletes and control participants who attempted to maintain their balance when subjected to a strong postural perturbation. We

Key to Abstracts

KS = Keynote Session

FS = Featured Symposia

Concurrent Oral and Poster Sessions

First character denotes day of presentation

S = Sunday, July 15

M = Monday, July 16

T = Tuesday, July 17

W = Wednesday, July 18

Second character denotes session

O = Oral

P = Poster

Number denotes order of presentation (for oral) or board number (for poster)